

TOWN OF BELLINGHAM, MASSACHUSETTS
BELLINGHAM WATER AND SEWER COMMISSION

SERVICE CONNECTION SPECIFICATIONS

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TABLE OF CONTENTS

	<u>Section Number</u>
Introduction	
General Requirements	
Clearing and Grubbing	02100
Earthwork	02200
Rock Excavation and Disposal	02211
Paving	02575
Walkway Replacement	02576
Precast Manholes	02601
Gravity Sewer Service Cleanouts	02602
Polyvinyl Chloride Gravity Pipe and Fittings	02625
Sewer Pressure Piping	02626
Sewer Vavles and Appurtenances	02642
Tracer Tape	02649
Single Building Sewer Pumping Units	11306
Multiple Building Sewer Pumping Units	11307
Typical Detail Drawings	Appended

INTRODUCTION

The intention of these Specifications is to set quality standards for the installation of service connection pipelines within the Town of Bellingham, Massachusetts. These Specifications are directed toward connections for Residential and Commercial properties and should be used in conjunction with the "Town of Bellingham Sewer Use Regulations" and all other State and Local permits. This is not intended to serve as a contract document or agreement between the said "OWNER" (individual property owner of the connecting lot) and the "CONTRACTOR" (person/company installing the service connection for the connecting lot).

The specifications and attached details pertaining to the actual pipe installation (i.e. Earthwork, Rock Excavation and Disposal, Precast Manholes, PVC pipe and Tracer Tape) shall act as minimum standards set forth by the Town of Bellingham Water and Sewer Commission. These sections must be complied with in order for the service connection to be approved by the Water and Sewer Department Superintendent (herein referred to as "SUPERINTENDENT"). It should be noted that in some instances it may be necessary to use higher standards or stronger materials based on existing conditions. As mentioned in the Specifications, all State standards and requirements, as amended, shall be adhered to.

The Specifications contain sections indirectly related to the pipeline installation (i.e. Clearing and Grubbing, Paving and Walkway Replacement). These are intended as suggested guidelines. The Owner and the Contractor should address these issues in an agreement to clearly define the scope and extent of work to be completed by the CONTRACTOR.

(SERV-16)

GENERAL REQUIREMENTS

Abandonment of Existing Septic Systems

After connection to the public sewer is completed all existing septic systems must be abandoned and disposed of safely and properly. First, all septic tanks, cesspools, leaching pits and drywells shall be pumped out. All pumping and disposal shall be performed in accordance with State and Local Codes and Regulations. After pumping is completed, all non-concrete type tanks, (i.e. steel), shall be collapsed and backfilled. All concrete type tanks shall be completely filled with sand and existing covers shall be reinstalled and secured. These procedures shall also comply with regulations adopted by the Town of Bellingham Board of Health on April 3, 1989 under the authority of Chapter 111, Section 31 of the Massachusetts General Laws.

(SERV-16)

SECTION 02100

CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. The Contractor shall do all clearing and grubbing required to carry out the sewer installation, as agreed with the Owner and as herein specified. The Contractor shall clear and grub only the area required for construction operations. Care shall be taken to leave nothing of material size or accumulated mass which might thereafter float or obstruct the pipeline.
- B. The contractor shall not cut or injure any trees or other vegetation outside the limits of the area on which work is to be done, without permission of the Owner.

PART 2 - PRODUCTS: NOT APPLICABLE

PART 3 - EXECUTION

3.01 RIGHT TO WOOD AND LOGS:

- A. The Owner shall have the right to cut and remove logs and other wood of value in advance of the Contractor's operations. Any remaining logs and other wood to be removed in the course of clearing shall remain the property of the Owner.

3.02 CLEARING:

- A. From areas to be cleared, the Contractor shall cut or otherwise remove all trees, saplings, brush and vines, windfalls, logs and trees lying on the ground, dead trees and stubs more than 1-foot high above the ground surface (but not their stumps), trees which have been partially uprooted by natural or other causes (including their stumps), other vegetable matter such as shags, sawdust, bark, refuse, and similar materials.
- B. Except where clearing is done by uprooting with machinery or where stumps are left longer to facilitate subsequent grubbing operations, trees, stumps, and stubs to be cleared shall be cut as close to the ground as practicable but not more than 6-inches above the ground surface in the case of small trees, and 12-inches in the case of large trees. Saplings, brush and vines shall be cut off close to the ground.

3.03 GRUBBING:

- A. In areas to be grubbed, the Contractor shall remove completely all stumps and also remove to a depth of 18-inches all roots larger than 3-inches in diameter.
- B. Any depression remaining from the removal of a stump and not filled in by backfilling shall be filled with loam.

3.04 DISPOSAL:

- A. All material collected in the course of the clearing and grubbing which will not remain shall be disposed of in a satisfactory manner, by disposal away from the site, or as otherwise approved. Such disposal shall be carried on as promptly as possible after removal of the material in the clearing and grubbing operations and shall not be left until the final period of cleaning up.

END OF SECTION

(SERV-2)

SECTION 02200

EARTHWORK

PART 1 GENERAL

1.01 WORK INCLUDED:

- A. The Contractor shall make excavations of normal depth in earth for trenches, shall backfill such excavations to the extent necessary and shall make miscellaneous earth excavations and do miscellaneous grading.

1.02 RELATED WORK:

- A. Section 02100, CLEARING AND GRUBBING
- B. Section 02211, ROCK EXCAVATION AND DISPOSAL
- C. Section 02575, PAVING.

1.03 SYSTEM DESCRIPTION:

- A. The program of excavation shall be carried out in such manner as to prevent undermining or disturbing the foundations or floors of existing structures.
- B. The Contractor shall make excavations in such manner and to such width as will give suitable room for laying and jointing the piping and shall render the bottoms of the excavations firm and dry and acceptable in all respects.
- C. If the bottom of any excavation is taken out beyond the limits indicated or prescribed, the resulting void shall be backfilled with thoroughly compacted gravel borrow.

1.04 REFERENCES:

- A. The following standard forms a part of these specifications and indicates the minimum standards required:

American Society for Testing and Materials (ASTM)

ASTM	D1557	Test for moisture - density relations of soils and soil - aggregate mixtures using 10 lb. rammer and 18-inch drop.
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PART 2 - PRODUCTS

2.01 MATERIAL:

A. GRAVEL BORROW:

Gravel borrow shall consist of sound durable sand and gravel, essentially free of organic matter, plastic fines (clay) and debris, and shall meet the gradation requirements below:

<u>Sieve Opening</u>	<u>Percent Passing (weight)</u>
3 inch	100
1/2 inch	50-85
No. 4	40-75
No. 40	10-45
No. 200	0-8

B. CRUSHED STONE:

Crushed stone shall consist of sound, hard, durable, angular fragments of crushed rock. Crushed stone shall not contain vegetation, masses of roots, loam and other organic matter, clay, and other fine or harmful substances. It shall be well graded and shall meet the gradation requirements listed below:

<u>Sieve Opening</u>	<u>Percent Passing (weight)</u>
1 inch	100
3/4 inch	90-100
3/8 inch	20-55
No. 4	0-10
No. 8	0-5

C. BACKFILL MATERIALS:

Backfill materials shall consist of granular soil. Materials shall be of such a nature that they will form a stable dense fill. Materials shall not contain vegetation, masses of roots, individual roots more than 12-inches long or more than 1/2-inch in diameter, trash, clays, or plastic fines. Organic matter shall not exceed two percent (2%).

Nonplastic fines (silts) shall not exceed 20 percent (20%). Backfill materials are subdivided according to the maximum allowable size of stone or blacktop piece as follows:

<u>Type</u>	<u>Largest Stone Diameter</u>
1. Select Backfill	3-inches
2. Class B Backfill	6-inches
3. Class C Backfill	12-inches

PART 3 - EXECUTION

3.01 PROTECTION AND RESTORATION OF PROPERTY:

- A. All existing buildings, utilities, pipes, poles, wires, fences, curbing, property line markers and other structures which the Owner decides must be preserved in place without being temporarily or permanently relocated, shall be carefully supported and protected from injury by the Contractor. Should such items be injured, they shall be restored by the Contractor to at least as good condition as that in which they were found immediately before the work was begun.
- B. The contractor shall enclose the trunks of trees, which are adjacent to his work and not to be removed, with substantial wooden boxes of such height as may be necessary to protect them from injury from piled material, from equipment, from his operations, or otherwise due to his work. Excavating machinery shall be of suitable type and be operated with care to prevent injury to trees not to be removed and particularly to overhanging branches and limbs.
- C. Branches, limbs, and roots shall not be cut except by permission of the Owner. All cutting shall be smoothly and neatly done without splitting or crushing. When there is cutting or unavoidable injury to branches, limbs, and trunks of trees, the cut or injured portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint as directed.
- D. Cultivated hedges, shrubs, and plants which might be injured by the Contractor's operations shall be protected by suitable means or dug up if necessary. After the construction operations have been substantially completed, they shall be replanted.
- E. No significant plantings or permanent structures shall be placed within 10 feet of either side of the pipeline.

F. On paved surfaces the Contractor shall not use or operate tractors, bulldozers, or other power-operated equipment the treads or wheels of which are so shaped as to cut or otherwise injure such surfaces.

G. All property injured by the Contractor's operations shall be restored to a condition at least equal to that in which it was found immediately before work was begun. Suitable materials and methods shall be used for such restoration.

H. Restoration of existing property and structures shall be done as promptly as practicable.

3.02 EXCAVATION:

A. TRENCH EXCAVATION:

1. Trenches in pavement shall have the surface cut in a straight line by a concrete saw or equivalent method to the full depth of pavement. Excavation shall only be between these lines. Cutting operations shall not be done by backhoe, gradall, or other ripping equipment.
2. Trenches shall be excavated to such depths as will permit the pipe to be laid at the elevations, slopes, or depths of cover necessary.
3. Where pipe is to be laid in crushed stone bedding, the trench may be excavated by machinery to, or to just below the designated depth, provided that the material remaining at the bottom of the trench remains undisturbed.
4. Pipe trenches shall be made as narrow as practicable and shall not be widened by scraping or loosening materials from the sides. Every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed and consolidated.
5. Trenches shall be excavated with vertical sides between the elevation of the center of the pipe and elevation one foot above the top of the pipe.

3.03 BACKFILLING AND COMPACTION:

A. GENERAL:

1. In general, material removed in the course of making the construction excavation shall be suitable material for backfilling trenches.
2. Class C Backfill available from the excavations may be used for filling and building embankments.

3. If the material removed from the excavation is suitable for backfill with the exception that it contains stone or pavement sections having a maximum allowable size larger than that specified, the Contractor has the option to remove the oversized materials from the backfill or provide replacement backfill.
4. Frozen material shall not be placed in the backfill nor shall backfill be placed upon frozen material. Frozen material shall be removed or shall be otherwise treated as required, before backfill is placed.
5. After the subgrade has been prepared as specified, the fill material shall be placed and built up in successive layers until the required elevation is reached.
6. Layers of fill shall not exceed 12 inches in thickness (loose). Thinner layers shall be used if necessary to achieve the required compaction.
7. Each layer of material shall be compacted by the use of vibratory compaction equipment or rollers or other means to achieve the required compaction. At such points as cannot be reached by mobile mechanical equipment, the materials shall be thoroughly compacted by the use of suitable power-driven tampers.
8. All backfill shall be compacted to at least the specified percent of maximum density as determined by ASTM D1557, Method C.
9. Previously placed or new materials shall be moistened by sprinkling, if required, to ensure proper bond and compaction. No compacting shall be done when the material is too wet, from either rain or too great an application of water, to compact it properly; at such times the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compaction. The Contractor shall provide all labor and equipment to adjust the water content of the soil by wetting or drying as may be necessary to obtain proper compaction.
10. WATER JETTING:
 - a. If the backfill is to be compacted by water jetting, the entire layer shall be thoroughly saturated throughout its full depth across and along the trench until all slumping ceases. To accomplish this the Contractor shall furnish one or more jet pipes, each of sufficient length to reach

to the specified depth and of sufficient diameter (not less than 2 inches) to supply an adequate flow of water to compact the material. The jet pipe shall be equipped with a quick-acting valve and be supplied through a fire hose or a pump having adequate pressure and capacity.

- b. In general, water jetting may be used whenever the backfill material does not contain more than 10 percent passing the number 200 sieve.
- c. If water jetting does not adequately compact the backfill, mechanical compaction shall be used.

11. COMPACTION REQUIREMENTS:

- a. The requirements for compaction of backfill shall conform to the following guidelines based on ASTM D1557 Method C:

<u>Location</u>	<u>Percent Maximum Density</u>
Below pipe centerline	95
Above pipe centerline	92
Below pavement (upper 3 ft.)	95
Below pipe in embankments	95
Adjacent to structure	92

B. PIPE TRENCHES:

- 1. No backfilling of excavation shall take place until the Superintendent of the Sewer Department has inspected and approved the service connection pipe.
- 2. Select backfill shall be placed with hand shovels in 6-inch thick lifts up to a level of 12-inches above the top of pipe. This area of backfill is considered the zone around pipe and shall be thoroughly compacted before the remainder of the trench is backfilled. Compaction of each lift in the zone around pipe shall be done by use of power-driven tampers weighing at least 20 pounds or by vibratory compactors. Care shall be taken that material close to the bank, as well as in all other portions of the trench, is thoroughly compacted to densities required.
- 3. Class B backfill shall be placed from the top of the select backfill to grade. Compaction of backfill in the remainder of the trench shall be done in layers not exceeding 12 inches in depth and by use of power driven tampers weighing at least 20 pounds or by vibratory plate compactors weighing at least 200 pounds and imparting a dynamic force of at least 2000 pounds.

4. If settlement takes place the Contractor shall immediately deposit additional material to restore the level of the ground.
5. If existing material below trench grade is unsuitable for properly laying pipe, the Contractor shall excavate, remove and dispose of the unsuitable material to the required width and depth and replace it with gravel borrow or 3/4" crushed stone.

END OF SECTION

(SERV-3)

SECTION 02211

ROCK EXCAVATION AND DISPOSAL

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. The Contractor shall excavate rock, if encountered, to the lines and grades necessary to lay the pipe, shall dispose of the excavated material, and shall furnish the required material as specified in Section 02200 EARTHWORK for backfill in place of the excavated rock.

1.02 RELATED WORK:

- A. Section 02200, EARTHWORK

1.03 DEFINITIONS:

- A. The word "rock," wherever used as the name of the excavated material or material to be excavated, shall mean only boulders and pieces of concrete or masonry exceeding one cubic yard in volume, or solid ledge rock which requires, for its removal, drilling and blasting, wedging, sledging, barring, or breaking up with a power-operated tool.
- B. The word "earth," wherever used as the name of an excavated material, or material to be excavated shall mean all kinds of material other than rock as above defined.

1.04 QUALITY ASSURANCE:

- B. The Contractor shall conform to all municipal ordinances and State and Federal laws relating to the transportation, storage, handling, and use of explosives. In the event that any of the above mentioned laws, ordinances, or regulations require a licensed blaster to perform or supervise the work of blasting, said licensed blaster shall, at all times, have his license on the work site and shall permit examination thereof by officials having jurisdiction.

1.05 DELIVERY/STORAGE AND HANDLING:

- A. The Contractor shall keep explosives on the site only in such quantity as may be needed for the work under way and only during such time as they are being used. Explosives shall be stored in a secure manner and separate from all tools. Caps or detonators shall be safely stored at a point over 100 feet distant from the explosives. When the need for explosives has ended, all such materials remaining on the work shall be promptly removed from the premises.

PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION

3.01 EXCAVATION:

- A. The Contractor shall excavate rock to the lines and grades necessary to lay the pipe. The excavated rock shall be removed and disposed of by the Contractor as specified for surplus excavated materials under Section 02200, EARTHWORK.

This specification does not relieve the Contractor, his consultant, or his blasting subcontractor, of the responsibility to conduct the blasting activities in a safe and prudent manner, nor of the responsibility to perform the blasting activity in a timely and efficient manner.

The Contractor shall be held liable for all claims resulting from personal injury or damage to property or equipment that may result from his or his subcontractor's blasting operations. Work damaged by blasting shall be repaired or replaced by the Contractor.

- B. All operations involving explosives shall be conducted with all possible care to avoid injury to persons and property. Blasting shall be done only with such quantities and strengths of explosives and in such a manner as will break the rock approximately to the intended lines and grades and yet will leave the rock not to be excavated in an unshattered condition. Care shall be taken to avoid excessive cracking of the rock upon or against which any structure will be built, and to prevent injury to existing pipes or other structures and property above or below ground. The Contractor shall use blasting mats for all blasts unless at least 5 feet of soil covers all sections of rock involved in the blast, including the relieved face. Sufficient warning shall be given to all persons in the vicinity of the work before a charge is exploded.
- C. All state and local regulations governing air blast levels and monitoring shall be complied with.
- D. If rock is excavated beyond the limits of necessary trench excavation, the excess excavation, whether resulting from overbreakage or other causes, shall be backfilled, by the Contractor, as specified below in this section.
- E. In pipe trenches, excess excavation shall be filled with the required material and compacted in the same manner as specified for the material in the zone around the pipe under Section 02200 EARTHWORK.

- F. Rock in pipe trenches shall be excavated so as to be not less than 6 inches from the pipe after it has been laid. Before the pipe is laid, the trench shall be backfilled to the subgrade with thoroughly compacted suitable material, furnished and placed by the Contractor.
- G. For all excavations in rock, the Contractor shall thoroughly inspect all excavation faces and remove loose or unstable pieces of rock before workers enter the excavation for construction. The Contractor shall also examine the excavation faces to identify potentially unstable blocks of rock. Such potentially unstable blocks which can not be reasonably removed shall be temporarily supported.

END OF SECTION

(SERV-4)

SECTION 02575

PAVING

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. The Contractor shall furnish all labor, materials and equipment and shall replace the pavements "in kind" or as herein specified.

1.02 REFERENCES

- A. The following standards form a part of these specifications and indicate the minimum standards required:

American Society for Testing and Materials (ASTM)

ASTM	D1557	Test for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 Pound Rammer and 18-Inch Drop
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Commonwealth of Massachusetts Department of Public Works
Standard Specification for Highway and Bridges (MDPW)

MDPW	405	Gravel Base Course
MDPW	420	Class I Bituminous Concrete Base Course, Type I-1
MDPW	460	Class I Bituminous Concrete Pavement
MDPW	476	Cement Concrete Pavement
MDPW	860	Reflectorized Pavement Markings

PART 2 - PRODUCTS

2.01 GRAVEL SUBBASE:

- A. Gravel subbase shall consist of inert material that is hard durable stone and coarse sand, free from loam and clay, surface coatings and deleterious materials.

- B. Gradation requirements for gravel subbase shall be as specified in Section 02200, EARTHWORK for Gravel Borrow.

2.02 BITUMINOUS CONCRETE PAVEMENT:

- A. Bituminous concrete pavements shall consist of Class I Bituminous Concrete, Type I-1.

- B. Bituminous concrete mixtures shall be within the composition limits of binder courses, top courses and surface treatment, in accordance with MDPW M3.11.03.

2.03 SEAL COAT:

- A. Seal coats shall be within the composition limits for protective seal coat emulsion in accordance with MDPW M3.03.3.
- B. Silica sand when blended with seal coat emulsion shall be No. 30 silica sand.

PART 3 - EXECUTION

3.01 GENERAL:

- A. Paving of parking lots and driveways shall consist of installation of the gravel subbase, the binder course and the top course.

3.02 GRAVEL SUBBASE:

- A. The gravel subbase to be placed under pavement shall consist of 12-inches of gravel evenly spread and thoroughly compacted.
- B. The gravel shall be spread in layers not more than 4-inches thick, compacted measure. All layers shall be compacted to not less than 95 percent of the maximum dry density of the material as determined by ASTM D1557 Method C at optimum moisture content.

3.03 BINDER COURSE PAVEMENT:

- A. Immediately prior to installing the binder course, the trimmed edges shall be made stable and unyielding, free of loose or broken pieces and all edges shall be thoroughly broomed clean. Contact surfaces of trench sides, curbs, manholes, catch basins, or other appurtenant structures in the pavement shall be painted thoroughly with a thin uniform coating of bitumen (Specifications RS-1) just before any mixture is placed against them.
- B. The binder course bituminous concrete mixtures shall be within the composition limits of binder courses in accordance with MDPW M3.11.03. The binder course shall be placed only between edges of the existing pavement.

C. The binder course pavement shall be 2 compacted inches thick.

3.04 TOP COURSE OR SURFACE TREATMENT PAVEMENT:

- A. The top course shall be placed over the trench as specified.

- B. The top course pavement shall be 1-1/2 compacted inches thick.
- C. Prior to placement of the top course, the entire surface over which the top course is to be placed shall be broom cleaned and tack coated.
- D. Top course pavement placed over trenches shall be feathered to meet existing paved surfaces.

3.05 GENERAL:

- A. Adjacent concrete work, slate work, sidewalks, structures, etc., shall be protected from stain and damage during the entire operation. Damaged or stained areas shall be replaced or repaired to equal their original condition.
- B. All joints between binder and top course or surface treatment shall be staggered a minimum of 6-inches.
- C. After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until it has cooled and hardened, and in no case in less than 6 hours.
- D. Smoothness of all areas of the finished surface shall not vary more than 1/4-inch when tested with a 16 foot straight-edge, applied both parallel to and at right angles to the centerline of the paved area. At building entrances, curbs, and other locations where an essentially flush transition is required, pavement elevation tolerance shall not exceed plus or minus 1/8-inch. Irregularities exceeding these amounts, or which retain water on the surface, shall be corrected by removing the defective work and replacing or repairing it.
- E. When seal coating is required, the surface area to be seal coated shall be swept and air cleaned. The first coat shall be applied with eight (8) pounds of #30 silica sand blended with each gallon of emulsion applied at a rate of 0.15 gallons per square yard. The second coat shall be a straight sealer applied at the rate of 0.1 gallons per square yard.

END OF SECTION

(SERV-6)

SECTION 02576

WALKWAY REPLACEMENT

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. Where replacement of concrete walks is required, the Contractor shall construct either bituminous concrete walks or cement concrete walks, as determined in the field, to the required lines and grades and in accordance with these specifications.
- B. If applicable, the Contractor shall restore gravel walks to a condition at least equal to that existing immediately before the work was started.
- C. The Contractor shall furnish all labor, materials, equipment, and incidentals required to construct new walks where existing walks are disturbed by the Contractor. This work shall include placement of all concrete, reinforcing steel, forms, and joint filler required to replace existing concrete walks and ramps.

2.01 RELATED WORK:

- A. Section 02200, EARTHWORK
- B. For driveways, see Section 02575, PAVING

PART 2 - PRODUCTS (See Part 3 - Execution)

PART 3 - EXECUTION:

3.01 BITUMINOUS CONCRETE WALKS:

- A. Except as otherwise specified, construction of the bituminous concrete walks shall be in accordance with the Standard Specifications for Highways and Bridges of the Department of Public Works of the Commonwealth of Massachusetts, dated 1973, and all amendments thereto.
- B. The subgrade for the bituminous concrete walks shall be shaped parallel to the proposed surface of the walks and shall be thoroughly rolled and tamped. All depressions occurring shall be filled with suitable material and again rolled or tamped until the surface is smooth and hard in order for a gravel foundation to be placed upon it.
- C. The Contractor shall use a 1-1/2-inch thick binder course with 3/4-inch maximum size stone and a 1-inch thick wearing course with 3/8-inch maximum size stone.

3.02. CEMENT CONCRETE WALKS:

- A. In general, concrete for one course walks shall be 4 inches thick.
- B. The subgrade for the walk or driveway shall be shaped to a true surface conforming to the proposed slope of the walk, thoroughly rolled at optimum moisture content, and tamped with a power roller weighing not less than one ton and not more than 5 tons. All depressions occurring shall be filled with suitable material and again rolled or tamped until the surface is smooth and hard.
- C. After the subgrade has been prepared as hereinbefore specified, a subbase of gravel at optimum moisture content shall be placed, thoroughly rolled by a power roller, and tamped. For walks, the gravel shall be a minimum of 8 inches in thickness and 4 inches below and parallel to the proposed finished surface.
- D. The forms for one-course walks shall be smooth, free from warp, strong enough to resist springing out of shape, and deep enough to conform to the thickness of the proposed walk. All mortar or dirt shall be completely removed from forms that have been previously used. The forms shall be well staked, thoroughly braced, and set to the established lines with their upper edge conforming to the grade of the finished walk. The finished walk shall have sufficient pitch from the outside to the edge of the walk to provide for surface drainage. This pitch shall be $\frac{3}{8}$ of an inch per foot. Before the concrete is placed, the subbase for one course walks shall be thoroughly dampened until it is moist throughout but without puddles of water.
- E. The concrete shall be conveyed from the place of mixing to the place of deposit in such a manner that no mortar will be lost, and the composition of the mix shall be uniform, showing neither excess nor lack of mortar in any one place. The consistency shall be such that water will float to the surface under heavy tamping. The concrete shall be placed as close to its final position as practicable and thoroughly consolidated, with precautions taken not to overwork it while it is still plastic. The concrete shall be thoroughly spaded along the forms or screeds to eliminate voids and honeycombs at the edges. Retempering of concrete will not be permitted.
- F. Finishing of the concrete surface shall be done by experienced and competent cement finishers as soon as is practicable. Finishing shall not be delayed until all bleed water and water sheen has left the surface and the concrete has begun to stiffen. The concrete surface shall be finished as directed with a steel trowel or wood float to

give a smooth, uniform and attractive surface finish and uniformly scored into block units or areas of not more than 36 square feet. Following this, the Contractor shall draw a fine nylon push broom lightly over the surface to produce a non-slip surface. Application of neat cement to the surface to hasten hardening is prohibited.

- G. The Contractor shall make every effort to protect the newly placed concrete surface against vandalism and marking or defacing and must stand ready to replace any blocks which are defaced.
- H. Adequate protection shall be provided where temperatures of 40°F or lower occur during placing of concrete and during the early curing period. The minimum temperature of fresh concrete after placing and for the first 3 days shall be maintained above 55°F. In addition to the above requirements, an additional 3 days of protection from freezing shall be maintained.
- I. Except as otherwise specified, the construction of the concrete walks shall be in accordance with the Standard Specifications for Highways and Bridges of the Department of Public Works of the Commonwealth of Massachusetts, dated 1973, and all amendments thereto.

END OF SECTION

(SERV-7)

SECTION 02601
PRECAST MANHOLES

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This sections covers all precast manholes complete, including, but not limited to, bases, walls, cones, mortar, inverts, frames and covers.

1.02 RELATED WORK:

- A. Section 02200, EARTHWORK
- B. Section 02575, PAVING

1.03 SYSTEM DESCRIPTION:

- A. Precast sections shall conform in shape, size, dimensions, materials, and other respects to the attached details.
- B. All manholes shall have concrete bases. Concrete bases shall be precast. Invert channels shall be formed of brick and mortar upon the base.
- C. Riser and cone sections, if required, shall be precast concrete.

1.04 REFERENCES:

- A. The following standards form a part of this specification as referenced:

American Society for Testing and Materials (ASTM)

ASTM	A48	Gray Iron Castings
ASTM	C32	Sewer and Manhole Brick
ASTM	C144	Aggregate for Masonry Mortar
ASTM	C207	Hydrated Lime for Masonry Purposes
ASTM	C478	Precast Reinforced Concrete Manhole Sections

PART 2 - PRODUCTS

2.01 PRECAST CONCRETE SECTIONS:

A. All precast concrete sections shall conform to ASTM C478 with the following exceptions and additional requirements:

1. The wall thickness of precast sections shall be as designated on the enclosed detail, meeting the following minimum requirements:

<u>Section Diameter</u> <u>(Inches)</u>	<u>Minimum Wall Thickness</u> <u>(Inches)</u>
48	5

2. Type II cement shall be used.
 3. Sections shall be steam cured and shall not be shipped until at least five days after having been cast.
 4. Minimum compressive strength of concrete shall be 4000 psi at 28 days.
 5. No more than two lift holes may be cast or drilled in each section.
 6. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section.
 7. Acceptance of the sections will be on the basis of material tests and inspection of the completed product.
 8. Circumferential steel reinforcement in walls and bases shall be a minimum of 0.12 sq. in./lin. ft. for 4-foot diameter sections. Reinforcing shall extend into tongue and groove.
- B. Conical reducing sections, if required, shall have a wall thickness not less than 5-inches at the bottom and wall thickness of 8-inches at the top. Conical sections shall taper from a minimum of 48-inches diameter to 24-inches diameter at the top.
- C. Except where insufficient depth of cover dictates the use of a shorter base, bases shall be a minimum of 4 feet in height.
- D. The tops of the bases shall be suitably shaped by means of accurate ring forms to receive the riser sections, if required.

- E. Precast sections shall be manufactured to contain wall openings of the minimum size to receive the ends of the pipes, such openings being accurately set to conform with line and grade of the sewer or drain. Subsequent cutting or tampering in the field, for the purpose of creating new openings or altering existing openings, will not be permitted.
- F. The exterior surfaces of all precast manhole bases, walls, and cones shall be given one shop coat of bituminous waterproofing, bituminous Super Service Black as manufactured by Koppers Company.

2.02 BRICK MATERIALS:

- A. Brick shall be sound, hard, and uniformly burned brick, regular and uniform in shape and size, of compact texture. Bricks shall comply with ASTM C32, for Grade SS, hard brick, except that the mean of five tests for absorption shall not exceed 8 percent by weight.
- B. Mortar shall be composed of portland cement, hydrated lime, and sand in which the volume of sand shall not exceed three times the sum of the volumes of cement and lime. The proportions of cement and lime shall be as directed and may vary from 1:1/4 for dense hard-burned brick to 1:3/4 for softer brick. In general, mortar for Grade SS Brick shall be mixed in the volume proportions of 1:1/2:4-1/2; portland cement to hydrated lime to sand.
- C. Cement shall be Type II portland cement as specified for concrete masonry.
- D. Hydrated lime shall be Type S conforming to ASTM C207.
- E. The sand shall comply with ASTM C144 specifications for "Fine Aggregate", except that all of the sand shall pass a No. 8 sieve.

2.03 FRAMES, COVERS AND STEPS:

- A. Castings shall be of good quality, strong, tough, even-grained cast iron, smooth, free from scale, lumps, blisters, sandholes, and defects of every nature which would render them unfit for the service for which they are intended. Contact surfaces of covers and frame seats shall be machined to prevent rocking of covers.
- B. All castings shall be thoroughly cleaned.
- C. Castings shall be at least Class 30 conforming to ASTM A48.

- D. Before being shipped from the foundry, castings shall be given one coat of coal-tar-pitch varnish applied in a satisfactory manner so as to make a smooth coating, tough, tenacious, and not brittle or with any tendency to scale off.
- E. The surface of the manhole covers shall have a diamond pattern with the cast word "SEWER".
- F. Manhole frames with 26-inch covers for 24-inch openings shall be 475 pounds minimum by E.L. LeBaron Foundry Co., No. LK110; Neenah Foundry Co. R1720; or Quality Water Products, Style 40.
- G. Watertight type manhole frames with 26-inch diameter covers (bolted and gasketed) shall be 4 bolt, 475 pounds minimum, and shall be E.L. LeBaron Foundry Co. No. LBB268; Mechanics Iron Foundry Type A2073 or Quality Water Products, Style 40WT.
- H. Manhole steps shall conform to ASTM C478 and shall be fabricated of either extruded aluminum or steel reinforced plastic. Steps shall be spaced at a maximum of 12-inches.

2.04 SEWER MANHOLE ACCESSORIES:

- A. Gasket materials shall be top grade (100% solids, vulcanized) butyl rubber and shall meet or exceed Federal Specification SS-S-00210 and AASHTO M-198.
- B. Couplings at the manhole-pipe interface shall be of the method shown on the enclosed detail. The boot system shall be neoprene rubber with stainless steel straps recommended for this type of connection. Only cast-in-place couplings shall be acceptable; couplings for core-drilled or cast-in-place openings will not be acceptable.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. PRECAST SECTIONS:

1. Precast bases shall be supported on a compacted level foundation of crushed stone, as specified in Section 02200 EARTHWORK, at least 6-inches thick, but shall vary to the depth necessary to reach sound undisturbed earth.
2. Precast reinforced concrete sections, if required, shall be set vertical and with sections in true alignment.
3. Butyl rubber joint sealant shall be installed between each concrete section.

4. All holes in sections used for handling the sections shall be thoroughly plugged with mortar. Mortar shall be one part cement to 1-1/2 parts sand, mixed slightly damp to the touch (just short of "balling"), hammered into the holes until it is dense and an excess of paste appears on the surface, and then finished smooth and flush with the adjoining surfaces.
5. Where cone sections cannot be installed because of depth of pipe restrictions, a manhole top slab shall be installed as specified on the enclosed details.

B. BRICK WORK:

1. Bricks shall be moistened by suitable means, as directed, until they are neither so dry as to absorb water from the mortar nor so wet as to be slippery when laid.
2. Each brick shall be laid as a header in a full bed and joint of mortar without requiring subsequent grouting, flushing or filling, and shall be thoroughly bonded.
3. The brick inverts shall conform accurately to the size of the adjoining pipes. Side inverts shall be curved and main inverts (where direction changes) shall be laid out in smooth curves of the longest possible radius which is tangent to the centerlines of adjoining pipe.

C. CASTINGS:

1. Cast iron frames and covers shall be as specified. The frames and covers shall be set by the Contractor to conform accurately to the grade of the finished grade or existing ground surface.
2. Cast iron manhole frames and covers not located in paved areas shall be set 6-inches above finished grade. The top of the cone shall be built up with a minimum of 1 course and a maximum of 5 courses of brick and mortar used as headers for adjustment to final grade.
3. Frames shall be set concentric with the top of the concrete section and in a full bed of mortar so that the space between the top of the concrete section or brick headers and the bottom flange of the frame shall be completely filled and made watertight. A thick ring of mortar extending to the outer edge of the concrete shall be placed all around the bottom flange. The mortar shall be smoothly finished to be flush with the top of the flange and have a slight slope to shed water away from the frame.

4. Covers shall be left in place in the frames, for safety reasons, except while work is being performed.

D. ACCESSORIES:

1. Accessories shall be installed in accordance with manufacturer's instructions.

- E. All connections to existing manholes shall be cored and performed under the direction and supervision of the Superintendent.

3.02 LEAKAGE TESTS:

- A. Leakage tests shall be made and observed by the Superintendent on each sewer manhole located within 1/2 mile of a municipal (public) drinking water well supply. The test shall be by vacuum or by water exfiltration as described below:

B. VACUUM TEST:

1. The vacuum testing system shall be as supplied by NPC Systems, Inc., or approved equal. The testing shall be done immediately after assembly of the manhole and before backfilling. A 60-foot-lb. torque wrench shall be used to tighten the external clamps that secure the test cover to the top of the manhole. All lift holes shall be plugged with a non-shrinking mortar, as specified in paragraph 3.01 A. The Contractor shall plug the pipe openings, taking care to securely brace the plugs and the pipe to prevent the plugs from being drawn into the manhole. A vacuum of 10 inches Hg (4.9 psi) shall be drawn and the vacuum pump shut off. The manhole shall pass the test if the vacuum remains at 10-inches Hg or drops to 9 inches Hg (4.4 psi) in a time greater than one minute for 0-10 feet deep manholes; one minute fifteen seconds for 10-15 feet deep manholes; and one minute thirty seconds for 15-25 feet deep manholes.
2. If the manhole fails the initial test, the Contractor shall locate the leaks and make proper repairs. Leaks may be filled with a wet slurry of accepted quick setting material. If the manhole should again fail the vacuum test, additional repairs shall be made, and the manhole water tested as specified below.

C. WATER EXFILTRATION TEST:

1. After the manhole has been assembled in place, all lifting holes shall be filled and pointed with an approved non-shrinking mortar. All pipes and other openings into the manhole shall be suitably plugged and

the plugs braced to prevent blow out. The test shall be made prior to placing the shelf and invert. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test.

2. The manhole shall be filled with water to the top of the cone section. If the excavation has not been backfilled and observation indicates no visible leakage, that is, no water visibly moving down the surface of the manhole, the manhole may be considered to be satisfactorily water-tight. If the test, as described above, is unsatisfactory or if the manhole excavation has been backfilled, the test shall be continued. A period of time may be permitted if the Contractor so wishes, to allow for absorption by the manhole. At the end of this period, the manhole shall be refilled to the top of the cone, if necessary, and a measuring time of at least 8 hours begun. At the end of the test period, the manhole shall be refilled to the top of the cone, measuring the volume of water added. This amount shall be extrapolated to a 24-hour loss rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed one gallon per vertical foot for a 24-hour period. If the manhole fails this requirement, but the leakage does not exceed 3 gallons per vertical foot per day, repairs by approved methods may be made as directed by the Superintendent to bring the leakage within the allowable rate of one gallon per foot per day. Leakage due to a defective section or joint or exceeding the 3 gallon per vertical foot per day, shall be cause for rejection of the manhole. It shall be the Contractor's responsibility to uncover the rejected manhole as necessary and to disassemble, reconstruct or replace it. The manhole shall then be retested and, if satisfactory, interior joints shall be filled and pointed.
3. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc. It shall be assumed that all loss of water during the test is a result of leaks through joints or through the concrete. Furthermore, the Contractor shall take any steps necessary to assure that the water table is below the bottom of the manhole throughout the test.
4. If the groundwater table is above the highest joint in the manhole, and there is no leakage into the manhole such a test can serve to evaluate water-tightness of the manhole. However, if the Superintendent is not satisfied with the results, the Contractor shall lower the water table and carry out the test as described hereinbefore.

3.03 CLEANING:

- A. All new manholes shall be thoroughly cleaned of all silt, debris and foreign matter of any kind, prior to final inspection.

(SERV-12)

END OF SECTION

SECTION 02602

GRAVITY SEWER SERVICE CLEANOUT

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section covers the furnishing and installation of cleanout assemblies on gravity sewer services as indicated on the attached detail and as specified herein.

1.02 RELATED WORK:

- A. Section 02200, EARTHWORK
- B. Section 02601, PRECAST MANHOLES
- C. Section 02625, POLYVINYL CHLORIDE GRAVITY PIPE AND FITTINGS
- D. Section 02649, TRACER TAPE

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All gravity clean outs shall be constructed using six (6) inch diameter PVC pipe and fittings as specified under Section 02625.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Cleanouts will be allowed on six (6) inch sewer service pipes only. All larger pipes must install manholes in lieu of cleanouts.
- B. Cleanouts shall be installed no more than ten (10) feet upstream of any bend in a sewer service line which is greater than twenty-two and a half (22 1/2) degrees.
- C. A cleanout must be installed no less than every one hundred and fifty (150) feet on a sewer service line.
- D. The sum of the bends between cleanouts (inclusive of the basement cleanout) will not exceed ninety (90) degrees.

- E. The top of the cap or plug on the cleanout must be a maximum of six (6) inches below the finished ground surface.
- F. The top of all cleanouts will be wrapped with not less than four feet of tracer tape as specified under Section 02649. The tracer tape will be secured to the top of the cleanout using electrical or duct tape.
- G. There must be a cleanout no more than ten (10) feet upstream of any wye branch or other fitting which brings flow from two pipes down to one. The cleanout for a wye or tee fitting should be on the branch line, not on the straight line.
- H. The Superintendent, or his appointee, has the authority to require the installation of additional cleanouts during field inspections.

3.02 TESTING

- A. Cleanouts will be tested at the same time and in the same manner as all other PVC pipes as specified in Section 02625.

3.02 AS BUILT DRAWINGS

- A. Cleanouts will be shown on the as built sketch with measured ties from each cleanout to the building corners.

END OF SECTION

SECTION 02625

POLYVINYL CHLORIDE GRAVITY PIPE AND FITTINGS

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section covers the furnishing and installation of Polyvinyl Chloride (PVC) pipe and fittings, as indicated on the attached detail and as specified herein.

1.02 RELATED WORK:

- A. Section 02200, EARTHWORK
- B. Section 02649, TRACER TAPE

1.03 REFERENCES:

- A. The following standards form a part of these specifications as referenced:

ASTM	D2321	Recommended Practice for Under-ground Installation of Flexible Thermoplastic Sewer Pipe
ASTM	D3034	Specification for Type PSM Poly-vinyl Chloride (PVC) Sewer Pipe and Fittings
ASTM	D3212	Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. PVC nonpressure sewer pipe 4-inches through 15-inches diameter shall conform to ASTM D3034, with SDR of 35 unless noted, and shall meet the specific requirements and exceptions to the aforementioned specifications which follow.
- B. PVC nonpressure sewer pipe shall be furnished in standard lengths.
- C. One pipe bell consisting of an integral wall section with a solid cross section rubber ring, factory assembled, shall be furnished with each standard, random and short length of pipe. Rubber rings shall be provided to the requirements of ASTM D3212.

- D. The rubber ring shall be retained within the bell of the pipe by a precision formed groove or recess designed to resist fishmouthing or creeping during assembly of joints.
- E. Spigot pipe ends shall be supplied with bevels from the manufacturer to ensure proper insertion. Each spigot end shall have an "assembly stripe" imprinted thereon to which the bell end of the mated pipe will extend upon proper jointing of the two pipes.
- F. PVC fittings shall be provided with bell and/or spigot configurations with rubber gasketed joints compatible with that of the pipe.
- G. All pipe delivered to the job site shall be accompanied by independent testing laboratory reports certifying that the pipe and fittings conform to the above-mentioned specifications. In addition, the pipe shall be subject to thorough inspection and tests, the right being reserved for the Superintendent to apply such of the tests specified as he may deem necessary.
- H. All cutting of pipe shall be done with a machine suitable for cutting PVC pipe. Cut ends shall be beveled when recommended by the pipe manufacturer.
- I. Service connection pipe shall be six (6) inches in diameter; any deviation from this standard shall be approved by the Superintendent in writing.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Except as modified herein, installation of the PVC pipe shall be in accordance with ASTM D2321.
- B. Each pipe length shall be inspected before being laid to verify that it is not cracked. Pipe shall be laid true to line and grade and in such a manner as to form proper connection to the public sewer. Each pipe shall be so laid as to form a close concentric joint with the next adjoining pipe and bring the inverts continuously to the required grade.
- C. The pipe shall be supported by compacted crushed stone. Crushed stone shall be as specified under Section 02200 EARTHWORK.
- D. The pipe shall not be driven down to grade by striking it with a shovel handle, timber, rammer, or other unyielding object. When each pipe has been properly bedded, enough of the backfill material shall be placed and compacted between the pipe and the sides of the trench to hold the pipe in correct alignment.

- E. Before a joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that inverts are matched and conform to the required line and grade.
- F. For pipe placed on crushed stone, immediately after the joint is made, the jointing area shall be filled with suitable materials so placed and compacted that the ends of either pipe will not settle under backfill load.
- G. No pipe or fitting shall be permanently supported on saddles, blocking, or stones.
- H. Branches and fittings shall be laid by the Contractor as necessary.
- I. All pipe joints shall be made as nearly watertight as practicable. There shall be no visible leakage at the joints and there shall be no sand, silt, clay, or soil of any description entering the pipeline at the joints. Where there is evidence of water or soil entering the pipeline, connecting pipes, or structures, the defects shall be repaired.
- J. The Contractor shall build a tight bulkhead in the pipeline where new work enters an existing sewer building connection. This bulkhead shall remain in place until its removal is authorized by the Superintendent.
- K. Care shall be taken to prevent earth, water, and other materials from entering the pipe.
- L. All connections made between PVC and pipe of any different material shall be made using a suitable connector.
- M. The minimum cover distance (from the top of the pipe to the finished grade) shall be maintained at 4 feet for frost protection.
- N. The minimum slope allowable for the service connection pipe is 1/8-inch per foot for a six (6) inch pipe.
- O. The sum of the bends between cleanouts (inclusive of the basement cleanout) shall not exceed 135°. Refer to attached detail for installation standards.
- P. Any work that must be performed to the mainline public sewer shall be done under the direction and supervision of the Superintendent. The Contractor shall submit a description of work to be performed in writing to the Superintendent for review and approval.

(SERV-8)

3.02 QUALITY ASSURANCE

A. LEAKAGE TESTING:

1. On completion of a section of sewer, including building connections installed to the property line, the Contractor shall install suitable bulkheads as required, dewater and test the sewer for leakage.
2. Unless otherwise approved, the section shall be tested using low pressure air test procedures. If circumstances permit, the Engineer may allow testing by infiltration or exfiltration in lieu of air testing.
3. The air test procedures shall conform to the Uni-Bell Recommended Practice for Low Pressure Air Testing of Installed Sewer Pipe, UNI-B-6. The starting air pressure for the test shall be 4 psi. The minimum duration permitted for the prescribed low pressure air exfiltration pressure drop between two consecutive manholes shall not be less than provided in Table I or Table II of UNI-B-6. The two tables are reproduced on the following pages.
4. If either infiltration or exfiltration testing is permitted by the Engineer, the test shall be conducted for at least 24 hours. The amount of infiltration or exfiltration shall not exceed 100 gallons per inch-diameter per mile of sewer per 24 hours.
5. The infiltration test measures leakage into a section of sewer and may be used only where the groundwater level is one foot or more above the crown of the section of sewer pipe at its upper end and at least one foot above the top of building connections and chimneys. For making the infiltration tests, underdrains, if used, shall be plugged and other groundwater drainage shall be stopped to permit the groundwater to return to its normal level insofar as practicable. Allowances shall be made for water which may enter the sewer through pipe connections and inlets during the infiltration test.
6. Where the groundwater level is less than 1 foot above the top of the pipe at its upper end, the exfiltration test may be used. The sewers shall be subjected to an internal pressure by plugging the pipe at the lower end and then filling the pipelines and manholes with clean water to a height of 2 feet above the highest point in the system to be tested, including main pipeline, service connections and chimneys. When slopes between manholes are steep, the Contractor shall insure that this test can be accomplished without danger of forcing stoppers from wye or tee branches.

7. The rate of exfiltration from the sewers shall be determined by measuring the amount of water required to maintain the water level at the elevation established at the beginning of the test.
8. The Contractor shall construct such weirs or other means of measurements as may be required, shall furnish water and shall do all necessary pumping to enable the test to be properly made.
9. The Contractor shall be responsible for the satisfactory watertightness of the entire section of sewer. Should the sections under test fail to meet the requirements, the Contractor shall do all work of locating and repairing leaks and retesting as the Engineer may require without additional compensation. A plan of the method of repairing any leaks that are found shall be submitted to the Engineer for review.

B. PIPE DEFLECTION MEASUREMENT:

1. No less than six months after completion of the PVC sewer pipe installation, the Contractor shall test the pipeline for deflection using a "go no-go" deflection mandrel having a minimum of nine evenly spaced arms or prongs. The "go no-go" gauge shall be hand pulled through all sections of the pipeline by the Contractor. The Contractor shall submit drawings of the "go no-go" gauge to the Engineer for approval prior to testing. Complete dimensions of the gauge for each diameter of pipe to be tested shall be provided on the drawings.
2. Any section of pipe found to equal or exceed 5.0 percent deflection shall be deemed a failed pipe and shall be excavated and replaced by the Contractor at his own expense.

TABLE 1

SPECIFICATION TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q=0.0015

1 Pipe Diameter (in.)	2 Minimum Time (min: sec)	3 Length for Minimum Time (ft)	4 Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)								
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24	
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48	
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38	
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04	
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41	
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31	
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33	
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48	
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15	
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53	
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46	

TABLE 2

SPECIFICATION TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q=0.0015

1 Pipe Diameter (in.)	2 Minimum Time (min: sec)	3 Length for Minimum Time (ft)	4 Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	46:04
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

END OF SECTION

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SECTION 02626

SEWER PRESSURE PIPING

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section covers the furnishing and installation of pressurized sewer force main piping and fittings as indicated on the attached detail and as specified herein.
- B. Pressure sewer mains are allowed. A pressure sewer main which transports wastewater from more than one single building pumping units to a gravity sewer shall be called the "sewer header". A pressure sewer main which transports wastewater from a pumping unit which services more than a single building, to a gravity sewer will be called a "sewer force main".

1.02 RELATED WORK:

- A. Section 02200, EARTHWORK
- B. Section 02601, PRECAST MANHOLES
- C. Section 02649, TRACER TAPE
- D. Section 02642, SEWER VALVES AND APPURTENANCES

1.03 REFERENCES:

- A. The following standards form a part of this specification as referenced:

American Water Works Association (AWWA)

- | | | |
|------|------|--|
| AWWA | C104 | Cement-Mortar Lining for Ductile Iron Pipe and fittings. |
| AWWA | C105 | Polyethylene Encasement for Ductile Iron Piping for water and other liquids. |
| AWWA | C110 | Ductile-Iron and Gray-Iron Fittings, 3-In. through 48-In., for Water and Other Liquids |
| AWWA | C111 | Rubber Gasket Joints for Ductile Iron and Grey Iron Pressure Pipe and fittings. |
| AWWA | C150 | Thickness Design of Ductile Iron Pipe. |

- AWWA C151 Ductile Iron Pipe, Centrifugally Cast for Water or Other Liquids.
- AWWA C153 Ductile-iron mechanical joint compact fittings 4-In. through 16-In.
- AWWA C600 Installation of Ductile-Iron Water Mains and Their Appurtenances
- AWWA C651 Disinfecting Water Mains
- AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4-In. through 12-In.,
- AWWA C907 Polyvinyl Chloride (PVC) Fittings 4-In. through 8-In.
- American Society for Testing and Materials (ASTM)
- ASTM D1784 Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds
- ASTM D1785 Specification for Polyvinyl Chloride (PVC) Plastic Pipe. Schedule 40, 80 and 120.
- ASTM D2241 Specification for Polyvinyl Chloride (PVC) Pressure-Rated Pipe (SDR-Series)
- ASTM D2321 Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
- ASTM D2467 Specification for Socket-Type for Polyvinyl Chloride (PVC) Plastic Pipe Fittings Schedule 80.
- ASTM D2564 Specifications for Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings.
- ASTM D2855 Recommend Practice for making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.
- ASTM D3139 Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- ASTM F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

1.05 SUBMITTALS:

- A. Two sets of Shop drawings shall be submitted and shall consist of manufacturer's scale drawings, cut, or catalogs including descriptive literature and complete characteristics and specifications, and code requirements. Shop drawings shall be submitted for the pressure pipe, type of joints, fittings, and coupling in accordance with specifications.
- B. Lay out drawings must include a plan and profile drawn to scale and stamped by a Registered Land Surveyor or Professional Engineer. Lay out drawings should be drawn with a scale of 1"=40' horizontal and 1"=4' vertical on the plan and profile drawings.

PART 2 - PRODUCTS

2.01 PIPE:

- A. All sewer pipe system: type, sizes, layout, check valves, pumping units, gate valves, clean outs manholes, air release manholes, etc., shall be designed and stamped by a licensed professional engineer.
- B. All PVC pressure pipe shall be designed and manufactured in accordance with ASTM D2241 or AWWA C900, as appropriate, using materials which conform to ASTM D1784.
- C. Unless otherwise indicated or specified, pressure pipe from 1 1/2-inch through 3-inch shall be PVC pressure class 200 (SDR 21) and from 4-inch through 12-inch shall be PVC pressure class 150 (DR 18) or Ductile Iron thickness class 52.
- D. Pipe shall be homogeneous throughout; free from voids, cracks, inclusions, and other defects; as uniform as commercially practicable in color, density, and other physical properties.
- E. Pipe surfaces shall be free from nicks, scratches, and other blemishes. The joining surfaces of pipe spigots and of integral-bell and sleeve-reinforced bell sockets shall be free from gouges and other imperfections that might cause leakage at joints.
- F. All exposed PVC pressure pipe shall be SCH 80 conforming to ASTM D1785 and ASTM D2467.

2.02 JOINTS:

- A. Push-on joints for PVC pressure pipe shall conform to ASTM D3139 and F477.
- B. Joints for Ductile Iron pipe shall conform to AWWA C111.
- C. Pipe and fittings shall be furnished with approved thrust restraining appurtenances to keep the piping from pulling apart under pressure.
- D. All socket fittings shall be joined with solvent cement conforming to ASTM D2564 and ASTM D2855.

2.03 FITTINGS:

- A. PVC Fittings shall be used for all pipe sizes 1 1/2-inch through 3-inch.
- B. Fittings for pipe sizes 4" through 8" shall conform to AWWA C907 PVC or AWWA C153 ductile iron compact mechanical joint. A non-toxic epoxy coating safe for potable water shall be factory applied to interior and exterior of all ductile iron fittings.
- C. Ductile iron fittings, conforming to AWWA C153 shall be used for pipe sizes 10-inch through 12-inch.
- D. Pressure classification of fittings shall be at least equal to that of the pipe with which they are used.
- E. Gaskets shall be of a composition suitable for exposure to the liquid within the pipe.
- F. Ductile iron fittings should have all bell mechanical joint ends, and PVC fittings shall have all bell ends conforming to ASTM D3139.

2.04 FLEXIBLE COUPLINGS:

- A. To ensure correct fitting of pipe and couplings, all sleeve-type couplings and accessories shall be furnished by the supplier of the pipe and shall be of a pressure rating at least equal to that of the pipeline in which they are to be installed. Sleeve-type couplings shall be made by Dresser Mfg. Div., Bradford, PA; Rockwell International, Pittsburgh, PA; Clow Corporation, Rochester, NY; or be an approved equal.
- B. Couplings for buried pipe shall be of cast iron and shall be Dresser Style 38 or 153, Rockwell Type 441, Clow Type F-1208, or approved equal products.

Coupling shall be provided with galvanized steel bolts and nuts.

- C. All couplings shall be furnished with the pipe stop removed.
- D. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The pipe installation shall be in accordance with the manufacturer's and the professional engineer's recommendations. Plans and profiles of the piping must be submitted and accepted by the Superintendent before any work is undertaken.
- B. A pressure sewer pipe from an individual building pumping unit which connects to a sewer header must have an isolation valve located at approximately the property line of the property. The valve shall be as specified in Section 02624 of these specifications. This valve is in addition to the valve required in Section 11306 of these specifications.
- C. On a pressure pipe from an individual building pumping unit which connects to a sewer header, a minimum of two (2) check valves must be installed. One valve must be installed just upstream (building side) of the isolation valve. The second check valve must be an integral part of the pumping unit and should be in an accessible location. (See attached detail.)
- D. Pressure sewer pipe from multiple building pump units will not be connected to a header. Only individual building pump units may be connected to a header pipe system. (This paragraph may be waived by the Superintendent if it can be proven to him that all buildings will be controlled or owned by one private party in perpetuity.)
- E. Each pipe length shall be inspected before being laid to verify that it is not cracked. Each pipe shall be so laid as to form a close concentric joint with the next adjoining pipe and so that no abnormality exist along the inside wall of the pipe, which could cause a clog or stoppage.
- F. All PVC pipe shall be installed in a sand envelope so

that there is a minimum of six (6) inches of sand beneath the pipe and twelve inches of sand above and to either side of the pipe. The sand shall have no stone larger than one half (1/2) inch in diameter and otherwise shall have all of the characteristics of the Gravel Borrow described in Section 02200 of these Specifications. On site sandy material shall not be used for the encasement of pressure sewer pipes. Once the pipe has been properly installed in the sand envelope the pipe zone shall be compacted to insure that the pipe does not move from its installed position.

- G. Before a joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained.
- H. No pipe or fitting shall be permanently supported on saddles, blocking, or stones. Each pipe shall have firm support along its entire length.
- I. All pipe joints shall be made watertight.
- J. Care shall be taken to prevent earth, water, and other materials from entering the pipe during the pipe installation work. At all time when pipe laying is not actually in progress, the open ends of the pipe shall be closed by temporary water-tight plugs or by other approved means. If water is in the trench when work is resumed, the plug shall not be removed until all danger of water entering the pipe has passed. Should earth enter the pipe it must be removed and will not be allowed to enter the Public sewer system.
- K. All connections made between any different materials shall be made using a suitable connector.
- L. Assembling of fittings with mechanical joint ends shall conform to AWWA C600, Section 9B and all amendments thereto.
- M. The minimum cover distance from the top of the pipe to the finish grade shall be maintained at four and one half (4 1/2) feet for frost protection.
- N. All pipes installed in the Town's right-of-way must be installed with a linear alignment. No bends, sweeps or fittings other than ninety degree (90) connection tees will be allowed in the Town's right-of-way unless a clean out manhole is installed. Individual property pipes must connect to the main at a ninety (90) degree angle and be installed with a

"perpendicular to the sewer header" alignment until it leaves the Town right-of-way. Individual property lines shall be installed in a generally linear alignment. Bends and sweeps are to be avoided whenever possible. This requirement can only be waived if the entire length of sewer pressure pipe in the Town's right-of-way is Ductile Iron pipe (CL 52).

- O. For bends on proposed private property, fittings and sweeps are to be avoided. No fitting shall be allowed with an angle of forty-five (45) degrees or larger. Slow sweeping bends constructed by deflecting lengths of pipe, in accordance with the pipe manufacturer's permissive alignment deflections, are allowed and preferred in lieu of fitting type bends. Permissible alignment deflection shall not be achieved by using mechanical means, but shall be accomplished manually by application of uniform forces along the pipe's length. (This clause is for pipes installed on private property only).
- P. When pressure pipe is to be drilled and tapped, it shall be done in accordance with the manufacturer's recommendations. Only sharp cutting tools shall be used and the tool shall be lubricated during drilling to avoid a build-up of excess heat locally in the pipe. All tapped connections to sewer headers shall be done with the use of tapping saddles which wrap around the pipe with one stainless steel strap.
- Q. Clean Out manholes will be required every five hundred (500) feet.
- R. At no time shall there be more than one fitting style bend between Clean Out manholes. The Superintendent may require additional Clean Out manholes on pipe lines with long sweeping bends.
- S. Clean Out manholes will be constructed with a tee and gate or ball valve on a removable, three (3) foot, section of the pressure pipe as shown on the detail. The removable section of pipe will be jointed to the sewer header or force main using flexible couplings or or flange connection. The floor of the Clean Out manhole shall be a minimum of eighteen (18) inches below the invert of the force main pipe. The pipe in the manhole will be braced against thrust and to prevent movement by using removable galvanized steel or aluminum brackets.
- T. The pipe shall be installed so that it has a continuously positive slope from the pumping unit.

Any changes to negative slope will require the installation of an Air Release manhole. Changes from a negative slope to a positive slope may require the installation of an additional Clean Out manhole.

- U. Air Release manholes if needed must be designed by the professional engineer that designs the pumping unit and pipe system. Any Air Release manhole must be designed to protect the piping against freezing, and release gases which could cause an air lock condition in the pipe line.
- V. Clean Out and Air Release manholes structures shall be governed by Section 02601 of these Specifications. All items that apply in Section 02601 will apply in the Clean Out or Air Release manhole. No top slabs will be allowed in Air Release or Clean Out manholes unless they are installed to a depth that allows six and one half (6 1/2) foot of clearance between the floor of the manhole and bottom of the top slab.
- W. Sewer pressure pipes may not discharge directly into the gravity sewer through an existing stub connection. All force mains must terminate at a sewer manhole.
- X. When any sewer pressure pipe crosses a water pipe the sewer main will be installed a minimum of eighteen (18) inches below the water pipe. Sewer pressure pipe will at all times be installed a minimum of five (5) feet horizontal distance away from any water pipe.
- Y. Any location where a PVC pressure pipe crosses a water pipe at a distance of less than eighteen (18) inches, the sewer pipe will be installed inside a sleeve of ductile iron or galvanized steel pipe for a length that will insure that there is a distance of five (5) feet from each end of the sleeve to the water pipe.
- Z. Tracer tape, as specified in Section 02649, will be installed not lower than six (6) inches below the finish ground surface, directly above all sewer pressure piping.

3.02 TESTING

- A. Prior to the pressure and leakage tests, the piping shall be thoroughly cleaned of all dirt, dust, oil, grease, and other foreign material. This work shall be done with care to avoid damage to the pipe.

B. PRESSURE AND LEAKAGE TESTS:

1. All pipelines shall be given combined pressure and leakage tests in sections of approved length. The Contractor shall furnish and install suitable temporary testing plugs or caps; all necessary pressure pumps, pipe connections, meters, gates, and other necessary equipment; and all labor required. The Town shall have the privilege of using their own gages.
2. Unless it has already been done, the section of pipe to be tested shall be filled with water and all air shall be expelled from the pipe. The Contractor shall follow established procedures for filling the pipe and expelling trapped air to avoid exposing the piping system to water hammer.
3. The section under test shall be maintained full of water for a period of 24 hours prior to the combined pressure and leakage test being applied.
4. The pressure and leakage test shall consist of first raising the water pressure (based on the elevation of the lowest point of the section under test corrected to the gage location) to the pressure rating of the pipe. If the Contractor cannot achieve the specified pressure and maintain it for a period of one hour, the section shall be considered as having failed to pass the pressure test.
5. Following or during the pressure test, the Contractor shall make a leakage test by metering the flow of water into the pipe while maintaining the specified pressure in the section being tested. If the average leakage during a two hour period exceeds 11.6 gallons per day, per inch of diameter, per mile of pipe, the section shall be considered as having failed the leakage test. For example, if 1,000 feet of 4-inch pipe is to be tested, the allowable leakage is 0.73 gallons over a 2 hour period, calculated as follows:

$$L = \frac{(11.6 \text{ gal}) \times (4") \times (2 \text{ hr.}) \times (1,000')}{(1") \times (24 \text{ hr.}) \times (5280')} = 0.73 \text{ gal}$$

- C. No testing shall be accepted unless the Superintendent or his appointee is on the site to observe the test.
- D. A pressure pipe must be tested from the pumping unit to where it discharges into the gravity sewer. No

segment testing will be allowed.

3.03 AS BUILT DRAWINGS

- A. Pressure sewer pipe as built drawings must indicate ties to:
- all sweeps, couplings, valves, tees, etc.
 - all changes in pipe direction,
 - all crossings of water pipes,
 - all clean out, air release, and end manholes'-
the pipes location and depth every 100 feet on
any sweeping section of pipe.
- B. All pressure sewer pipe as built drawings must be drawn to scale. A marked up set of scale construction plans is acceptable.
- C. As built drawings must show a plan and profile of the completed project with the depths and elevations clearly indicated.

END OF SECTION

SECTION 02642

SEWER VALVES AND APPURTENANCES

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section of the specification covers furnishing, and installation of all valves and appurtenances for use in sewer pressure piping.

1.02 RELATED WORK:

- A. Section 02200, EARTHWORK
- B. Section 02601, PRECAST MANHOLES
- C. Section 02625, POLYVINYL CHLORIDE GRAVITY PIPE AND FITTINGS
- D. Section 02626, SEWER PRESSURE PIPE

1.03 REFERENCES:

- A. The following standards form a part of this specification, as referenced:

American Society for Testing and Materials (ASTM)

ASTM A48 Gray Iron Castings

ASTM A148 High Strength Steel Castings for Structural Purposes

American Water Works Association (AWWA)

AWWA C500 AWWA Standard for Gate Valves, 3 through 48 Inches NPS, for Water and Sewer Systems

Federal Specifications (FS)

FS TT-V-51F Asphalt, Varnish

1.04 SUBMITTALS:

- A. Two (2) sets of shop drawings shall be submitted for valves and appurtenances, indicating type of joint, and lining and coating, etc., in accordance with the specifications.
- B. Shop drawings shall consist of manufacturer's scale drawings, cuts or catalogs, including descriptive literature with complete characteristics and specifications, and code requirements.

PART 2 - PRODUCTS

2.01 RESILIENT SEAT GATE VALVES:

- A. Resilient seat, wedge type gate valves shall be manufactured to meet all applicable requirements of AWWA C509. Mainline pressure sewer valves 2" through 10" shall be bubble-tight at 200 psi water working pressure, tested in both directions.
- B. Valve bodies shall be of cast iron and shall have non-rising threaded bronze stems acting through a bronze stem nut. Opening nuts shall be 2 inches square and shall open left. All buried valves shall have mechanical joint ends.
- C. Valves wedges shall be of cast iron with resilient seating surfaces permanently bonded to the wedges in strict accordance with ASTM D429 or attached to the face of the wedges with stainless steel screws. Each valve shall have a smooth, unobstructed water way free from sediment pockets.
- D. Valves shall have low friction, torque-reduction thrust bearings. All o-rings and gaskets shall be removable without taking the valves out of service.
- E. A non-toxic epoxy coating which is safe for potable water shall be applied to exterior and interior valve surfaces.
- F. Resilient seat gate valves shall be as manufactured by Clow Corporation, Besenville, IL; Mueller Co., Decatur, IL; Dresser Industries, Inc., Bradford, PA; or be an approved equal.

2.02 BALL VALVE:

- A. 1 1/2-inch and inch 2-inch ball valves shall be pvc ball valves with pre-loaded EPDM stem seals according to U.S. Patent No. 4,665,937 which increases the life of the stem seal, ABS impact resistant handle, precision molded micro-finished PVC ball, self-adjusting polyethylene ball seat seals to compensate for wear, and shall comply with ASTM D2846. It shall be designed for use with corrosive fluids, for low torque manual operation, and for a working pressure of 150 psi. The pvc material shall be type 1 (NSF). The valve shall be Model No. LT-1500-S or LT-2000-S, as manufactured by KBI (Kings Brothers Industries), or equal approved by the Superintendent.

- B. Ball valves shall be installed on pressure service connections as shown on the drawings. Buried valves shall have valve boxes.

2.03 VALVES BOXES:

- A. Each underground valve shall be provided with a box. Covers shall be close fitting and substantially dirt-tight. The top of the cover shall be flush with the top of the box rim. An arrow and the word OPEN to indicate the direction of the turning to open the valve shall be cast in the top of the cover, along with the word "SEWER."
- B. Valve boxes shall be of cast iron and of the adjustable threaded, heavy pattern type. They shall be so designed and constructed as to prevent direct transmission of traffic loads to the pipe or valve. The upper or sliding section of the box shall be provided with a flange having sufficient bearing area to prevent undue settlement. The lower section and stuffing box shall be designed to enclose the operating nut and stuffing box of the valve and rest on the backfill. The boxes shall be adjustable through at least 6 inches vertically without reduction of lap between sections to less than 4 inches.
- C. The inside diameter of boxes shall be at least 4-1/2 inches and the lengths shall be as necessary to suit the ground elevation and the depth of each valve.

2.04 CHECK VALVES:

- A. Check valves shall be PVC swing check valves designed for use with corrosive fluids and shall have a Buna-N seal on a swing gate which lifts to allow for unobstructed flow. The PVC material shall be type 1 (NSF). The valve shall have no metallic parts. It shall have a working pressure of 150 psi and shall require only 0.5 psi back pressure for complete closure. It shall be as manufactured by King Brothers Industries, an approved equal.

PART 3 - EXECUTION:

3.01 INSTALLATION:

- A. All material shall be carefully inspected for defects in workmanship and material, all debris and foreign material shall be cleaned out of valve openings and seats, all operating mechanisms operated to check their

proper functioning, and all nuts and bolts checked for tightness.

- B. Valves and other equipment which do not operate easily or are otherwise defective shall be repaired or replaced at the Drain Layer's expense.
- C. All valves shall be carefully installed and supported in their respective positions free from all distortion and strain. Care shall be taken to prevent damage or injury to the valves and appurtenances during handling and installation.
- D. Valve boxes shall be set plumb and centered directly over the operating nut of the valves. Earth fill shall be carefully tamped around the valve box to a distance of 4 feet on all sides of the box or to undisturbed trench faces if less than 4 feet.

END OF SECTION

SECTION 02649

TRACER TAPE

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section of the specification covers tracer tape to be installed on all service connections.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Tracer tape shall be Terra-Tape and Terra-Tape D by Reef Industries, Houston, TX; or Markline and Detectatape by Allen Systems, Houston, TX, or equivalent by Industrial Tape & Supply Company, Atlanta, GA.

2.02 TRACER TAPE:

- A. Tracer tape shall be at least 3-inches wide.
- B. Tracer tape for non-ferrous pipe shall be constructed of a metallic core bonded to plastic layers. The metallic tracer tape shall be a minimum 5-mil thickness and must be locatable at a depth of 18 inches with ordinary pipe locaters.
- C. The tape shall bear the wording: "BURIED SEWER LINE BELOW" continuously repeated every 30 inches to identify the pipe.
- D. Tape colors shall be green as recommended by APWA:

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Tracer tape shall be installed directly above the pipe or conduit it is to identify.
- B. The Contractor shall follow the manufacturer's recommendations for installation of the tape.

END OF SECTION

(SERV-11)

SECTION 11306

SINGLE BUILDING SEWER PUMPING UNITS

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section covers the furnishing and installing of factory-built centrifugal and semi-positive displacement submersible grinder single building sewer pumping units.
- B. This section has been inserted to set standards for the sewer pumping units that may be installed by a private party on private property. No single building sewer pumping unit will be installed on public property. Maintenance and ownership of all single building sewer pumping units will at all times remain with the owner of the pumping unit.
- C. Each unit shall be complete with all necessary parts and equipment specified in the plans and submittals which must be stamped and approved by a Professional Engineer
- D. No sewer pumping units will be allowed if there is a cost effective way to connect the building to the sewer by means of gravity flow. Pumping units must be avoided whenever possible.

1.02 RELATED WORK

- A. SECTION 02200 EARTHWORK
- B. SECTION 02601 PRECAST MANHOLES
- C. SECTION 02626 SEWER FORCE MAIN PIPING

1.03 SYSTEM DESCRIPTION:

- A. The system shall consist of either a single centrifugal or semi-positive displacement type pumps, each with a grinder, electric motor, electric controls, level controls, tank with integral access way, pump installation and removal systems, fittings, valves and all associated equipment and accessories required to make a complete system.
- B. A holding tank must be installed as part of the wet well or as part of the piping system. The holding tank must be able to hold a minimum of 1,000 gallons of waste water. The holding tank requirement can be waived if the pumping unit is duplex (dual pumps each

able to handle all flows) and if a permanently mounted emergency generator is supplied at the property.

- C. Equipment and accessories not specifically described herein shall be the manufacturer's standard catalog products.

1.04 QUALITY ASSURANCE:

A. All equipment shall conform to the following criteria:

1. Equipment shall be manufacturer's standard products presently in commercial production.
2. Conform to Hydraulic Institute Standards.
3. All the equipment specified under this Section shall be furnished by a single supplier and shall be products of manufacturers regularly engaged in the production of said equipment. The supplier shall have the sole responsibility for proper functioning of the complete grinder pump package.
4. Any reference to a specific manufacturer or model number is for the purpose of establishing a quality or parameter for specification writing and is not to be considered proprietary. In all cases, any source or device that has the quality and operating capabilities specified may be accepted.
5. Conform to requirements for materials, installation, and equipment approvals of State, Local, Underwriter's Laboratories, Inc., or other applicable codes.
6. Workmanship shall be first class in all respects.

B. MANUFACTURER'S QUALIFICATIONS:

1. Upon request from the Superintendent, the grinder pump manufacturer shall demonstrate proof of financial responsibility with respect to performance and long term maintenance.
2. Upon request from the Superintendent, the grinder pump manufacturer shall provide proof or evidence of the facilities, equipment, and skills required to produce the equipment specified herein.
3. The manufacturer shall provide the supervisory service of a factory trained engineer, who is specifically trained on the type of equipment supplied, for a period of not less than one 8-hour

day to assist the Drain Layer in installation of at least one of the pumping units and related appurtenances. This requirement applies to each new manufacturer used for any installation of grinder pump units.

4. The manufacturer will provide initial start-up of each grinder pump, and give one (1) hour of instruct to the first owner of each building.

C. TESTING

Field acceptance tests shall be performed as specified in Part 3 Execution.

1.05 REFERENCES:

- A. The latest editions of the following standards form a part of this specification as referenced:
 1. ASTM A48 Specifications for Gray-Iron Castings.
 2. ASTM A53 Specifications for Pipe, Steel, Black and Hot-dipped, Zinc Coated, Welded and Seamless.
 3. ASTM D1785 Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 4. ASTM D2464 Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.
 5. ASTM D2467 Socket-Type Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.
 6. ASTM D2564 Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.

NATIONAL ELECTRIC CODE (NEC)

1. NEC CODE NATIONAL ELECTRICAL CODE.

National Electric Manufacturers Association (NEMA)

1. NEMA Standard as Specified.

1.06 SUBMITTALS:

A. SHOP DRAWINGS AND PRODUCT DATA:

1. Two complete sets of shop drawings stamped by a Professional Engineer, including manufacturer's

data sheets showing illustrated cuts of the item(s), scale details, sizes, dimensions, capacities, performance characteristics, wiring diagrams, controls, and other pertinent information, shall be submitted to the Superintendent for review and approval. If more than one size or type is shown, the proposed items shall be clearly indicated. Approval of the shop drawings will not relieve the Drain Layer of the responsibility for proper fit or detail design.

2. Provide descriptive literature, bulletins, and/or catalog cuts for each item of equipment.
3. Provide data on the characteristics and performance of all pumps and motors. Pump data shall include guaranteed performance curves, based on actual shop tests of similar units, which show that they meet the specified requirements for head, capacity, efficiency, allowable NPSH, and horsepower. Curves shall be submitted on 8 1/2-inch by 11-inch sheets.
4. Provide the total weight of each item of equipment including the weight of the single largest component of each item.
5. Provide a complete total bill of materials for all equipment.

B. DESIGN DATA:

1. Provide structural design calculations and drawings for the pump chamber including a buoyancy analysis which demonstrates that the grinder pump unit is stable against buoyant forces produced by groundwater. The structural drawings and calculations shall be prepared and stamped by a Registered Professional Engineer.
2. Design and hydraulic data for Sewer Pressure pipe size design are the responsibility of the Drain Layer and must be approved by a Professional Engineer. The design should be consistent with Section 02626, "Sewer Pressure Pipe."
3. Provide complete wiring diagrams and schematics of all controllers, control panels, and control devices furnished under this section.
4. Provide complete wiring diagrams and schematics of all power and control systems including connections to the work of other sections.

- C. Submit details on all items in other specification sections which are to be supplied and installed as part of the grinder pump package specified in this Section.

1.07 WARRANTY:

- A. The manufacturer shall offer a limited warranty guaranteeing its product to be free from defects in material and factory workmanship for a minimum period of eighteen (18) months from initial building occupancy or completion of start-up, provided the product is properly installed, serviced, and operated under normal conditions and according to the manufacturer's instructions. Parts repair or replacement required as a result of such defects shall be made free of charge during this period upon return of the defective parts or equipment to the manufacturer or its nearest authorized service center.

PART 2 - PRODUCTS:

2.01 ACCEPTABLE MANUFACTURERS:

A. SEMI-POSITIVE DISPLACEMENT GRINDER PUMP:

1. Environment/One Corporation, Schenectady, New York.
2. An acceptable equivalent manufacturer.
3. *Vortex (see attached at end of section) 2/17/99*

B. CENTRIFUGAL GRINDER PUMP:

1. Hydromatic Pumps, a Marley Company, Mission, Kansas
2. Myers Division, a Pentair Company, Ashland, Ohio.
3. Peabody Barnes, Incorporated, Mansfield, Ohio.
4. Acceptable equivalent manufacturer.

2.02 EQUIPMENT - SEMI-POSITIVE DISPLACEMENT GRINDER PUMPS:

A. GENERAL:

1. The semi-positive displacement type grinder pump shall be a removable core type unit rated at one horsepower, operating on a 240 volt, single phase, 60 Hertz electrical system.

B. CORE UNIT:

1. Grinder Pump: Cartridge type easily removable core assemblies containing pump, motor, grinder, controls, check valve, anti-siphon valve and wiring.

2. The watertight integrity of the core unit, including wiring and access cover, shall be established by 100% factory test at a minimum of 5 psig.

C. PUMP:

1. Custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with mechanical seal.
2. Rotor: Highly polished, precipitation hardened stainless steel.
3. Stator: Specifically compounded ethylene propylene synthetic elastomer suitable for domestic wastewater service. Physical properties: High tear abrasion resistance, grease resistance, water and detergent resistance, temperature stability, good aging properties, and outstanding wear resistance.

D. GRINDER:

1. Rotating type with a stationary hardened and ground chrome steel shredding ring spaced in close annular alignment to the drive impeller assembly positioned immediately below the pump elements; direct-driven by a single, one piece motor shaft.
2. Grinder Impeller Assembly: Securely fastened to pump motor shaft; carry two hardened type 400 series stainless steel cutter bars; balanced to operate without objectionable noise or vibration over the entire range of recommended operating pressures.
3. Constructed to eliminate clogging and jamming under all normal starting and operating conditions with sufficient vortex action to scour tank free of deposits or sludge banks which would impair the operation of the pump.
4. To meet the above requirements, the following shall be accomplished in conjunction with the grinder pump tank:
 - a. Grinder shall be positioned in such a way that solids are fed in an up-flow direction.
 - b. Diameter of inlet shroud opening shall be no less than 5 inches (127 mm).
 - c. Average inlet velocity, at maximum flow, shall

not exceed 0.2 feet per second.

d. Cutter bars shall extend above the impeller disc 0.20 to 0.25 inches (5.1 to 6.4 mm).

e. Nominal speed of impeller disc to be 1725 rpm.

5. The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable quantity of "foreign objects," such as paper, wood, plastic, glass, rubber and the like, to finely-divided particles which will pass freely through the pump and the 1-1/4 inch diameter discharge piping.

E. ELECTRIC MOTOR:

1. One HP (746 watts), 1725 RPM, capacitor start, ball bearing, squirrel cage induction type with a low starting current not to exceed 30 amperes and high starting torque of at least 8.4 foot pounds.
2. Inherent protection against running overloads or locked rotor condition shall be provided for the pump motor by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. The motor protector combination to be investigated and listed by Underwriters' Laboratories, Inc., for the specific application.

F. MECHANICAL SEAL:

1. Core: Provided with a mechanical shaft seal to prevent leakage between the motor and pump.
2. Seal: Stationary ceramic seat and carbon rotating sealing surface with faces precision lapped and held in position by a stainless steel spring.

G. CHECK VALVE:

1. Pump to be equipped with factory installed, gravity operated, flapper type integral check valve built into the discharge pipe, providing full-ported passageway when open and introducing friction loss of less than 6 inches of water at maximum rated flow.
2. Valve Body: High gloss injection molded PVC Type I-II.
3. Working Parts: Series 300 stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability and

fatigue strength.

4. Non-metallic hinge: Integral part of flapper assembly providing maximum degrees of freedom for assured seating at a low back pressure.

H. ANTI-SIPHON VALVE:

1. Pump shall be constructed with a positively-primed flooded suction configuration.
2. Pump shall be equipped with integral anti-siphoning, air relief valve in the discharge piping just below the main check valve to provide added assurance that the pump cannot lose prime even under negative pressure conditions in the discharge piping system. This valve shall automatically close when the pump is running and open to atmosphere when the pump is off.

I. CONTROLS:

1. Necessary controls to be integral with the grinder pump and located in the top housing of the core unit inside a water-proof access cover which is attached with stainless steel, tamper-proof fasteners.
2. Non-fouling wastewater level detection for controlling pump operation to be accomplished by monitoring the pressure changes in an integral, air-bell level sensor connected through air-tight tubing to a pressure switch. The level detection device shall have no moving parts in direct contact with the wastewater. Overflow sensing shall be accomplished by a separate air-bell sensor of the same type.
3. Each level control to have its own built in fail safe design to prevent the entrance of moisture into the controls in case of switch diaphragm failure.
4. To assure reliable operation of pressure sensitive switches, each core to be equipped with a quick disconnect breather assembly, complete with check valve to prevent accidental entry of water into the motor compartment in the event of access way flooding.
5. Each grinder pump to be furnished with two ten-foot lengths of type UF cable, pre-wired and connected

with weather-proof materials. Power supply cable: 12-2 W.GND., designed for single phase, 240 volt, 60 Hertz power supply and to meet UL requirements. Alarm signal cable: 14-2 W.GND., designed for single phase, 120 volts, 60 Hertz power supply, and to meet UL requirements. All wiring to be in full compliance with Electrical Code and all wiring installed to be approved by the Wiring Inspector.

6. Electrical inlet connections shall be provided on both sides of inlet pipe, each at 45 degree angle from pipe to provide flexibility in route of electrical connection to house and panel.

J. CORROSION PROTECTION:

1. All materials exposed to wastewater shall have inherent corrosion protection; i.e., cast iron, fiberglass, stainless steel, or PVC. Any exterior steel surfaces are to be suitably protected against corrosion.

K. SERVICEABILITY:

1. Provide two lifting eyes in the top housing of the grinder pump core unit which can be used to facilitate removal from the tank.

L. SAFETY:

1. The grinder pump shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirements, the completely assembled and wired grinder pump in its tank shall be listed by Underwriters' Laboratories, Inc.
2. The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences; shall be free from noise, odor, or health hazards; and shall have been tested by an independent laboratory to certify its capability to perform as specified in either individual or low pressure sewer system applications. As evidence of compliance with this requirements, the grinder pump shall bear the National Sanitation Foundation seal of approval.

2.03 EQUIPMENT - CENTRIFUGAL GRINDER PUMP:

A. GENERAL:

1. The centrifugal type grinder pump shall be removable on rails and shall be rated two horsepower when operated on a 240 volt, single phase, 60 Hertz electrical system.

B. PUMPS:

1. Pumps shall be submersible type, single stage, centrifugal pumps capable of pumping continuously at conditions indicated on the drawings by the Professional Engineer. Pump casing shall be made of high tensile close-grained cast iron.
2. The pump shall be arranged to automatically clamp the pump discharge to the discharge connection when lowered along guides.
3. Discharge connection shall be cast iron, rigidly bolted to floor with stainless steel cinch anchors; machined to receive yoke and face of the pump discharge; discharge connection also shall hold the lower ends of the guides.
4. Shaft seals shall consist of two mechanical seals mounted in tandem, with an oil chamber between the seals. The rotating faces of the seals shall be carbon and the stationary faces shall be ceramic.

C. MOTOR:

1. Submersible motor windings shall be open type with Class F insulation. Winding housing shall be filled with a clean dielectric oil for cooling windings and seals and lubricating bearings.
2. The motor shall be protected from excessive temperatures by built-in automatic overload protection. The heat sensor thermostats embedded in the motor windings shall open when the temperature in the motor rises to over 220 degrees Fahrenheit and shall automatically reset when the temperature drops. The overload shall be connected in series with the starter coil so that the starter is tripped if the overload opens. The motor starter shall be equipped with overload heaters so all normal overloads are protected by external heater block.
3. Motors shall be sufficient horsepower for operation anywhere on the pump head-capacity curve without overloading, with a 1.15 service factor based on the nameplate rating.

4. Motor ball bearings shall be designed for minimum B-10 life of 30,000 hours.
5. Flexible Power and Control Panels: Each pump shall be furnished with sufficient flexible power and control cable to reach from the pump to the electrical enclosure indicated. Cable leads shall be epoxy sealed at motor connection to prevent corrosion.
6. Design of each pump shaft shall have ample provision to compensate for pump thrust and for overhung load on impeller. Shafts to be stainless steel.
7. Grinder pump impeller shall be of bronze construction and recessed multi-vane semi-open design and shall thread onto motor shaft.
8. The grinder mechanism shall consist of radial cutter and a shredding ring mounted directly below the pump volute inlet. Both shredding ring and the cutter shall be removable from the outside without disassembling the pump. The shredding ring and the cutter shall be constructed of 440C stainless steel hardened to Rockwell 55-60.
9. Provide moisture sensing probes in oil filled seal chamber.
10. Provide stainless steel cable or chain to raise or lower the pump. The chain or cable shall be sized according to the pump weight by the manufacturer or Professional Engineer.

D. LIFT-OUT SYSTEM:

1. Lift-out system shall be self-sealing with a simple up and down motion required to remove and reinstall the pump in the basin.
2. All components of the lift-out system shall be made of corrosion-resistant materials.
3. Lift-out system shall be adjustable so that perfect vertical alignment can be obtained.
4. All stationary components of the lift-out system shall be securely attached to the structure.
5. Each pump shall have a hold down system to prevent pump uplift.

E. CONTROLS:

1. Three mercury float switches shall be suspended from a detachable stainless steel bracket fastened inside the tank to the access frame. They shall be suspended at the proper depths to control the following levels:
 - a. High water level
 - b. Pump "ON" level
 - c. Pump "OFF" level
2. Contacts shall be left for the following alarm conditions:
 - a. Motor Overload
 - b. Seal Leak
 - c. High Water
3. A NEMA 4X and 7 Cast Aluminum Junction Box shall be provided for mounting in the basin. Wire splices in the junction box shall be butt splices with heat shrink covering. All cord connectors to float switches and motors shall be quick disconnect, watertight, strain relief type. Conduit feed connector to the junction box shall include explosion proof seal "Y". Float switch wiring shall be in a separate conduit or shielded.
4. All switches in the control panel shall be labeled. A wiring diagram shall be provided in each panel with all wires color coded and numbered.
5. All control voltages to the pump chamber shall be low enough to be intrinsically safe from the possibility of arcing in the pump chamber.
6. Electrical inlet connections shall be provided on both sides of inlet pipe, each at 45 degree angle to the pipe to provide flexibility in route of electrical connection to house and panel.
7. All work will comply with the electrical code and electrical permits, from the electrical inspector's office will be obtained for all electrical work.

F. VALVES:

1. All valves shall be provided by the pump unit manufacturer's standard catalog product.
2. Check Valve:

- a. Pump unit shall be supplied with factory installed check valve built into the discharge pipe.

3. Shut-off Valve:

- a. A shut-off valve shall be furnished and installed in the discharge piping. The valve shall be in an accessible location. If the valve is more than 2 feet from the ground surface, a handle extension may be required. This valve shall not be buried.

4. Anti-Siphon Valve:

- a. The basin assembly shall be arranged for quick and easy acceptance of an anti-siphon valve. The valve shall be installed on the riser pipe between the check valve and shut-off valve to within 2 feet of the surface. The anti-siphon valve shall mount horizontally, shall be made of PVC and shall not interfere with pump removal or installation.

2.04 PUMP CHAMBER:

- A. Grinder pump unit shall be installed in a suitable manufacturer's standard custom molded fiberglass reinforced polyester (FRP) or reinforced concrete (RC) basin so that the unit is readily removable for maintenance. The basin shall be furnished with an inlet flange to accept a 4-inch nominal diameter PVC Drain-Waste-Vent (DWV) pipe and with provision for the pump discharge pipe. If a FRP Basin is used it shall sit on and be fastened to an anti-flotation weight which will prevent flotation when the unit is completely submerged. Basin height shall be as indicated on the drawings. The basin cover shall be watertight and shall withstand the weight of the pump unit plus one 250 pound man and shall be bolted to the basin. The cover shall not project more than one inch above the ground surface.

2.05 CONTROL PANELS:

- A. The electrical control panels shall be furnished by the grinder pump manufacturer and shall be installed to electrical code and inspected and approved by the wiring inspector.
- B. The control panels shall be NEMA 3R surface mounting type to use circuit breakers, alarm relay, alarm horn,

alarm light, and silence push button, manual transfer switch and one 600V generator receptacle.

- C. In addition, the control panels for centrifugal grinder pumps shall include the hand-off automatic switch and indicating lights for motor overload, seal leak, and high water level.
- D. Control panels shall be furnished with an inner, hinged, deadfront panel containing all operator control devices and mechanisms, such as circuit breaker operating handles, manual transfer switch operating handle, push buttons, selector switches, indicating lights, etc. The alarm harm silence push button shall be accessible from the outside of the panel.
- E. Generator receptacles shall be 30 ampere, 600 volt, weatherproof, 3 wire, 4 pole having an angle body, spring cover, arcing chamber, reversed contacts, and longer ground contact bonded to body.
- F. Manual transfer switches shall be 250 volt, 30 ampere, 2 pole, rated 2 HP.

2.06 REDUNDANT CHECK VALVE:

- A. Each grinder pump unit shall include one separate check valve per unit for installation in the discharge line between the grinder pump and the sewer main to ensure maximum protection against backflow in the event of sewer service line break.
- B. The valve shall be as specified in Section 02642 of these specifications.

2.07 ALARMS

- A. All pumping units must have a high level and low level alarm which indicates the alarm in an audible and visual manner inside the building.
- B. All pumping units must have an audible and visible "NOT IN AUTO" alarm which sounds inside of the building being served when the pump is switched off.
- C. All alarm controls must have a battery powered back up system capable of sending the alarm for twenty-four (24) hours without commercial power.
- D. All alarms may be silenced by a push button on the control panel. Once silenced an alarm indicator light must remain lit until the alarm condition is cleared.

2.08 EMERGENCY HOLDING TANK

- A. Holding tanks may be constructed of FRP or RC and must be water tight.
- B. If the wet well used in the centrifugal pump installations is sized to achieve the 1,000 gallon emergency storage capacity, no separate holding tank is required. However, it must be noted that the pump operation floats or sensors must be set so as to keep septic conditions from occurring and not use the full volume of the tank except for emergency conditions.
- C. If a separate holding tank is installed, it must have a high level float alarm which must be indicated with an alarm light and audible alarm, and must be wired to the pump control and alarm panel or a separate control panel located adjacent to the pump control panel.
- D. The holding tank high level alarm must sound when the holding tank contains 500 gallons of liquid or one half of its total holding area.
- E. Holding tank contents can be pumped into the town sewer system but this work must be done by a firm licensed as a Septage Hauler by the Bellingham Board of Health, and only with the permission of the Superintendent.

2.09 ACCESSIBILITY

- A. Access way openings for pump chambers, wet wells, or holding tanks will be large enough to allow removal of all individual components of the pumping unit. The access way will not be less than a twenty four (24) inch diameter opening. The cover on the access will be either of the locking hatch type or a typical cast iron manhole cover as specified under Section 02601.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Installation of the grinder pump and related appurtenances shall be performed in accordance with all written instructions furnished by the manufacturer.
- B. After installation, the Drain Layer shall clean all surfaces damaged in shipment or installation and shall touch-up in the field with the same materials as original coatings.

- C. All structures such as pump chambers, wet wells, and valve pits must be installed on a minimum of six (6) inches stone bedding. Crushed stone shall be as specified under Section 02200.
- D. Access ways to pumping chambers, wet wells and overflow tanks will be constructed so that they are flush with or above the finished ground surface. Grading around access ways will be done to discourage run-off from entering the structures.
- I. High level alarm sensors shall be installed at a level slightly above the level at which the pump starts.
- J. The pump activation sensors must be set so that the pumping unit pumps at least two (2) times per day during average daily flow conditions.
- K. Wet wells must be constructed with proper venting to prevent the accumulation of sewer gas.
- L. All electrical work must be properly permitted and inspected by the wiring inspector, and all electrical work must be installed by a Massachusetts licensed electrician.
- K. All plumbing work done within ten feet of a building foundation must be properly permitted and inspected by the plumbing inspector and installed by a Massachusetts licensed plumber.

3.02 FIELD ACCEPTANCE TESTS:

- A. After installation of the equipment the Drain Layer shall operate each unit to demonstrate its ability to pump without excessive vibration, motor overloading, or overheating. Each pump shall be operated for a sufficient period of time to permit thorough observation of all pump components.
- B. The Superintendent shall be notified in writing at least seven days in advance of the testing.
- C. All defects or defective equipment shall be corrected or replaced promptly.
- D. All final adjustments necessary to place the equipment in satisfactory working order shall be made at the time of the above tests.
- E. The Drain Layer shall provide water for testing. All labor and materials necessary for the test shall be

furnished by the Drain Layer.

- F. After installation, all piping shall be tested for tightness. Should leaks be found, faulty joints shall be repaired, even to the extent of disassembling and remaking the joint, and all defective pipe and fittings shall be removed and replaced in a manner satisfactory to the Superintendent.
- E. All wet well chambers will be tested for leakage as specified in Section 02601, Paragraph 3.02.

3.03 AS BUILT DRAWINGS

- A. The grinder pump manufacturer shall be responsible for supplying written instructions as noted below, which shall be sufficiently comprehensive to enable the building owner to operate and maintain the pump and all associated equipment supplied by the station manufacturer.

Two (2) copies to the Sewer Department
One (1) copy to the first permanent resident
One (1) copy to the builder or developer

The instructions shall include, but not be limited to, the following:

1. Descriptions of, and operating instructions for each major component of the grinder pump as supplied.
2. Instructions for operation of the grinder pump in all intended modes of operation.
3. Instructions for all adjustments which must be performed at initial start-up of the grinder pump, adjustment which must be performed after the replacement of level control system components, and adjustments which must be performed in the course of preventive maintenance as specified by the manufacturer.
4. Instructions for the adjustment, calibration, and testing of selected electronic components or assemblies, normally considered replaceable by the manufacturer, whose performance is not ascertainable by visual inspection.
5. Service instructions for major components not manufactured by the grinder pump manufacturer but which are supplied by him in accordance with these

specifications. Incorporation of literature produced by the actual component manufacturer shall be acceptable.

6. Electric schematic diagram of the grinder pump unit as supplied, prepared in accordance with NMTBA and JIC standards. Schematics shall show, to the extent of authorized repair, pump motor branch, control, and alarm system circuits and inter-connections among these circuits. Wire numbers shall be shown on the schematic. Schematic diagrams for electronic equipment, the detail parts of which are normally repairable by the owner-town-servicer, need to be included and shall not be substituted for an overall schematic diagram. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall schematic diagram.
- B. The company supplying the pumping unit must perform a minimum of one (1) hour on site training with the first permanent resident of the building for which the unit is installed.
 - C. In the case of a new building, the Sewer Department will not sign off on an occupancy permit until a signed statement is received from the new owner indicating that he (or she) has been trained and is satisfied with the training, and has received one copy of the materials sighted in Paragraph A above, and the pumping unit and piping system have tested and approved as stated in these specifications.
 - D. The location of the pumping unit access will be tied off on the as built sketch supplied as part of Section 02626. The ties will be to the building corners of the building it serves.

END OF SECTION

(GWPUMP.DOC 5/27/94)

SECTION 11307

MULTIPLE BUILDING SEWER PUMPING UNITS

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This section covers the general requirements for the furnishing of building sewer pumping unit which will service multiple buildings or buildings with multiple owners. No sewer pumping units will be allowed if there is a way to connect the buildings to the sewer by means of gravity flow. Pumping units must be avoided whenever possible.
- B. This section has been inserted to set standards for the sewer pumping units that may be installed by a private party on private property or on property that will at some future date become public property. Maintenance and ownership of all building pumping units on private property will at all times remain with the owner of the pumping unit. Pumping units installed for condominium type properties will be installed on property owned by the condominium owners and all maintenance and ownership responsibilities will remain with the condominium owners.
- C. No private party or developer will be allowed to construct a sewer pumping unit that would for any reason or at any time, become the property of the Town of Bellingham, unless an endowment fund established by the private party or developer depositing cash into a special gift account, an amount determined by the Superintendent. The endowment fund amount will be based on said endowment generating enough annual interest to operate and maintain the unit. This endowment fund will be no less than \$100,000.00.
- D. All proposed multiple building sewer pumping unit submittals will be reviewed by a professional engineer. A check, in the amount of \$5,000, will be given to the Town by the private party and place into a special account when plans are submitted and before they are reviewed. This account will be used to pay for the services of the professional engineer. If the review costs less than the \$5,000, the remaining funds will be returned. If the review costs more, no plans will be accepted until a check has been received to cover the entire cost.

1.02 RELATED WORK

- A. SECTION 02200 EARTHWORK
- B. SECTION 02601 PRECAST MANHOLES
- C. SECTION 02626 SEWER FORCE MAIN PIPING

1.03 REFERENCE MANUAL

- A. New England Interstate Water Pollution Control Commission, "Guides for design of Waste Water Treatment Works" T-R-16, 1980.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All pumping units shall be duplex, with controls that automatically alternate the pumps operations. No pneumatic ejector type of units will be accepted in order to maintain consistency in the maintenance and operations of the units installed in the Town.
- B. All pumping units shall have controls which allow for manual operation of pumps, and an audible and visible "NOT IN AUTO" alarm which sounds at the control panel.
- C. The pumping units must be constructed by a reputable manufacturer, who has over ten years experience in the construction of sewer pumping units. All pumps must be grinder type pumps or separate sewer grinders must be part of the submittal.
- D. Locus plans, site plans, building profiles, building elevations, shop drawings, wiring plans, catalogue cuts, landscaping plans, as well as all design calculations for the sewer pumping station must be submitted to the Superintendent, for review by the professional engineer.
- E. All pumping units must have a high level, low level, and power failure alarm which will send the alarm, via a automatic dialer system, to the Department of Public Works. An audible alarm at the control panel must sound and a red warning light must be activated in the case of a high water condition.
- F. Pump chambers shall be constructed with sufficient working area to allow easy access to the pumps and other parts for maintenance and removal.

I. All electrical work must be properly permitted and inspected by the wiring inspector, and all electrical work must be installed by a Massachusetts licensed electrician.

K. All plumbing work done within ten feet of a building foundation, must be properly permitted and inspected by the plumbing inspector and installed by a Massachusetts licensed plumber.

3.02 TESTING

A. Each pumping unit must be tested with clean water to indicate the full operation of all pump units and alarms.

B. Sufficient amounts of clean water must be supplied to force the lag pump to activate on one occasion.

C. The tests will run a minimum of two hours and the pumping units must automatically start at least three times during the test.

D. All piping in the pumping unit itself should be tested at the same time and in the same manner as the piping specified in Section 02626.

E. All wet well chambers will be tested for leakage as specified in Section 02601, Paragraph 3.02.

F. The stand-by generator and automatic transfer switch will be tested by filling the wet well with pumps in the off position, place the pumps in auto, then disconnecting the commercial power to simulate a power failure.

3.03 AS BUILT DRAWINGS AND SERVICE CONTRACTS

A. The company supplying the pumping unit must deliver three (3) copies of the operations and maintenance manual for all equipment installed to the Superintendent.

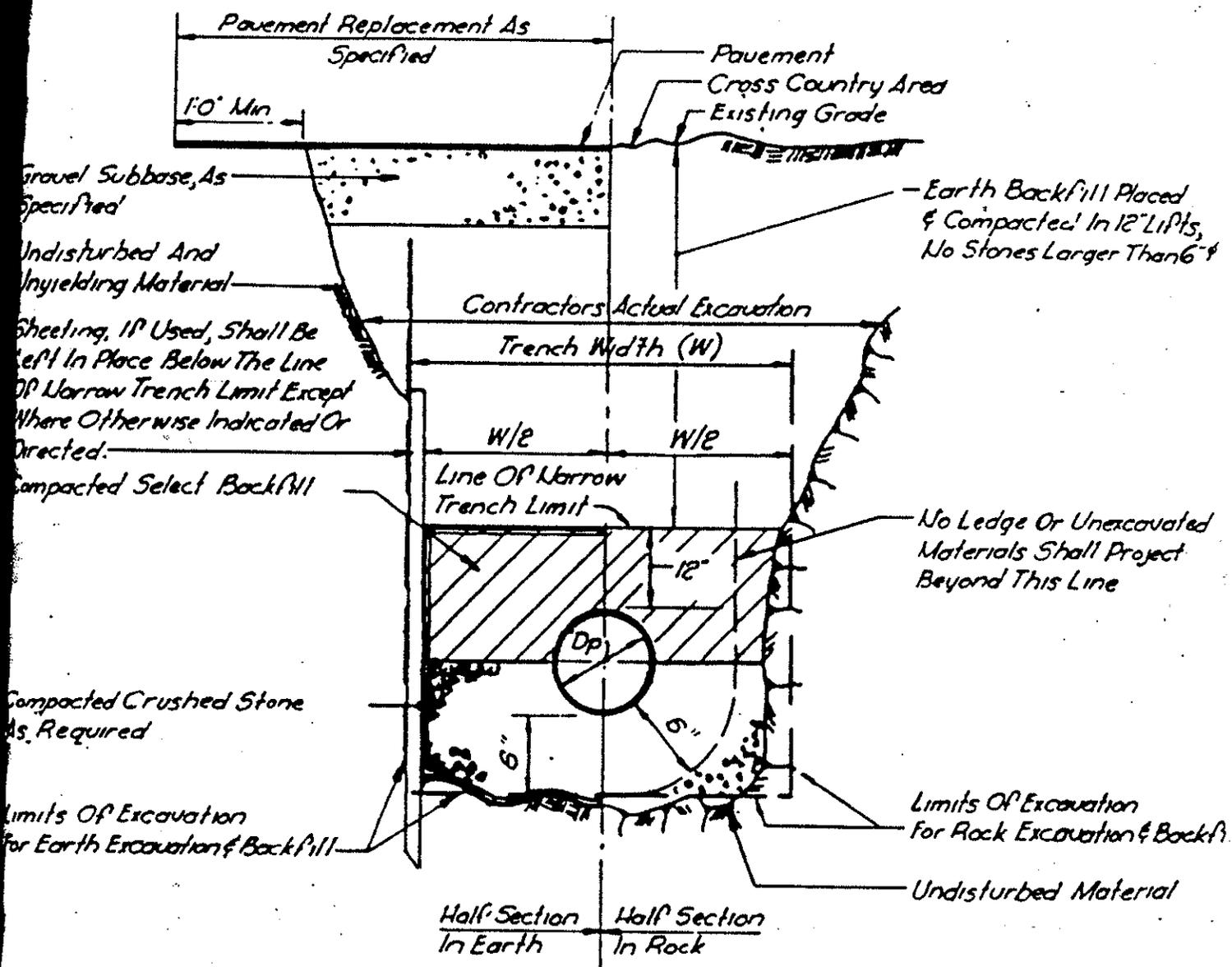
B. The company supplying the pumping unit must perform a minimum of one (1) hour on site training with the Sewer Department personnel.

C. The location of all access, fittings, or equipment will be tied off on the as built sketch supplied as part of Section 02626. Wiring as built drawings as well as complete building as built drawings must be

received before the unit will be accepted.

- D. A list of at least two (2) companies that supply service and parts for all components of the pumping unit must be submitted.
- E. A two (2) year service contract must be supplied for the pumps and the generator. This contract must be paid for by the person constructing the pumping unit.
- F. A one (1) warranty is required from the date the Superintendent accepts the pumping unit on all equipment supplied.

END OF SECTION



TYPICAL SEWER TRENCH DETAIL

N.T.S.

Town of Bellingham, MA

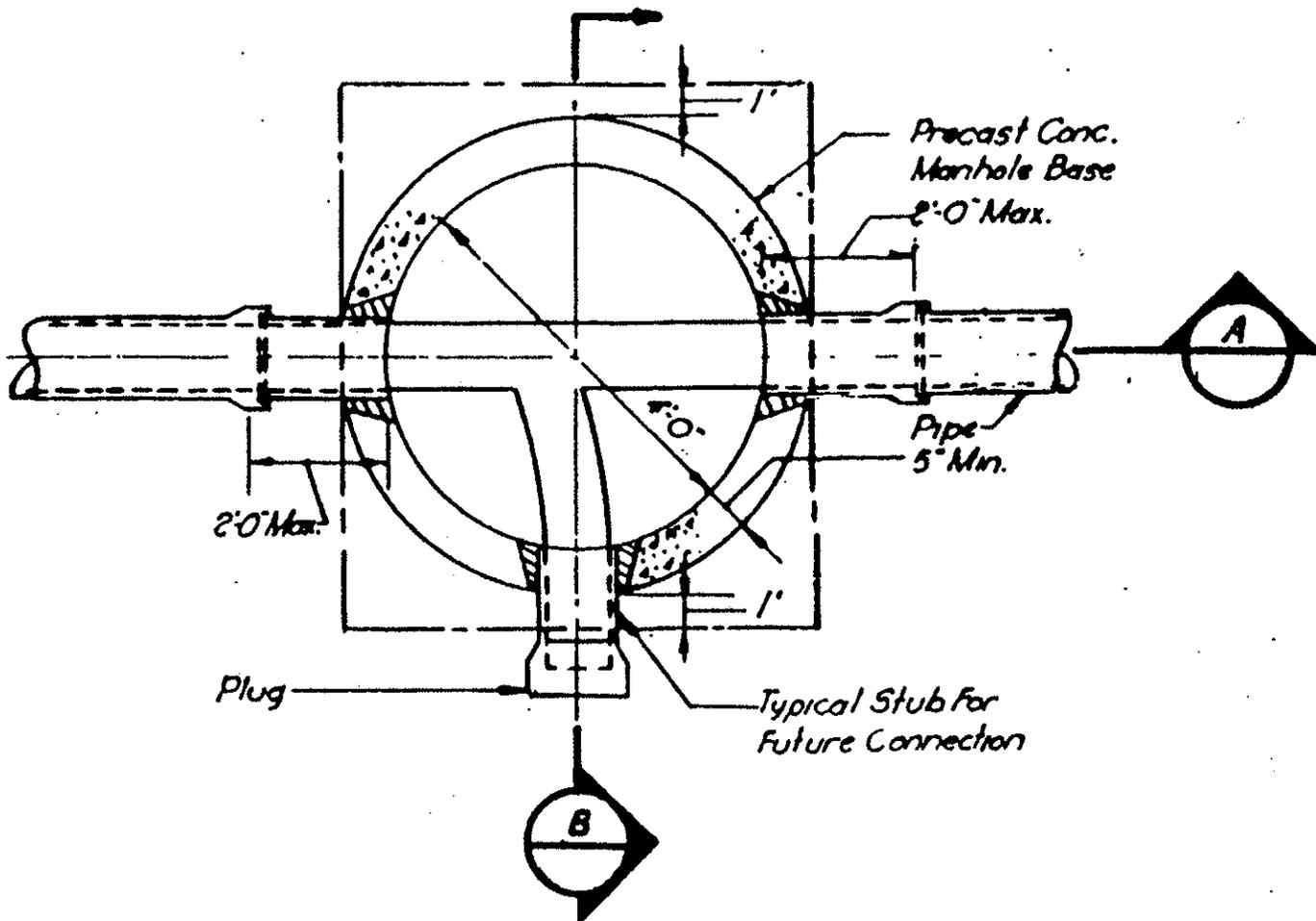
Water & Sewer Commission

Revision Descrip./Date

SERVICE CONNECTION DETAIL

Date: August, 1989

Sheet 1 of 7



PLAN

TYPICAL 4' PRECAST MANHOLE

M.T.S.

Note:
 Sections A & B On Following Pages

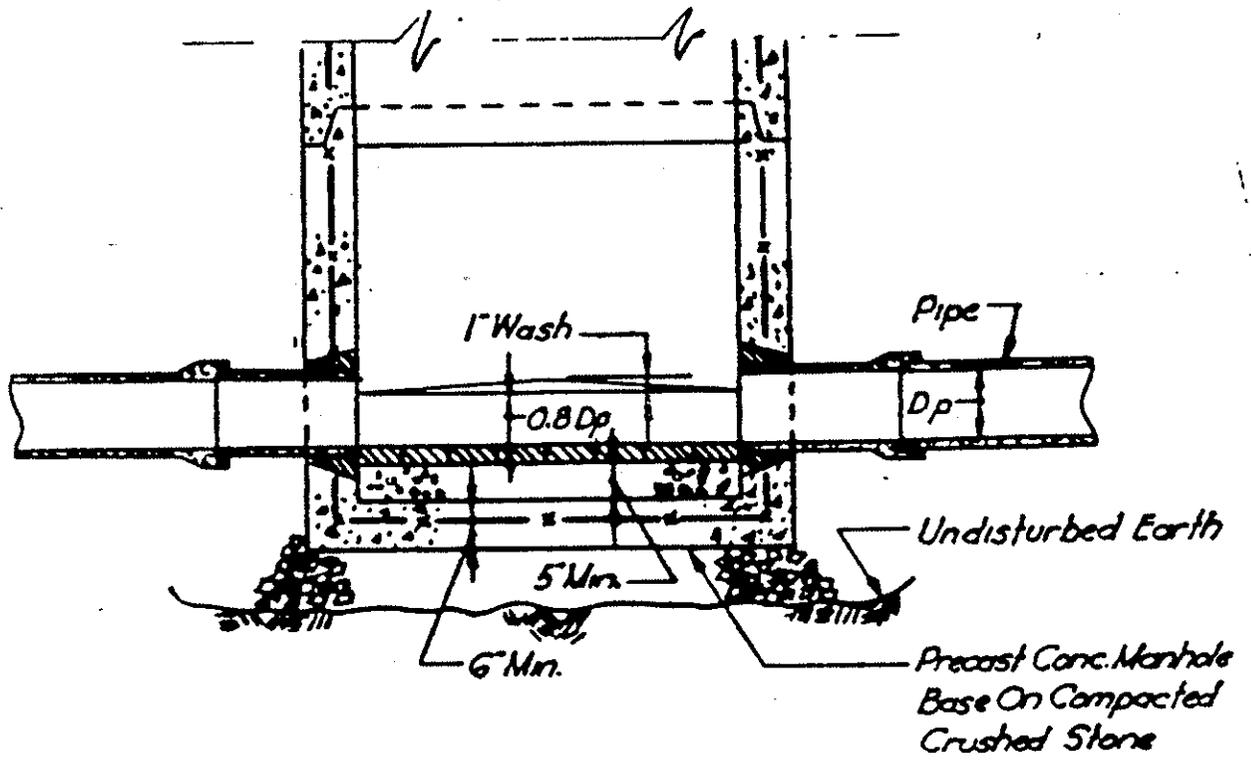
Town of Bellingham, MA Water & Sewer Commission

Revision Descrip./Date

SERVICE CONNECTION DETAIL

Date: August, 1989

Sheet 2 of 7



SECTION A

Town of Bellingham, MA	Water & Sewer Commission	Revision Descrip./Date
SERVICE CONNECTION DETAIL		
Date: August, 1989	Sheet 3 of 7	

Adjust To Required Grade.
 With A Minimum Of One
 Course & A Maximum Of
 Five Courses Of Brick
 Masonry Or Reinforced
 Conc. Grading Rings. All
 Bricks To Be Laid As Headers

Manhole Frame & Cover,
 See Specs.
 Finished Grade
 Mortar All Around

Manhole Steps, See
 Specs.

Precast Reinforced
 Concrete Manhole Cone

Make Watertight, Using
 Butyl Rubber Joint Sealant
 (Typ)

Precast Reinforced
 Concrete Manhole
 Carrel

5" Min.

Combination Of
 1, 2, 3 Or 4 Lengths
 In 6" Increments

4'0"

1" Wash (Typ)

Brick Masonry Invert

Concrete Fill

See Manhole Seal Detail

Undisturbed Earth

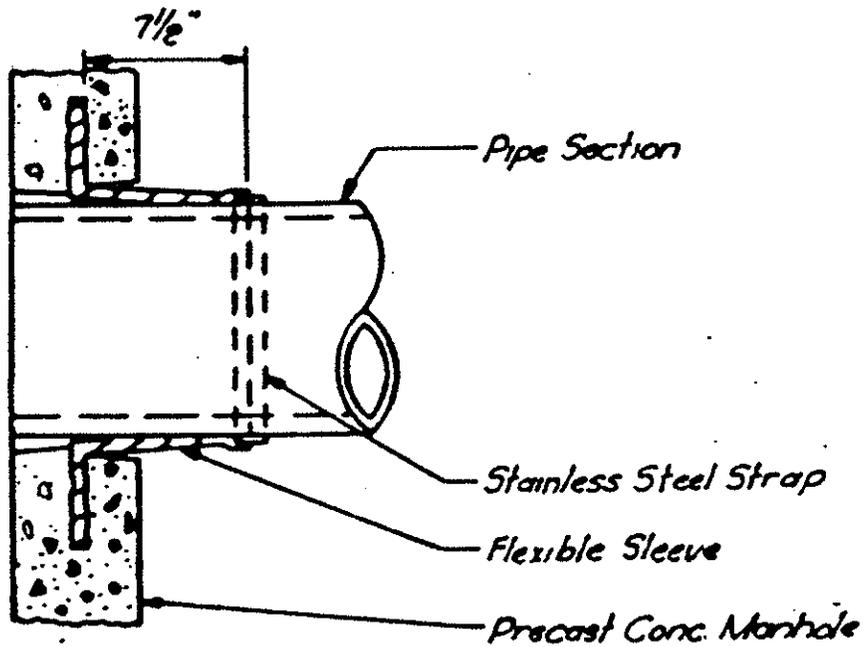
6" Min

Precast Reinforced Concrete
 Manhole Base On Compacted
 Crushed Stone

Precast Manhole Walls & Cones

SECTION B

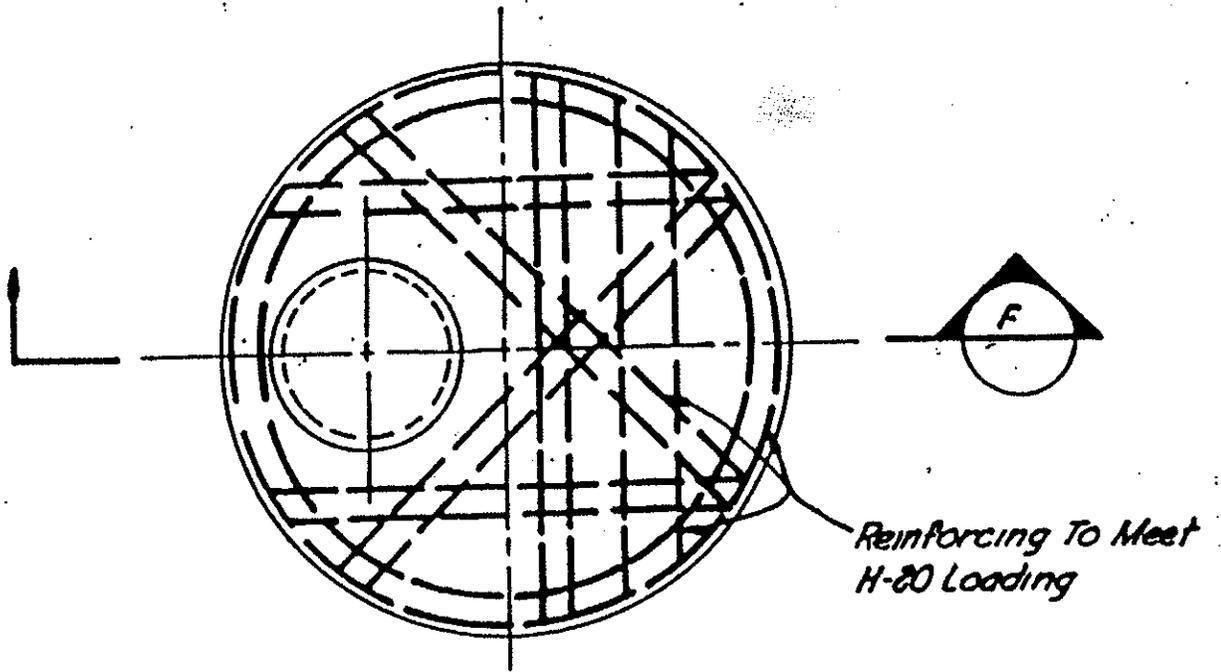
Town of Bellingham, MA	Water & Sewer Commission	Revision Descrip./Date
SERVICE CONNECTION DETAIL		
Date: August, 1989	Sheet 4 of 7	



MANHOLE SEAL DETAIL

U.T.S.

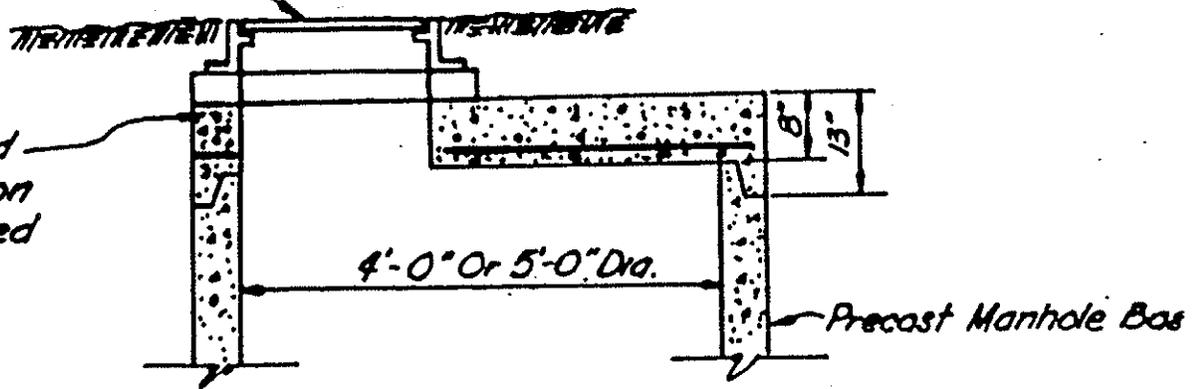
Town of Bellingham, MA	Water & Sewer Commission	Revision Descip./Date
SERVICE CONNECTION DETAIL		
Date: August, 1989	Sheet 5 of 7	



PLAN

Manhole Frame & Cover
See Spec's
Finished Grade

Top Slab To Be Used
Where Cone Section
Cannot Be Installed



SECTION F

MANHOLE TOP SLAB
U.T.S.

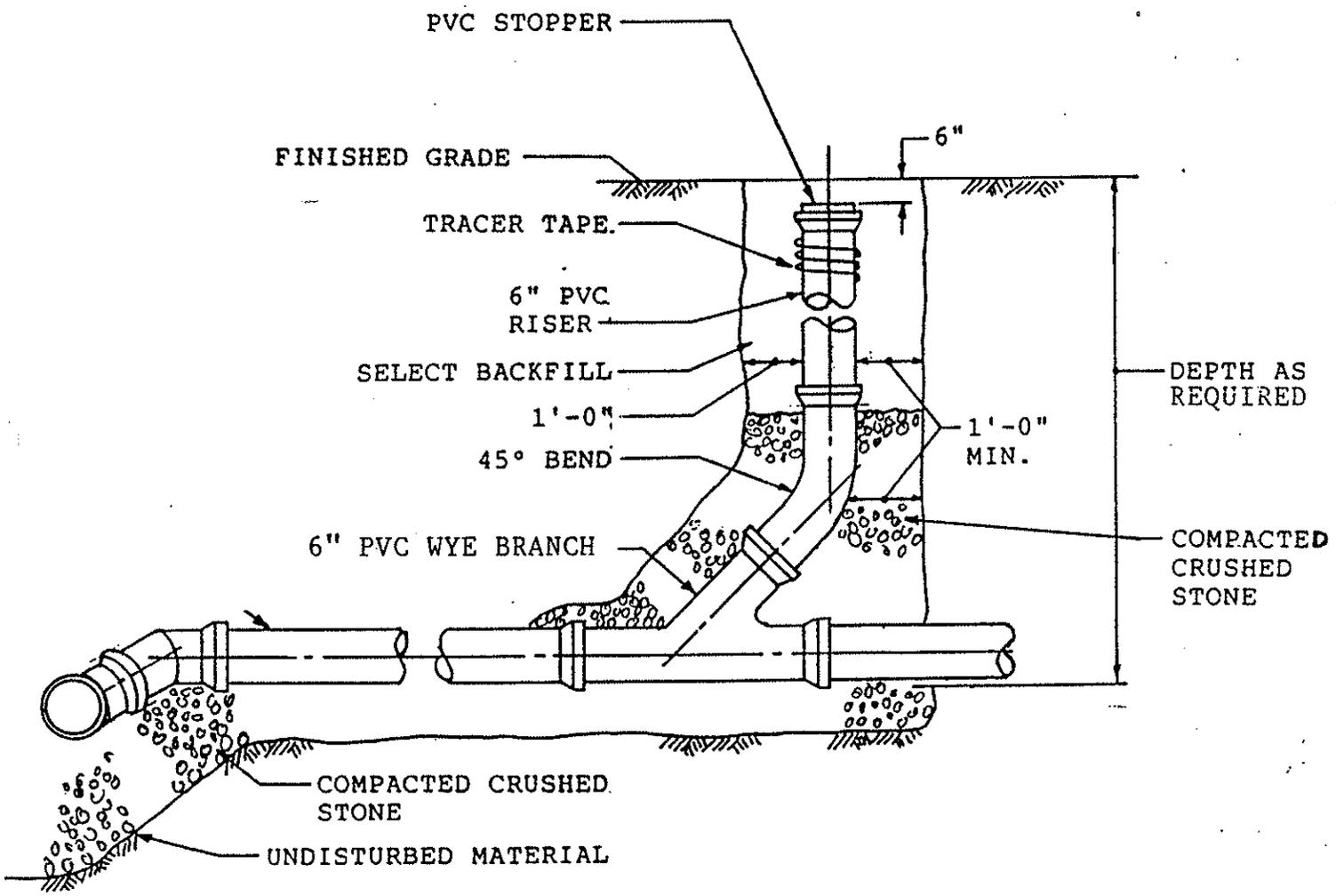
Town of Bellingham, MA Water & Sewer Commission

Revision Descr./Date

SERVICE CONNECTION DETAIL

Date: August, 1989

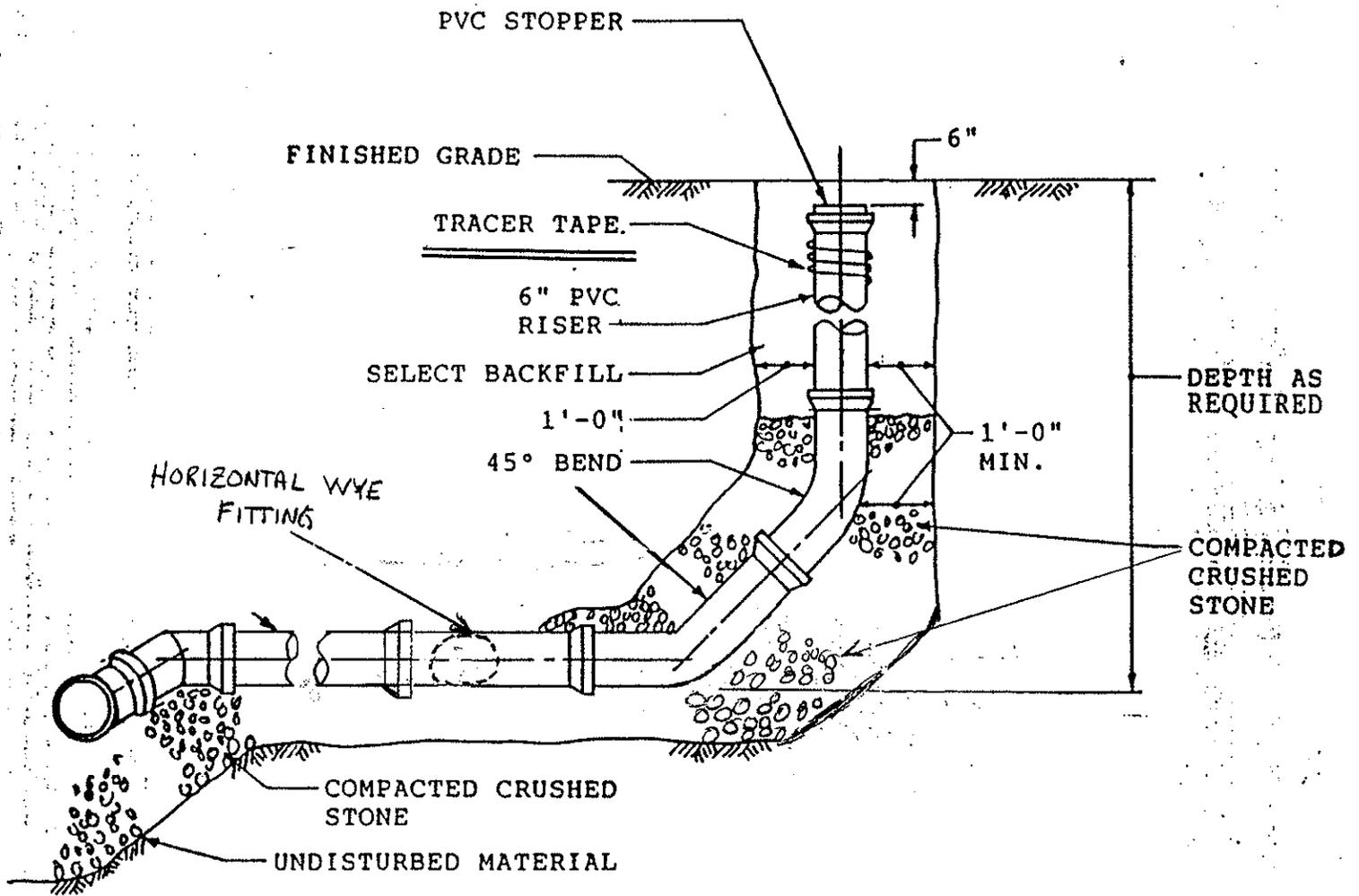
Sheet 6 of 7



TYPICAL CLEANOUT DETAIL

N.T.S.

City of Bellingham, MA	Water & Sewer Commission	Revision Descrip./Date
SERVICE CONNECTION DETAIL		
Date: August, 1989	Sheet 7 of 7	



TYPICAL CLEANOUT DETAIL

N.T.S. HORIZONTAL WYE

Town of Bellingham, MA Water & Sewer Commission

Revision Descr./Date

SERVICE CONNECTION DETAIL

Rev 3-22-94
A.P.F.

Date: August, 1989

Sheet — 7A

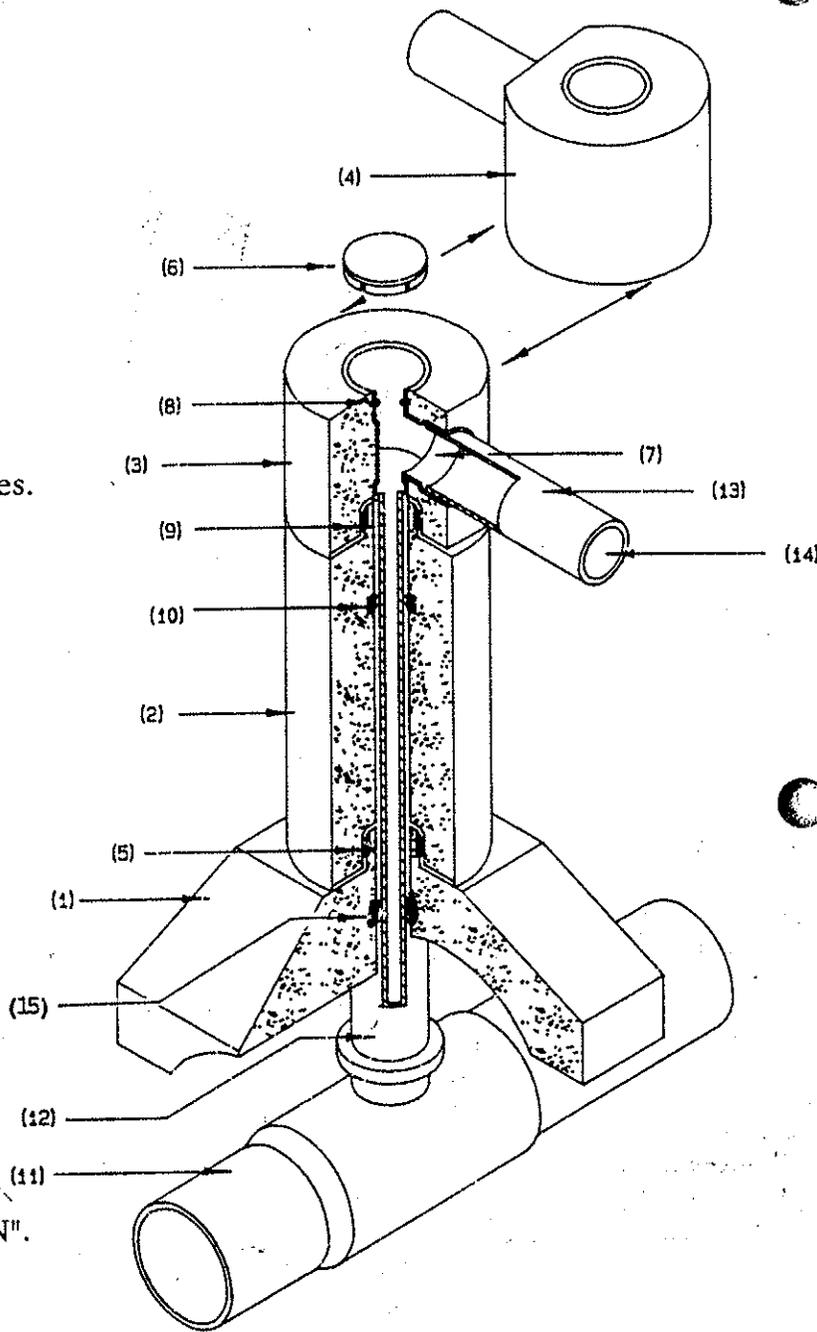
Added
9/10/84 *LOT*

LIST OF MATERIALS

- (1) Bridge Section
- (2) Intermediate Section (one-foot increments, maximum four feet).
- (3) Cap Block with PVC Tee, interchangeable Gasket on inlet.
- (4) Cap Block for additional service connection.
- (5) STS III Single Offset.
- (6) PVC Cleanout Plug.
- (7) 6" Diameter inlet (PVC SDR-35 or C-900).
- (8) Retained Gasket.
- (9) Riser Section STS III
- (10) Riser Section STS I
- (11) Sewer Main (by others), diameter varies.
- (12) 6" Diameter PVC Pipe (by others).
- (13) 6" Diameter Service Connection (by others).
- (14) Can be C-900 or DI
- (15) Base STS I

DESIGN DATA

- 1. CONCRETE STRENGTH 5,000 PSI
- 2. CEMENT PER ASTM C-150-81
- 3. REINFORCING PER ASTM-A615
- 4. RUBBERMAN STS I & STS III PER ASTM 443
- 5. BASE SECTION OR BRIDGE SECTION DESIGNED TO MEET H-20 LOADING
- 6. LUBRICANT FOR COUPLING DURING ASSEMBLY SHOULD BE "RUBBERMAN".
- 7. CHIMNEY DESIGN INCORPORATES A "TRIPLE SEAL" SYSTEM
- 8. PIPE ENCASEMENT INCORPORATES A "QUADRUPLE SEAL" SYSTEM
- 9. STRUCTURE MAY ALSO BE USED AS A PIPE WEIGHT



(508) 987-8175

L & L Concrete Products, Inc.



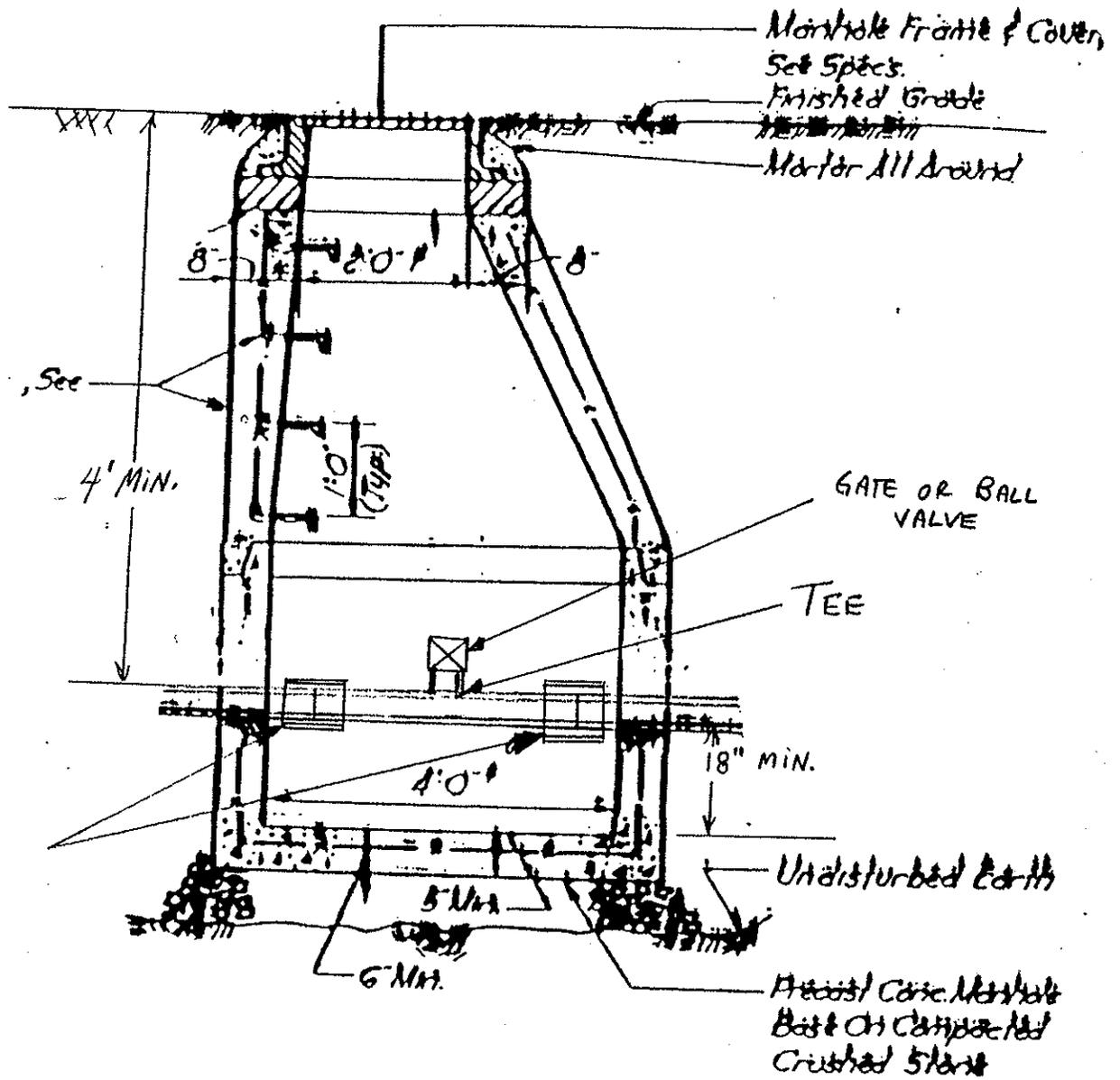
HAIL MARY RUBBER CO., INC.

P.O. Box 236
Warminster, PA 18974

LOUIS A. ESPOSITO, JR.
President

P.O. BOX 516
WEBSTER, MA 01570

TYP.
Manhole
Spec's
SECTION
02601

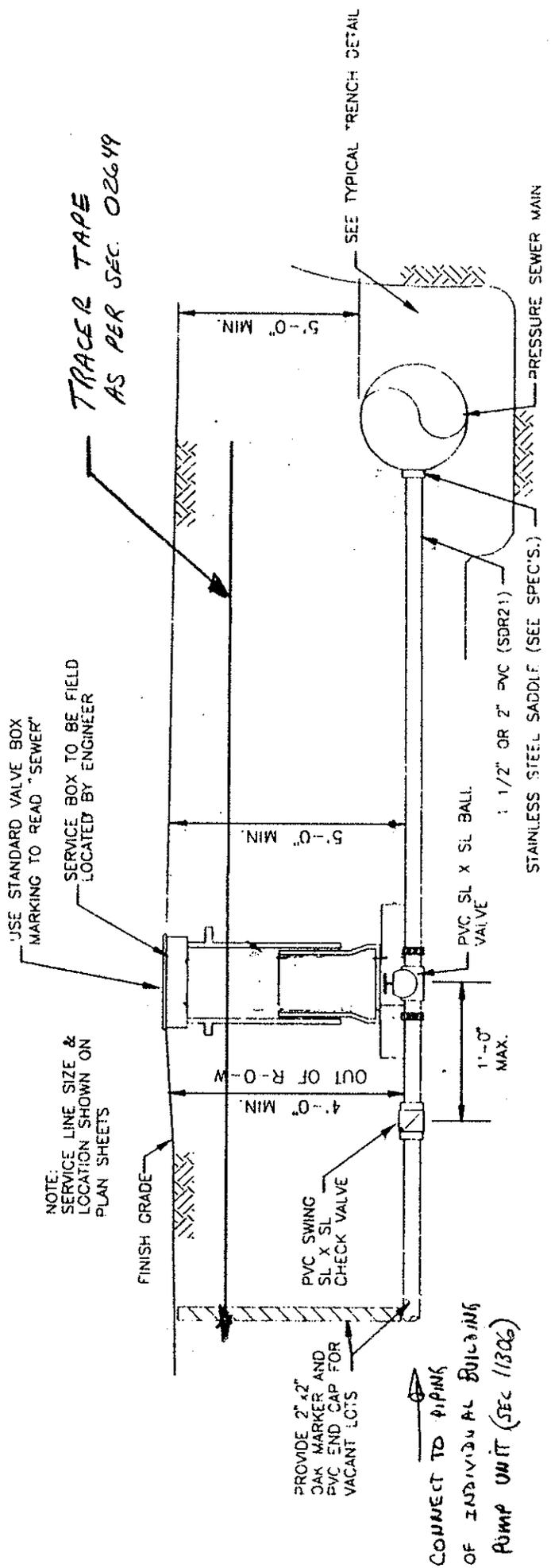


CLEAN - OUT
MANHOLE

(NOT TO SCALE)

3-10-94 DFD

WESTON & SAMPSON	ENGINEERS, INC. WAKEFIELD, MASS	PROJECT		DATE	PAGE
		BELLINGHAM S.C. SPECS	7-27-94		
			BY	CHKD BY	
			JFA.		



TYPICAL PVC SEWER SERVICE CONNECTION DETAIL

N.T.S.

PRESSURE PIPE

FOR INDIVIDUAL BUILDING PUMP UNIT SYSTEMS

7/27/94

PROVIDE 2" x 2" OAK MARKER AND PVC END CAP FOR VACANT LOTS

CONNECT TO PIPING OF INDIVIDUAL BUILDING PUMP UNIT (SEC 1306)

TRACER TUBE AS PER SEC. 02649

USE STANDARD VALVE BOX MARKING TO READ "SEWER"

SERVICE BOX TO BE FIELD LOCATED BY ENGINEER

NOTE: SERVICE LINE SIZE & LOCATION SHOWN ON PLAN SHEETS

FINISH GRADE

OUT OF R.O.W.

5'-0" MIN.

5'-0" MIN.

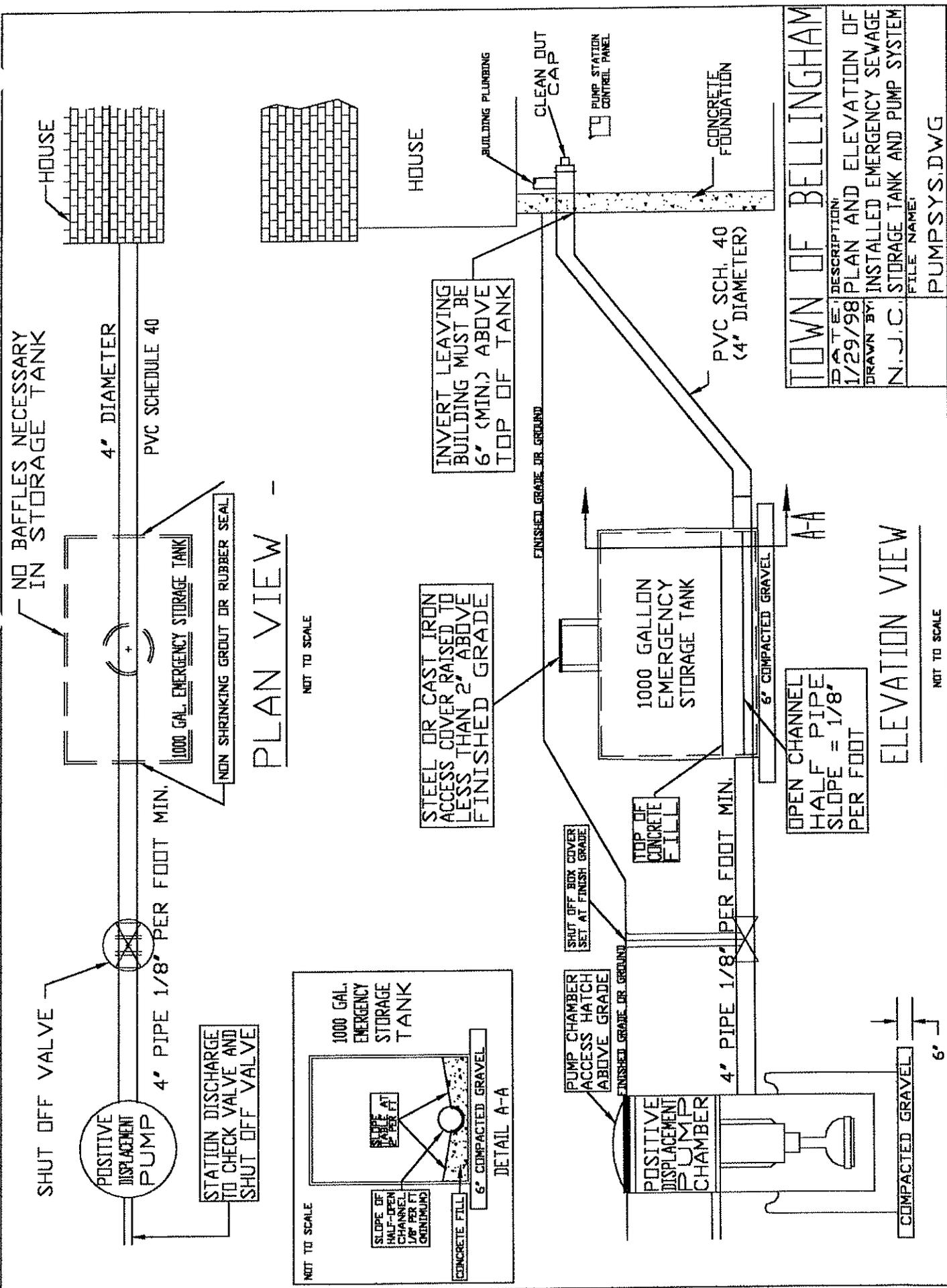
SEE TYPICAL TRENCH DETAIL

1/2" OR 2" PVC (SDR21)

STAINLESS STEEL SADDLE (SEE SPECS.)

PRESSURE SEWER MAIN

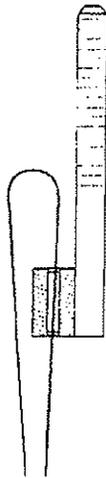
1'-0" MAX.



TOWN OF BELLINGHAM	
DATE: 1/29/98	DESCRIPTION: PLAN AND ELEVATION OF INSTALLED EMERGENCY SEWAGE STORAGE TANK AND PUMP SYSTEM
DRAWN BY: N.J.C.	FILE NAME: PUMPSYS.DWG

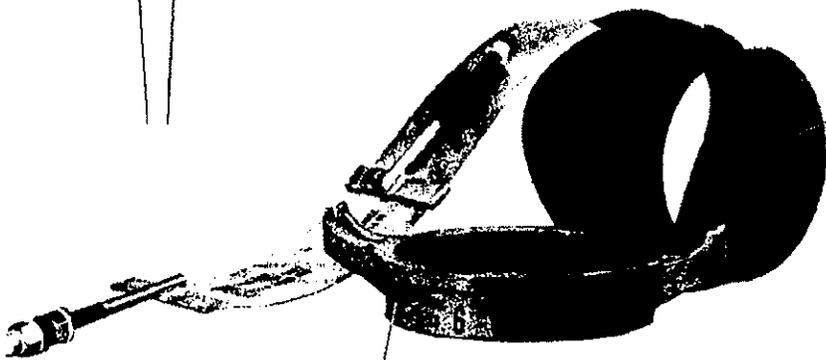


Detail Specifications for Romac "CB"™ Sewer Saddles



Adjustable Strap

Bolts are 1/2" UNC rolled thread, lubricant coated bolt or nut, stainless steel per ASTM A 193, type 304. Nuts are stainless steel per ASTM A 194, type 304. Washers are stainless steel per ASTM A 240, type 304. Band is 3 1/2" wide for spreading out clamp force on pipe. The stainless welds are fully passivated¹. Excess strap goes between pipe and band.



Gasket

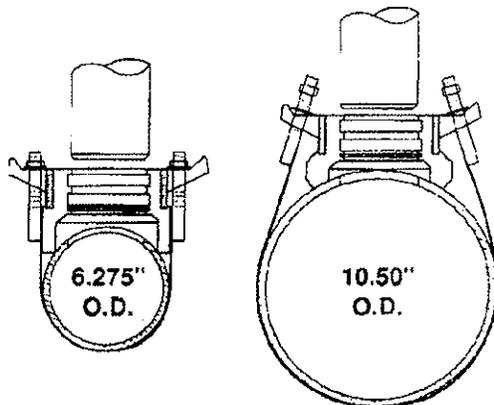
Virgin SBR per ASTM D 2000 MBA 710, compounded for water and sewer service. Gaskets are especially formulated with antioxidant/antiozonant agent to increase shelf life.

Saddle Casting

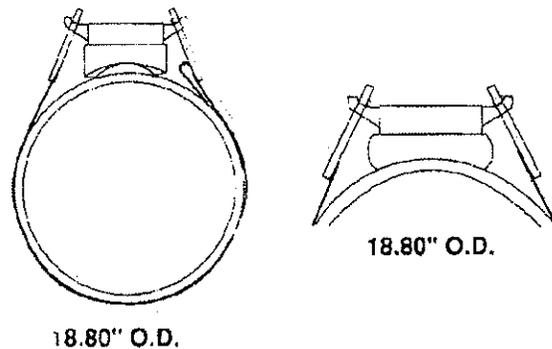
Ductile iron per ASTM 536, Grade 65-45-12. Protected with a yellow corrosion-resistant paint.

¹ **Passivated:** chemically treated after welding to produce a highly corrosion resistant coating.

Same saddle conforming to different outside diameters.



Saddle conforming to pipe.





ROMAC
INDUSTRIES,
INC.

1-800-426-9341

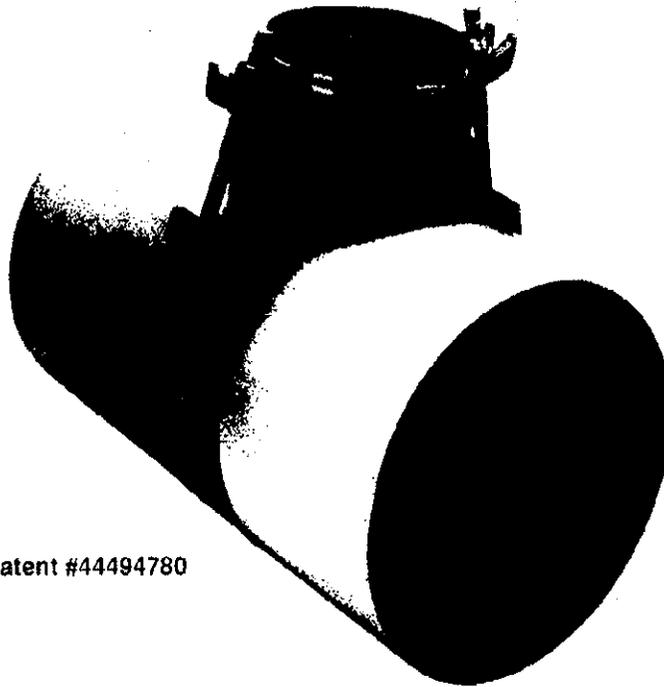


OK
D. P. D.
10/12/99

Style "CB"™ Sewer Saddle

A ROMAC ORIGINAL

- 1981 -



Patent #44494780

Design Advantages:

- **Inventory Reduction:** Unique gaskets fit wide range of diameters.
- **Ease of Installation:** Saddle can be installed by unskilled labor, using a socket or open end wrench. Built-in stop prevents blockages due to inadvertant insertion of branch into main.
- **Superior Strap:** Strong 304 stainless steel band GMAW & GTAW welded to roll threaded 304 stainless bolts adjusts over a wide range. Clamping force is well distributed by 3 1/2" width.
- **Flexibility:** Gasket allows considerable deflection due to earth movement, while large sealing surface and wide band strongly resist displacement.
- **Reliability:** Continuous rubber connection between rim and branch eliminates potential leak spots. Saddles have been tested to pressures well in excess of typical service test requirements.

Note: A pipe stop capable of withstanding 1000 pounds of thrust is molded into the CB saddle gasket. Care must be taken during system design and installation to assure that this thrust limit is not exceeded.

ROMAC INDUSTRIES, INC.
 1-800-426-9341

 MADE IN U.S.A.

Style "CB"™ Sewer Saddle

Material Specifications

Castings: Ductile iron per ASTM 536, Grade 65-45-12. Protected with a yellow shopcoat.

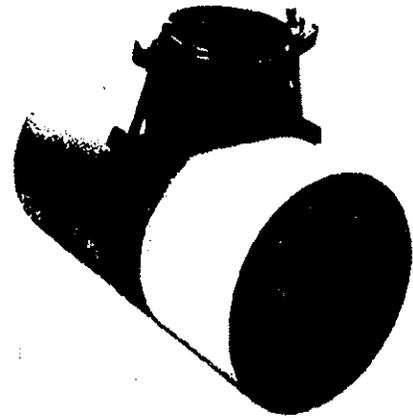
Adjustable Strap: 3 1/2" wide, stainless steel per ASTM A 240, type 304.

Bolts: 1/2" UNC rolled thread, lubricant coated, stainless steel per ASTM A 193, type 304.

Nuts: Stainless steel per ASTM A 194, type 304.

Washers: Stainless steel per ASTM A 240, type 304.

Gasket: Virgin SBR per ASTM D 2000 MBA 710, compounded for water and sewer service. Other compounds available on request.



CB-4.63UN
 Patent #4494780

NOM. BRANCH SIZE	NOM. PIPE SIZE	RANGE	BRANCH TYPE	BRANCH O.D.	CATALOG NUMBER	APPROX. WEIGHT (lbs.)
4"	6'-12" 48" Strap	6.27-14.40 Regular Gasket	PVC Sewer	4.215	CB-4.215	10 #
			Ty Seal	4.28	CB-4.28	
			C.I. Soil-No Hub	4.38	CB-4.38	
			PVC	4.50	CB-4.50	
			A/C M.E. Sewer	4.62	CB-4.62	
			Universal ¹	4.20-4.63	CB-4.63UN ¹	
			Cast Iron-D.I.	4.80	CB-4.80	
			Clay ¹	5.00-5.38	CB-5.38 ¹	
	14"-24" 96" Strap	14.40-25.80 Large O.D. Gasket	PVC Sewer	4.215	CB-4.215LS	11 #
			Ty Seal	4.28	CB-4.28LS	
			C.I. Soil-No Hub	4.38	CB-4.38LS	
			PVC	4.50	CB-4.50LS	
			A/C M.E. Sewer	4.62	CB-4.62LS	
			Universal ¹	4.20-4.63	CB-4.63UNLS ¹	
			Cast Iron-D.I.	4.80	CB-4.80LS	
			Clay ¹	5.00-5.38	CB-5.38LS ¹	
	24"-48" 192" Strap	25.80-54.00 Large O.D. Gasket	PVC Sewer	4.215	CB-4.215XLS	13 #
			Ty Seal	4.28	CB-4.28XLS	
			C.I. Soil-No Hub	4.38	CB-4.38XLS	
			PVC	4.50	CB-4.50XLS	
			A/C M.E. Sewer	4.62	CB-4.62XLS	
			Universal ¹	4.20-4.63	CB-4.63UNXLS ¹	
			Cast Iron-D.I.	4.80	CB-4.80XLS	
			Clay ¹	5.00-5.38	CB-5.38XLS ¹	
6"	8"-12" 48" Strap	8.00-14.40 Regular Gasket	PVC Sewer	6.28-6.30	CB-6.30	12 #
			C.I. Soil-No Hub	6.30	CB-6.30	
			A/C M.E. Sewer	6.66	CB-6.66	
			Universal ¹	6.28-6.66	CB-6.66UN ¹	
			Cast Iron-D.I.	6.90	CB-6.90	
			Clay ¹	7.19-7.56	CB-7.56 ¹	
	14"-24" 96" Strap	14.40-25.80 Large O.D. Gasket	PVC Sewer	6.28-6.30	CB-6.30LS	13 #
			C.I. Soil-No Hub	6.30	CB-6.30LS	
			A/C M.E. Sewer	6.66	CB-6.66LS	
			Universal ¹	6.28-6.66	CB-6.66UNLS ¹	
			Cast Iron-D.I.	6.90	CB-6.90LS	
			Clay ¹	7.19-7.56	CB-7.56LS ¹	
24"-48" 192" Strap	25.80-54.00 Large O.D. Gasket	PVC Sewer	6.28-6.30	CB-6.30XLS	15 #	
		C.I. Soil-No Hub	6.30	CB-6.30XLS		
		A/C M.E. Sewer	6.66	CB-6.66XLS		
		Universal ¹	6.28-6.66	CB-6.66UNXLS ¹		
		Cast Iron-D.I.	6.90	CB-6.90XLS		
		Clay ¹	7.19-7.56	CB-7.56XLS ¹		

Stainless Steel
 Hose Clamp



¹ CB Sewer Saddles for Universal and Clay pipe include stainless steel hose clamp.

PARTS LIST - 4" & 6" Branch

- Saddle Casting
- Gasket (Standard, XLS)
- Sliding Bolt
- Strap (Reg. LS, XLS)

To Order: Specify catalog number.

Example: To fit 4" branch to 6" -12" nominal pipe with branch 4.20 - 4.63, order **CB-4.63UN**



PUTNAM PIPE CORPORATION
SERVING THE WATER, SEWER & DRAINAGE INDUSTRIES

TELEX COVER PAGE

TO: Bellingham DPW FAX #: 1508 ~~609 3870~~ 966 5814

ATTN: Don DiMartino

FROM: Eli Pott

DATE: 10/12/99 TIME: 8:40 AM

NO. OF PAGES INCLUDING THIS COVER PAGE: 4

MESSAGE: Don This is the information on
The Romac Sewer Saddle. If this meet your spec
and is what you want please call Mr Buck
so I can get in touch with Frank Maarse. If you
need any more information please call 4353090

Thank alot

EP

CONFIRMATION: _____ REPLY: _____ NO REPLY NECESSARY: _____

THANK YOU

TOWN OF BELLINGHAM

OFFICE OF THE
DIRECTOR OF THE DEPARTMENT OF PUBLIC WORKS
26 BLACKSTONE STREET
BELLINGHAM, MA 02019
(508)-966-5813
FAX (508)-966-5814

MEMO

Date: April 7, 1999

To: Paul Bokoski
Tony Karakejian
DPW Staff Assigned to Inspecting Sewer Connections
DPW Office Staff
Ted Bailey

From: Donald F. DiMartino, DPW Director 

cc: Mark Thompson, SEA Consultants

RE: Sewer Connection Specification Change
11306 Single Building Sewer Pumping Units

The Barnes Ultra Cav Pump System was added to our Sewer Connection Specification on April 8, 1998, as an equal item to other pumps specified. This pumping system was added after we receiving a positive report from our sewer consultants. This was done to allow for fair competition for this item.

Mr. Bailey has brought to my attention that this pumping system has had many problems and service repair efforts to resolve these problems were not acceptable.

Therefore, until further notice:

NO Barnes Single Building Sewer Pumping Units will be allowed.

This office should not approve any sewer connection permit applications noting the use of this pumping unit.

AKA CONSTRUCTORS
Construction Management Services

SPEED MEMO

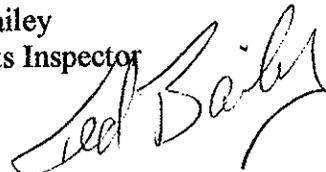
Telephone (508) 966-0565

April 6, 1999

To: Mr. Donald DiMartino – Director
Bellingham Department of Public Works

From: Ted Bailey
Projects Inspector

Subject: Individual House Sewer Pumping Units
Distributor: Williamson Electric Co., Inc.
Pump Brand: Barnes "Ultra-Cav" progressive cavity grinder pump



This letter is to inform you of the discrepancies found in the installation and operation of Williamson Electric sewerage pump systems on the above referenced project. A total of eleven (11) systems were installed. Williamson's letter dated April 9, 1998, it states the Ultra-Cav is a complete system. This pumped system was made up of individual parts and not NEMA approved as a homogeneous "system."

Installation of the Fiberglass tank burdened the site work contractor with working around the height the unit came in. Riser sections were not available in 12" or 18" units. The contractor had two heights to chose from, and had to pick six weeks in advance. Most of the units were covered with a well liner to match the front grade elevations.

The contractor was required to bore holes in the tank for the outlet and install the gasket. This operation is critical to the water tightness of the unit, and therefore made most of them hire Williamson for the installation (at a cost of \$ 400 per unit). The elevation of this hole was also critical in establishing the gallonage stored prior to pumping. If the elevation of the hole were at different heights the gallonage would change. One contractor even had to re-excavate the trench.

The pressure switch system installed on the first four systems froze during testing, and had to be changed. The high water switch would get attached to the run switch during the high water test. This meant the high water alarm went off each time the pump started.

In this, the first year of installation, at least two systems have had trouble. At one house, the high water alarm went off for two weeks before they called to have it repaired. The homeowner now fears it will go off again. At another house, the builder was called to fix the situation. He immediately called Williamson. They sent someone who checked the voltage and said the pump was OK. After much investigation, Williamson came back and changed the pump.

With this history so far, it is with great regret that I ask you to pull this system from the approved list. We should wait and see how these eleven units fair over the next few years.



EST. 1944

WILLIAMSON ELECTRICAL CO., INC.

43 FREMONT STREET
NEEDHAM HEIGHTS, MA 02194
(781) 444-6800
FAX (781) 449-6827

April 9, 1998

To: Home Builders in Brookside Estates Subdivision

Re: Progressing Cavity Grinder Pump

Williamson Electrical is pleased to provide you with the following pricing on our progressing cavity grinder pump units called the Barnes Ultra Cav.

The Ultra Cav is a complete packaged unit. The fiberglass tank is 24" x 84" and comes with a stainless steel C-Channel rail system, NEMA 4 junction box mounted on the underside of a polyethylene UltraCap cover, UltraSwitch level controls, SG1022 progressing cavity grinder pump, and simplex control panel.

Unit Pricing:	Quantity 1-9	Quantity 10 - 19	
	List \$ 3,174.00	List \$ 2,856.60	Net savings \$ 317.40

Pricing does not include freight, which will range from \$ 100.00 to \$ 125.00 per unit.

Advantages of Ultra Cav System:

- Ours is a **submersible** pump. It can be totally submerged without any damage to unit. The E-One unit is not.
- Our tank is wound fiberglass construction. This is much stronger than the poly material E-One uses.
- Easy removal of pump for service. There are no special tools required to remove the pump.
- 115v or 230v single phase power available.
- Easy access to pressure switch. To remove the E-One switch, you have to remove the whole pump assembly.
- 24 hour back up support provided by Williamson Electrical. E-One subs out service. We have a vested interest in keeping all Ultra Cav customers happy.

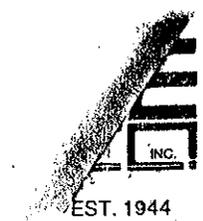
Williamson Electrical is also available for the installation of the Ultra Cav pump system. Pricing will be on an individual basis based on site inspection. There are many variables involved with the installation i.e.; trenching, installation of the tank, running of feed from the main breaker panel to control panel location, or finished basement.

Working together, we will be able to keep the cost of installation to a minimum by having the correct people doing the work they do best.

We look forward to working with you on this project. If you have any questions, please feel free to call at any time.

Sincerely,

Joe Pennini
J. Pennini
Sales Representative



WILLIAMSON ELECTRICAL CO., INC.

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NEEDHAM HEIGHTS, MA 02194
(781) 444-6800
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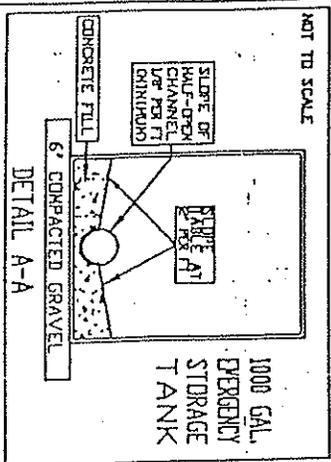
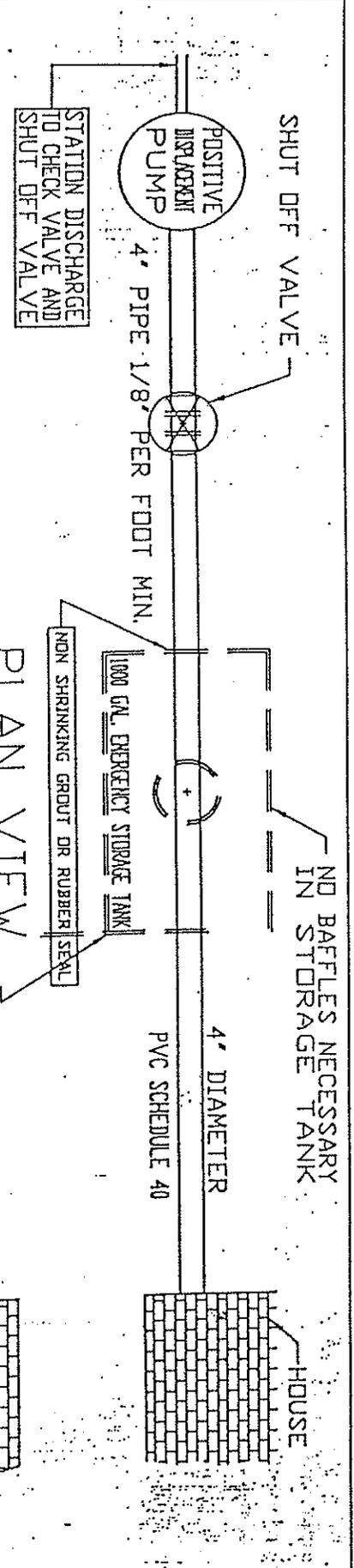
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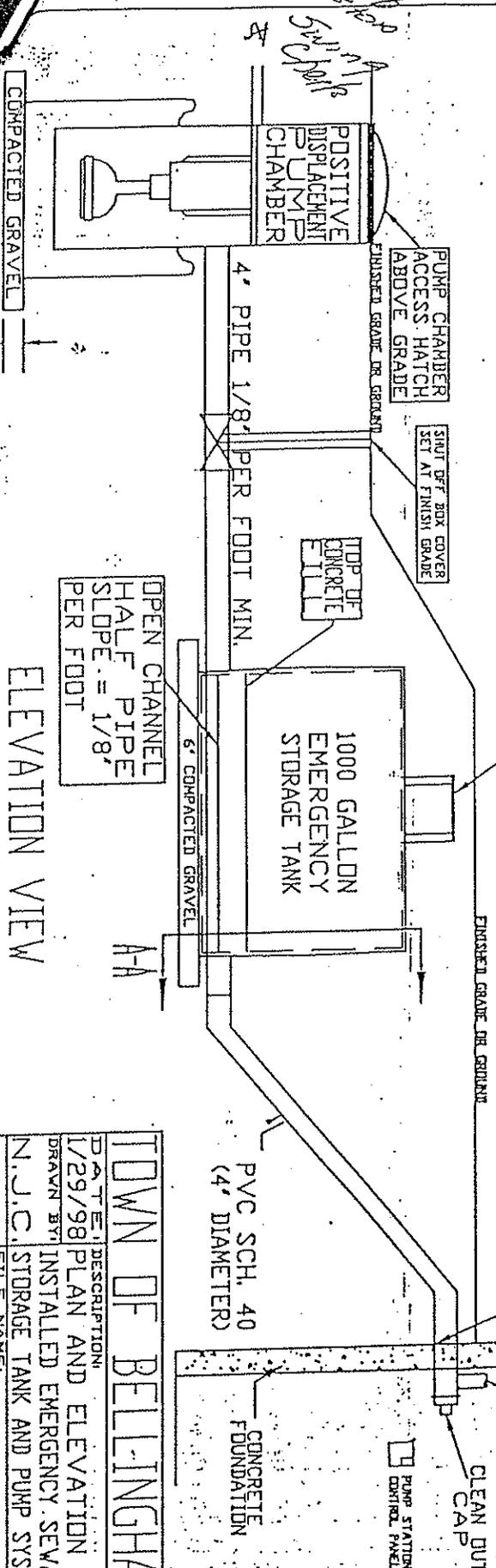
Sincerely,

J. Pennini
J. Pennini
Sales Representative



STEEL OR CAST IRON ACCESS COVER RAISED TO LESS THAN 2' ABOVE FINISHED GRADE

INVERT LEAVING BUILDING MUST BE 6' (MIN.) ABOVE TOP OF TANK

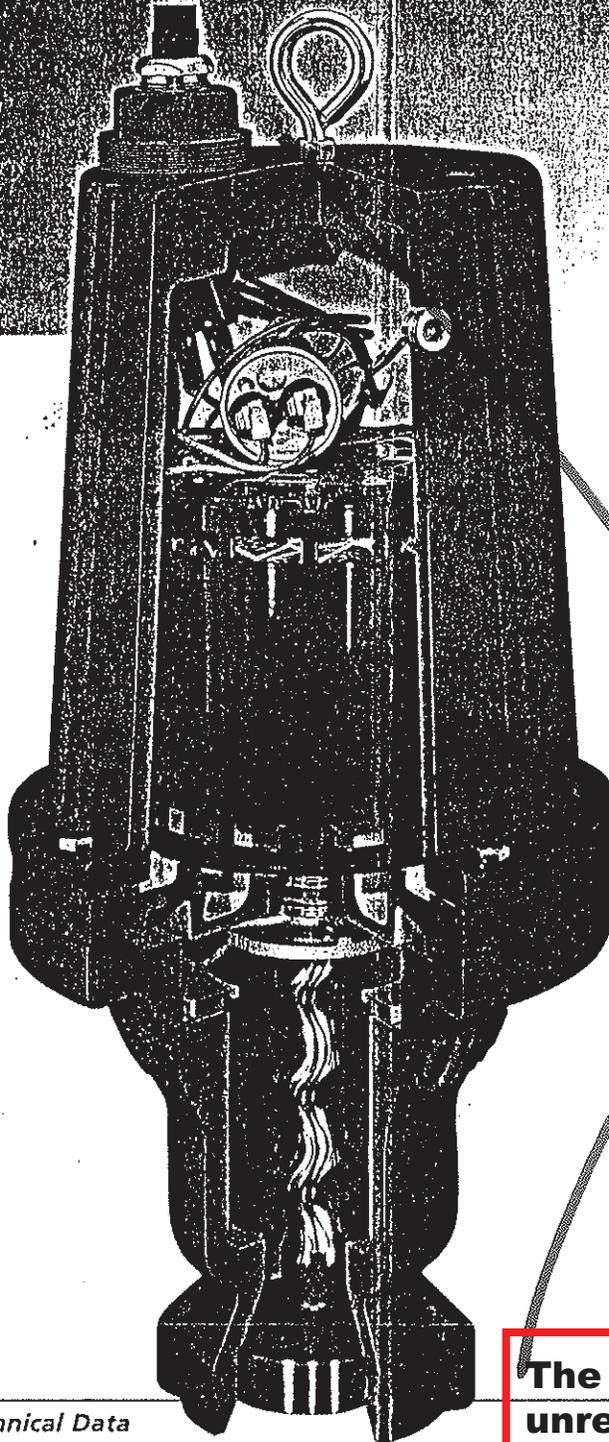


ELEVATION VIEW

NOT TO SCALE

TOWN OF BELLINGHAM	
DATE: 1/29/98	DESCRIPTION: PLAN AND ELEVATION OF
DRAWN BY: N.J.C.	INSTALLED EMERGENCY SEWAGE
FILE NAME: PUMPSYS.DWG	STORAGE TANK AND PUMP SYSTEM

NEW FROM
BARNES
 PRESSURE SYSTEMS



U L T R A
CAV™

PROGRESSING CAVITY GRINDER PUMP

High Head, High Efficiency Pump Provides Significant System Design, Installation And Operating Cost Savings

The Barnes UltraCAV™ Pressure System has been designed in partnership with the foremost manufacturer of progressing cavity pumps in North America to assure total quality and complete reliability. The high head UltraCAV pump often eliminates the need for lift or auxiliary pumping systems. This simplifies system design while substantially reducing installation and maintenance costs to the community and its homeowners.

Barnes UltraCAV Pressure System's capabilities are unmatched. With UltraCAV, you can choose the basin configuration, control system and alarm package that best suits your needs and budget. It costs less to operate than most household appliances. Fiberglass basins withstand hydraulic forces without relying on the concrete ballast for strength. Exclusive UltraCAP™ basin cover options cost less to install. Maintenance costs are lowered by eliminating the need to remove the pump in order to service control components. And UltraSWITCH™ modularized control assembly provides continuous fail-safe operation assurance with no need for preventive maintenance.

Not only does Barnes offer the best positive
 the

NOT APPROVED

technical know-how. For complete information
 contact your Barnes Pressure Systems representative.

Technical Data

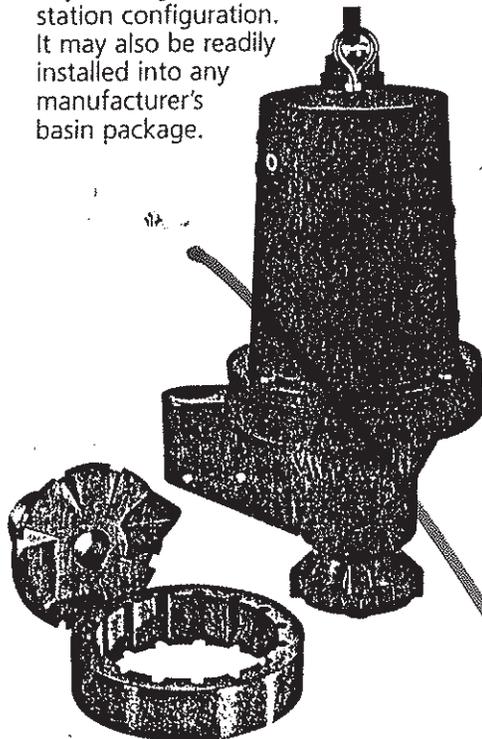
- Oil filled, 3/4 design, permanent split capacitor motor
- 1 hp, 230 or 115 volts, 1750 rpm
- Heads to 184 ft TDH (80 psi) constant duty; 230 ft TDH (100 psi) intermittent duty
- Flows to 17 gpm
- Hard chrome plated stainless steel pump rotor

The Barnes Pumps have proven to be unreliable and are no longer an accepted option. **11/5/2010**

- Exclusive S/R™ replaceable grinder radial cutter and reversible shredder ring
- Run-dry protection standard
- Closed valve protection optional
- NRTL approved to meet UL778 standards
- CSA certified, Standard 108

Handwritten note: Not Approved

**Barnes UltraCAV™
Progressing Cavity Pump**
UltraCAV pumps may be retrofit into any existing Barnes UltraGRIND™ station configuration. It may also be readily installed into any manufacturer's basin package.

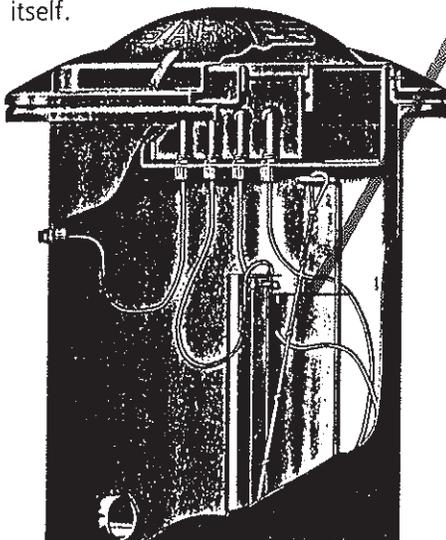


Exclusive Slicerator™
The staggered slicing action of the grinder radial cutter: dramatically

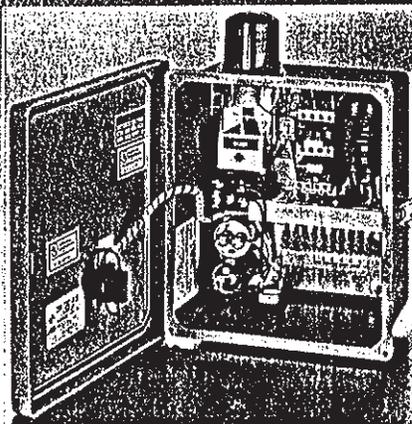
NOT APPROVED

reduces the torque requirement of the prevent clogging with particularly troublesome objects such as plastic, rubber, sanitary napkins, disposable diapers and cloth items.

UltraCAP™ Convertible Cover
Rotomolded polyethylene convertible cover can be used as a cover only or with an optional integrated controls configuration that relocates the panel from the home's exterior to the basin itself.



Barnes® Pressure Sewer Systems Offer A Practical, Proven Solution To Sewage Handling Problems



Optional Equipment and Accessories Control Panels

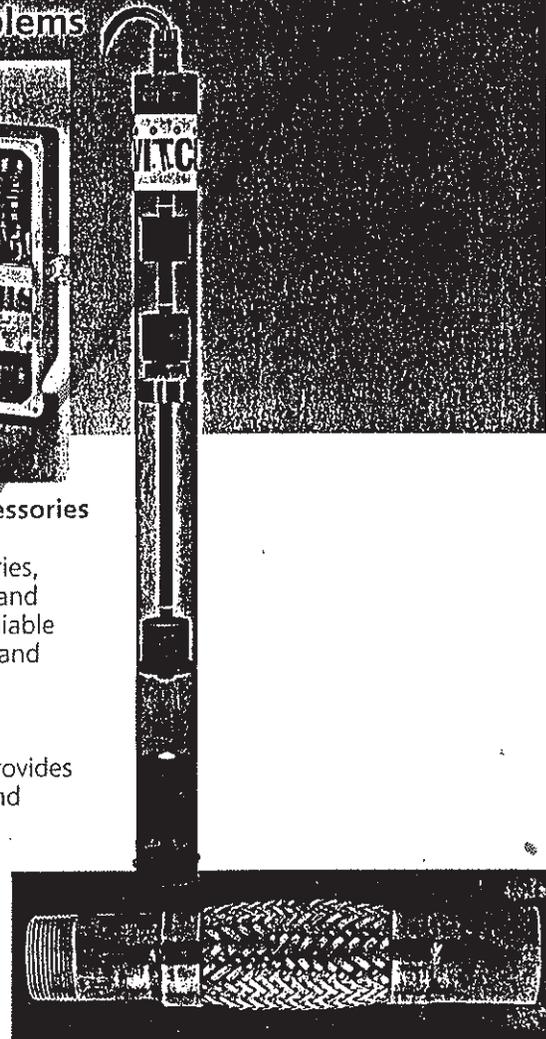
Listed by Underwriters Laboratories, Barnes Pressure System simplex and duplex control panels provide reliable grinder pump station operation and potential malfunction warning.

UltraSWITCH™
Modularized control assembly provides automatic operation, long life and trouble-free operation. Features Isolator™ controls protection.

Flexible Connector
Prevents potential misalignment problems by compensating for different settling rates of basin and discharge pipe.

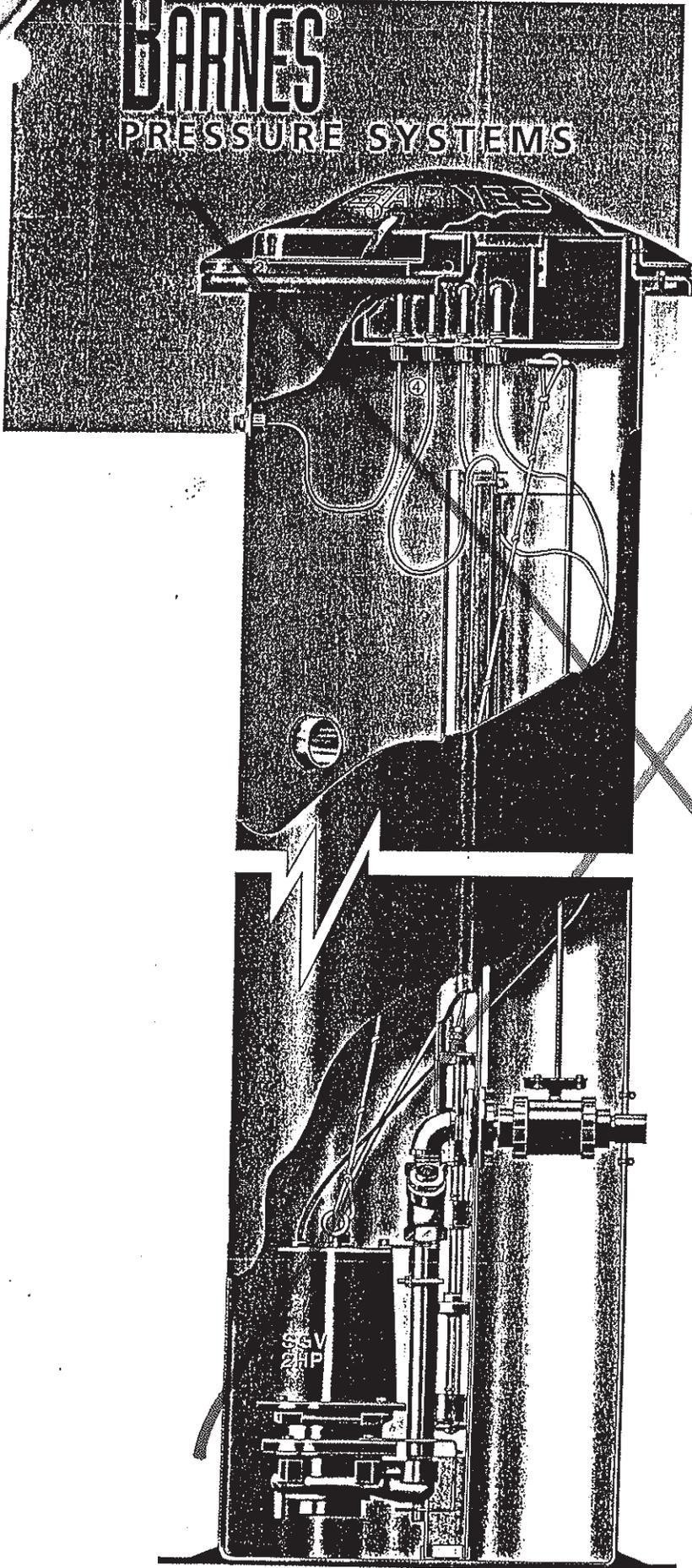
System Design Software
PC based Preliminary Pipe Sizing and System Function Evaluation program enables consultants and engineers to choose the Barnes pressure sewer products that best meet their needs.

Expert Assistance Available
Barnes engineers have gained considerable expertise in the design and installation of low pressure sewer systems. From site engineering through equipment specification and system installation we will work with you, your consultants and developers to design the best, most cost-effective pressure sewer system to meet your sewage handling needs.



Pipe Size (INCH)	Max Velocity (FT/SEC)	Friction Factor (F/T, FT)	Fr Loss This Pipe (FEET)	Accum. Fr. (FEET)	Max Head Required (FEET)	Segment Retention Time	Head in Discharge
1.5	2.0	0.00	0.00	0.00	14.0	0.00	14.0
1.5	2.5	0.00	0.00	0.00	14.0	0.77	13.23
1.5	3.0	0.00	0.00	0.00	14.0	1.54	12.46
1.5	3.5	0.00	0.00	0.00	14.0	2.31	11.69
1.5	4.0	0.00	0.00	0.00	14.0	3.08	10.92
1.5	4.5	0.00	0.00	0.00	14.0	3.85	10.15
1.5	5.0	0.00	0.00	0.00	14.0	4.62	9.38
1.5	5.5	0.00	0.00	0.00	14.0	5.39	8.61
1.5	6.0	0.00	0.00	0.00	14.0	6.16	7.84
1.5	6.5	0.00	0.00	0.00	14.0	6.93	7.07
1.5	7.0	0.00	0.00	0.00	14.0	7.70	6.30
1.5	7.5	0.00	0.00	0.00	14.0	8.47	5.53
1.5	8.0	0.00	0.00	0.00	14.0	9.24	4.76
1.5	8.5	0.00	0.00	0.00	14.0	10.01	3.99
1.5	9.0	0.00	0.00	0.00	14.0	10.78	3.22
1.5	9.5	0.00	0.00	0.00	14.0	11.55	2.45
1.5	10.0	0.00	0.00	0.00	14.0	12.32	1.68
1.5	10.5	0.00	0.00	0.00	14.0	13.09	0.91
1.5	11.0	0.00	0.00	0.00	14.0	13.86	0.14
1.5	11.5	0.00	0.00	0.00	14.0	14.63	-0.63
1.5	12.0	0.00	0.00	0.00	14.0	15.40	-1.40
1.5	12.5	0.00	0.00	0.00	14.0	16.17	-2.17
1.5	13.0	0.00	0.00	0.00	14.0	16.94	-2.94
1.5	13.5	0.00	0.00	0.00	14.0	17.71	-3.71
1.5	14.0	0.00	0.00	0.00	14.0	18.48	-4.48
1.5	14.5	0.00	0.00	0.00	14.0	19.25	-5.25
1.5	15.0	0.00	0.00	0.00	14.0	20.02	-6.02
1.5	15.5	0.00	0.00	0.00	14.0	20.79	-6.79
1.5	16.0	0.00	0.00	0.00	14.0	21.56	-7.56
1.5	16.5	0.00	0.00	0.00	14.0	22.33	-8.33
1.5	17.0	0.00	0.00	0.00	14.0	23.10	-9.10
1.5	17.5	0.00	0.00	0.00	14.0	23.87	-9.87
1.5	18.0	0.00	0.00	0.00	14.0	24.64	-10.64
1.5	18.5	0.00	0.00	0.00	14.0	25.41	-11.41
1.5	19.0	0.00	0.00	0.00	14.0	26.18	-12.18
1.5	19.5	0.00	0.00	0.00	14.0	26.95	-12.95
1.5	20.0	0.00	0.00	0.00	14.0	27.72	-13.72
1.5	20.5	0.00	0.00	0.00	14.0	28.49	-14.49
1.5	21.0	0.00	0.00	0.00	14.0	29.26	-15.26
1.5	21.5	0.00	0.00	0.00	14.0	30.03	-16.03
1.5	22.0	0.00	0.00	0.00	14.0	30.80	-16.80
1.5	22.5	0.00	0.00	0.00	14.0	31.57	-17.57
1.5	23.0	0.00	0.00	0.00	14.0	32.34	-18.34
1.5	23.5	0.00	0.00	0.00	14.0	33.11	-19.11
1.5	24.0	0.00	0.00	0.00	14.0	33.88	-19.88
1.5	24.5	0.00	0.00	0.00	14.0	34.65	-20.65
1.5	25.0	0.00	0.00	0.00	14.0	35.42	-21.42
1.5	25.5	0.00	0.00	0.00	14.0	36.19	-22.19
1.5	26.0	0.00	0.00	0.00	14.0	36.96	-22.96
1.5	26.5	0.00	0.00	0.00	14.0	37.73	-23.73
1.5	27.0	0.00	0.00	0.00	14.0	38.50	-24.50
1.5	27.5	0.00	0.00	0.00	14.0	39.27	-25.27
1.5	28.0	0.00	0.00	0.00	14.0	40.04	-26.04
1.5	28.5	0.00	0.00	0.00	14.0	40.81	-26.81
1.5	29.0	0.00	0.00	0.00	14.0	41.58	-27.58
1.5	29.5	0.00	0.00	0.00	14.0	42.35	-28.35
1.5	30.0	0.00	0.00	0.00	14.0	43.12	-29.12
1.5	30.5	0.00	0.00	0.00	14.0	43.89	-29.89
1.5	31.0	0.00	0.00	0.00	14.0	44.66	-30.66
1.5	31.5	0.00	0.00	0.00	14.0	45.43	-31.43
1.5	32.0	0.00	0.00	0.00	14.0	46.20	-32.20
1.5	32.5	0.00	0.00	0.00	14.0	46.97	-32.97
1.5	33.0	0.00	0.00	0.00	14.0	47.74	-33.74
1.5	33.5	0.00	0.00	0.00	14.0	48.51	-34.51
1.5	34.0	0.00	0.00	0.00	14.0	49.28	-35.28
1.5	34.5	0.00	0.00	0.00	14.0	50.05	-36.05
1.5	35.0	0.00	0.00	0.00	14.0	50.82	-36.82
1.5	35.5	0.00	0.00	0.00	14.0	51.59	-37.59
1.5	36.0	0.00	0.00	0.00	14.0	52.36	-38.36
1.5	36.5	0.00	0.00	0.00	14.0	53.13	-39.13
1.5	37.0	0.00	0.00	0.00	14.0	53.90	-39.90
1.5	37.5	0.00	0.00	0.00	14.0	54.67	-40.67
1.5	38.0	0.00	0.00	0.00	14.0	55.44	-41.44
1.5	38.5	0.00	0.00	0.00	14.0	56.21	-42.21
1.5	39.0	0.00	0.00	0.00	14.0	56.98	-42.98
1.5	39.5	0.00	0.00	0.00	14.0	57.75	-43.75
1.5	40.0	0.00	0.00	0.00	14.0	58.52	-44.52
1.5	40.5	0.00	0.00	0.00	14.0	59.29	-45.29
1.5	41.0	0.00	0.00	0.00	14.0	60.06	-46.06
1.5	41.5	0.00	0.00	0.00	14.0	60.83	-46.83
1.5	42.0	0.00	0.00	0.00	14.0	61.60	-47.60
1.5	42.5	0.00	0.00	0.00	14.0	62.37	-48.37
1.5	43.0	0.00	0.00	0.00	14.0	63.14	-49.14
1.5	43.5	0.00	0.00	0.00	14.0	63.91	-49.91
1.5	44.0	0.00	0.00	0.00	14.0	64.68	-50.68
1.5	44.5	0.00	0.00	0.00	14.0	65.45	-51.45
1.5	45.0	0.00	0.00	0.00	14.0	66.22	-52.22
1.5	45.5	0.00	0.00	0.00	14.0	66.99	-52.99
1.5	46.0	0.00	0.00	0.00	14.0	67.76	-53.76
1.5	46.5	0.00	0.00	0.00	14.0	68.53	-54.53
1.5	47.0	0.00	0.00	0.00	14.0	69.30	-55.30
1.5	47.5	0.00	0.00	0.00	14.0	70.07	-56.07
1.5	48.0	0.00	0.00	0.00	14.0	70.84	-56.84
1.5	48.5	0.00	0.00	0.00	14.0	71.61	-57.61
1.5	49.0	0.00	0.00	0.00	14.0	72.38	-58.38
1.5	49.5	0.00	0.00	0.00	14.0	73.15	-59.15
1.5	50.0	0.00	0.00	0.00	14.0	73.92	-59.92
1.5	50.5	0.00	0.00	0.00	14.0	74.69	-60.69
1.5	51.0	0.00	0.00	0.00	14.0	75.46	-61.46
1.5	51.5	0.00	0.00	0.00	14.0	76.23	-62.23
1.5	52.0	0.00	0.00	0.00	14.0	77.00	-63.00
1.5	52.5	0.00	0.00	0.00	14.0	77.77	-63.77
1.5	53.0	0.00	0.00	0.00	14.0	78.54	-64.54
1.5	53.5	0.00	0.00	0.00	14.0	79.31	-65.31
1.5	54.0	0.00	0.00	0.00	14.0	80.08	-66.08
1.5	54.5	0.00	0.00	0.00	14.0	80.85	-66.85
1.5	55.0	0.00	0.00	0.00	14.0	81.62	-67.62
1.5	55.5	0.00	0.00	0.00	14.0	82.39	-68.39
1.5	56.0	0.00	0.00	0.00	14.0	83.16	-69.16
1.5	56.5	0.00	0.00	0.00	14.0	83.93	-69.93
1.5	57.0	0.00	0.00	0.00	14.0	84.70	-70.70
1.5	57.5	0.00	0.00	0.00	14.0	85.47	-71.47
1.5	58.0	0.00	0.00	0.00	14.0	86.24	-72.24
1.5	58.5	0.00	0.00	0.00	14.0	87.01	-73.01
1.5	59.0	0.00	0.00	0.00	14.0	87.78	-73.78
1.5	59.5	0.00	0.00	0.00	14.0	88.55	-74.55
1.5	60.0	0.00	0.00	0.00	14.0	89.32	-75.32
1.5	60.5	0.00	0.00	0.00	14.0	90.09	-76.09
1.5	61.0	0.00	0.00	0.00	14.0	90.86	-76.86
1.5	61.5	0.00	0.00	0.00	14.0	91.63	-77.63
1.5	62.0	0.00	0.00	0.00	14.0	92.40	-78.40
1.5	62.5	0.00	0.00	0.00	14.0	93.17	-79.17
1.5	63.0	0.00	0.00	0.00	14.0	93.94	-79.94
1.5	63.5	0.00	0.00	0.00	14.0	94.71	-80.71
1.5	64.0	0.00	0.00	0.00	14.0	95.48	-81.48
1.5	64.5	0.00	0.00	0.00	14.0	96.25	-82.25
1.5	65.0	0.00	0.00	0.00	14.0	97.02	-83.02
1.5	65.5	0.00	0.00	0.00	14.0	97.79	-83.79
1.5	66.0	0.00	0.00	0.00	14.0	98.56	-84.56
1.5	66.5	0.00	0.00	0.00	14.0	99.33	-85.33
1.5	67.0	0.00	0.00	0.00	14.0	100.10	-86.10
1.5	67.5	0.00	0.00	0.00	14.0	100.87	-86.87
1.5	68.0	0.00	0.00	0.00	14.0	101.64	-87.64
1.5	68.5	0.00	0.00	0.00	14.0	102.41	-88.41
1.5	69.0	0.00	0.00	0.00	14.0	103.18	-89.18
1.5	69.5	0.00	0.00	0.00	14.0	103.95	-89.95
1.5	70.0	0.00	0.00	0.00	14.0	104.72	-90.72
1.5	70.5	0.00	0.00	0.00	14.0	105.49	-91.49
1.5	71.0	0.00	0.00	0.00	14.0	106.26	-92.26
1.5	71.5	0.00	0.00	0.00	14.0	107.03	-93.03
1.5	72.0	0.00	0.00	0.00	14.0	107.80	-93.80
1.5	72.5	0.00	0.00	0.00	14.0	108.57	-94.57
1.5	73.0	0.00	0.00	0.00	14.0	109.34	-95.34
1.5	73.5	0.00	0.00	0.00	14.0	110.11	-96.11
1.5	7						

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CAP™
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**Convertible Cover Can
 Accommodate Integral Controls For
 All Grinder Pump Station Types**

The UltraCAP rotomolded polyethylene convertible cover ① is engineered to fit all new or existing Barnes UltraGRIND™ pressure sewer systems and all standard 24-inch basins.

The self-venting design ② permits use as a cover only or with an optional integrated controls configuration. The solid cover enclosure ③ protects controls from the harmful effects of weather along with basin gases, vapors and liquids.

With UltraCAP's integrated controls design, the panel is relocated from the home's exterior to the basin itself. In addition to improved aesthetics, this reduces installation costs by bringing power directly to the basin...and by eliminating the need for a junction box or troublesome cord connections. ④

Additionally, the Barnes UltraCAP cover provides:

- Modern profile with no vent stack
- Benefits of rugged, lightweight polyethylene
- Lower installed cost
- Flexibility of convertible feature
- User-friendly servicing
- Easy retrofit of existing stations

See your Barnes Pressure Systems representative for more complete information.

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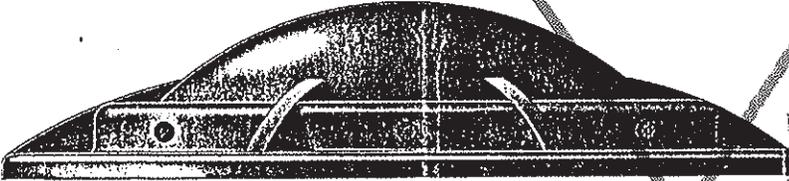
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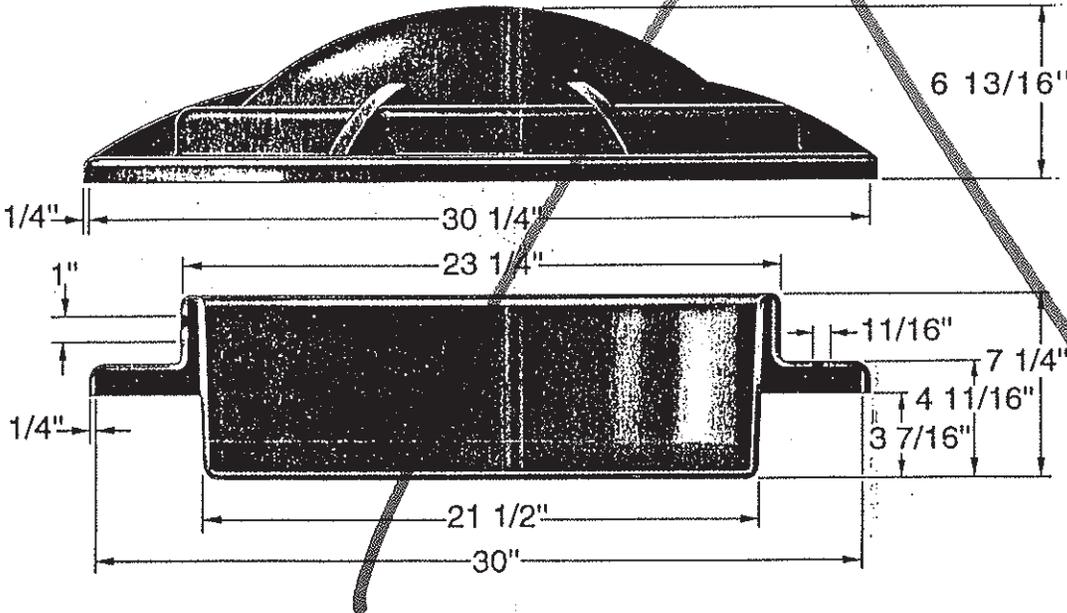
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Rotomolded polyethylene convertible cover is available in two designs.

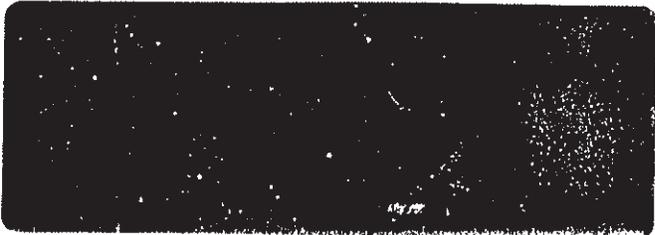
Standard Cover



Cover with Integrated Controls

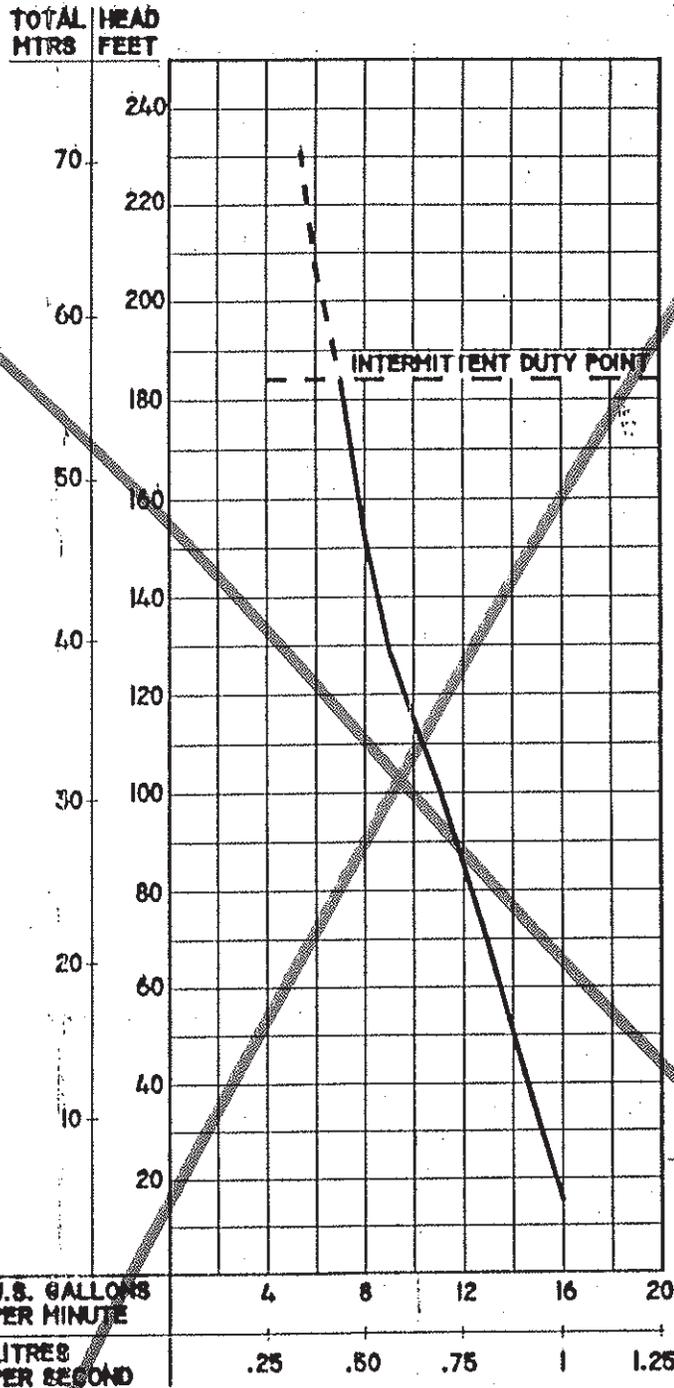


Note: UltraCAP covers fit all new or existing Barnes UltraGRIND pressure sewer systems and all standard 24-inch basins.



PERFORMANCE CURVE
Series: SGPC, 1HP, 1750RPM

Grinder Pumps	
PAGE	11
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Testing is performed with water, specific gravity of 1.0 @ 68° F, other fluids may vary performance.

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