

RULES AND REGULATIONS FOR SEWER CONSTRUCTION
(existing, as found in 2004)
(MS Word file created from hard copy July 10, 2009)

Section 1 General Requirements of Construction

1. General - The contractor shall furnish all labor, materials, tools and equipment necessary for the satisfactory installation of the Gravity Sewers, Forcemains and Appurtenances.
 - a. The installation of gravity sewers, forcemains and appurtenances shall be satisfactorily controlled regardless of the materials encountered.
 - b. It is drawn to the contractor's attention that all work is subject to the Safety and Health Regulations (CFR 29 Part 1926 and all subsequent amendments) as promulgated by the US Department of Labor. Contractors are urged to become familiar with the requirements of these regulations.
 - c. When working within the right-of-way (of a State Highway), the Contractor shall be bound by the conditions, restrictions, and regulations made by the appropriate body. All such regulations shall be in addition to those set down in these Specifications.
 - d. Excavation, dewatering, sheeting, and bracing shall be carried out in such a manner as to eliminate any possibility of undermining or disturbing the foundations of any existing structure or any work previously completed.
 - e. Any permits that may be necessary for the prosecution of the work shall be obtained by the Contractor, including street opening permits.
 - f. Where a **public** sewer (lines) cross private property, the Town may require that easements be obtained.
 - g. The contractor shall provide suitable and adequate room for materials and equipment during the progress of the work. He shall conduct his work so as to minimize public inconvenience and shall notify property owners and merchants that may be affected by the work.
 - h. Such traffic barriers and police protection as the Town may require shall be provided by the contractor.
 - i. Inspection of work by the Town does not imply acceptance. All periodic work will be subject to final inspection and testing procedures before acceptance.
2. Care and Restoration of Property and Utilities Applicable Only to Town and State Right-of-way/easement Property

- a. Excavating machinery, cranes, and all other heavy equipment, shall be operated with care to prevent damage to trees. Where required, trees and utility poles within or adjacent to the work site shall be braced by suitable means. Only those trees which are in direct physical interference with the work may, with the approval of the Town, be removed.
- b. All cutting of branches, limbs, trunks, and roots shall be smoothly and neatly done without splitting or crushing. In case of cutting or unavoidable damage to branches, limbs, and trunks of trees, the cut or damaged portion shall be neatly trimmed and covered with an application of grafting wax or tree healing paint as directed.
- c. At the beginning of the planting season that follows the original seeding of permanent grass, the seeded areas shall be inspected. Any section not showing dense, vigorous growth, at that time, shall be promptly reseeded by the Contractor at his own expense.
- d. Cultivated hedges, shrubs, and plants which might be injured by the Contractor's operations shall be protected by suitable means or shall be dug up and temporarily replanted and maintained, and if required, replaced.
- e. On paved surfaces, the contractor shall not use or operate steel track vehicles or other power-operated equipment with treads or wheels of which are so shaped as to cut or otherwise damage finished pavement or existing pavement surfaces.
- f. All lawns, paved surfaces, roadways, and structures which have been damaged by the contractor's operations shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of operations.
- g. The restoration of existing property or structures shall be done as promptly as practicable and shall not be left until the end of the construction period.

3. Excavation

- a. The contractor shall make excavations in such manner and to such widths as will give suitable room for building the structures or laying or joining pipe; shall furnish and place all sheeting, bracing, and supports; shall do all pumping and draining; and shall render the bottom of the excavation firm and dry and in all respects acceptable and shall dispose of surplus or unsuitable materials.
- b. In no case shall the earth be plowed, scraped, or dug by machinery below the finished grade so that the bottom of the excavation is unnecessarily disturbed. The last of the material to be excavated shall be removed with pick and shovel, just before placing pipe, masonry, or other structures. All loose material shall be removed from the bottom of the excavation so that the bottom shall be in an undisturbed condition.

- c. Loam, topsoil and usable surplus materials shall be carefully removed from areas within the excavation and separately stored to be used again, as directed. If the contractor prefers not to separate surface materials, he shall furnish clean loam, topsoil or gravel at least equal in quantity and quality to that excavated. When excavations are made in paved surfaces, the pavement shall be removed so as to provide a clean uniform edge with a minimum disturbance of remaining pavement.
- d. If pavement is removed it shall not be mixed with other excavated material, but shall be disposed of away from the work site, before the remainder of the excavation is made.
- e. The contractor shall furnish, place and maintain such sheeting and bracing as may be required to support the sides of the excavation to prevent personal injury or to prevent movement which might in any way minimize the width of the excavation below that necessary for proper construction, and to protect adjacent structures from undermining or other damage.
- f. All sheeting and bracing not left in place shall be removed carefully so as not to endanger the work or other structures, utilities, or property. All voids left or caused by removal of sheeting shall immediately be backfilled with gravel and compacted by ramming with tools especially adapted for that purpose, or by other means as may be directed.
- g. At all times during construction, the contractor shall temporarily provide, ample means with which to remove, and dispose of all water entering trenches and other excavations. Excavations shall be kept dry until the structures, pipes, and appurtenances to be built therein have been completed to such extent that they will not be damaged. At that time, the contractor may remove such temporary means and devices.
- h. During cold weather, all earth exposed at the bottom of excavations shall be protected against freezing by covering it with tarpaulins or straw where necessary, by the use of heating devices.
- i. All water pumped or drained from the work shall be disposed of in a manner satisfactory to the superintendent, without undue interference with other work or damage to pavements, lawns, or private property.
- j. If in the opinion of the superintendent the material below the depth to which excavation for structures or pipes would normally be carried is unsuitable for foundation, it shall be removed and shall be replaced with screened gravel or crushed stone meeting ASTM C33, stone size No. 67.

- k. Where the bottom of the excavation shall, by error of the contractor have been taken to a depth greater than the depth specified, or shown on the Drawings, said conditions shall be corrected by refilling to the proper grade with screened gravel or crushed stone meeting ASTM C33, stone size No. 67.
- l. All blasting operations shall be conducted in full compliance with all the laws of the State, all local ordinances, and with all possible care so as to avoid injury to persons and property. The rock shall be well covered, and sufficient warning shall be given to all persons in the vicinity of the work before blasting. Care shall be taken to avoid injury to all water pipes, gas pipes, or other structures and to private property. The contractor, in addition to observing all municipal and other ordinances relating to the storage and handling of explosives, shall also conform to any further requirements which the superintendent shall deem necessary.
- m. If rock below the required depth of excavation is shattered as a result of holes having been drilled too deeply, excessive charges of explosives having been used, or for any other causes related to the contractor's activities, and if in the opinion of the superintendent said shattered rock is unsuitable for foundations, the shattered rock shall be removed and the excavation refilled as required by the superintendent.
- n. Excavations near existing structures shall not be allowed below the bottom of the foundation, without shoring the excavation with sheeting.

The contractor's attention is directed to the fact that other underground utilities may exist within or immediately adjacent to the areas of proposed construction. Information as to the location of these utilities may be available, however this information is subject to field verification by the contractor. Any information furnished as to the location of these utilities shall be regarded as unverified and without guarantee. All utility lines shall at all times be located on the ground with pipe location equipment prior to the commencement of work. All such locations shall be plainly marked by coded paint symbols in pavement areas or in other areas by marked stakes. Only manual methods of excavating shall be employed around buried utilities. All utility services shall be supported by suitable means provided by the contractor so that the services do not fail.

- o. All existing pipes, poles, wires, fences, curbing, property line markers, and other structures which in the opinion of the superintendent must be preserved in place without being temporarily or permanently relocated, shall be carefully supported and protected from damage by the contractor.
- p. Unless otherwise approved or directed by the superintendent, backfilling from one foot above pipelines will be compacted in three foot lifts using suitable equipment.

- q. The extent of excavation left open at any one time will be controlled by the conditions but the contractor shall not have more than 100 feet of open trench at any one time for each working crew.
- r. The town may require the contractor to control dust through sweeping, the application of calcium chloride or sprinkling the area.

4. Repair of Utilities

- a. When excavations are to be made near existing underground utilities or damage occurs to underground utilities the contractor shall notify the owner of the effected utility and follow regulations i.e. dig safe.
- b. Sanitary sewer lines will be repaired in accordance with the Town's specifications for the installation of sanitary sewers and appurtenances.
- c. Connections to the existing sewers shall utilize "Caulder Couplings" to connect the repaired sections to existing pipe which shall be cut squarely and cleanly.
- d. The contractor shall pay the Town for the repair of any damaged water lines.

5. Repair of Pavements

The contractor shall repair all damaged paved areas to the depth and with materials specified herein.

- a. All bituminous paving work shall conform to the State of New Hampshire, Department of Transportation Standard Specifications for Road and Bridge Construction.

Gravel for subbase or roadways, driveways and shoulders shall consist of 12 inches of crushed gravel conforming to Section 304, Subsection 2.1.3 of the NH DOT Standard Specifications for Road and Bridge Construction.

Base course pavement shall be bituminous concrete Type B, as specified by the New Hampshire Department of Transportation Standard Specifications, applied to a two inch compacted depth.

- b. Where the existing pavement is concrete all cross trenches will be paved with high early strength concrete with reinforcement to match any reinforcement in original pavement.

6. Record Drawings

- a. The contractor shall maintain one record copy of all Specifications, Drawings and Shop Drawings at the site. The documents shall be kept in good order and noted to show all changes made during the construction process.
- b. The contractor shall submit to the superintendent within ten days after the completion of the work, one set of marked Drawings which will be used to make "RECORD PRINTS" containing all changes, additions and deviations from the original set of Drawings. Record prints shall accurately reflect locations, depths and character of all buried and covered works, as well as finished roadway grades and elevations of all structures and appurtenances, groundwater elevations and ledge encountered.
- c. The superintendent will require submission of detailed plans of all proposed sewer improvements prior to construction.

Section 2 Sewer design shall be in accordance with the following provisions:

1. Minimum internal diameter for all sanitary sewers shall be eight (8) inches.
2. Pipe material shall be Polyvinyl Chloride (PVC) conforming to the following:
 - a. Pipe and Fittings
 - 1) 8 inch through 15 inch diameter gravity sewer pipe, fittings, adapters and appurtenances shall conform to ASTM D-3034, and D-2241 Standard Specifications, Type SDR 35, polymer compounding and classification shall be in accordance with ASTM D-3915, (Class 12454-B).
 - 2) 18 inch through 27 inch diameter gravity sewer pipe, fittings, adapters and appurtenances shall conform to ASTM F-679 Standard Specification, Type SDR 35 or PS 46, polymer compounding and classification shall be in accordance with ASTM D-3915, (Class 12454-B).
 - 3) 30 inch through 48 inch diameter gravity sewer pipe and appurtenances shall conform to ASTM F-794 Standard Specification for Poly Vinyl Chloride (PVC) Large Diameter Ribbed Gravity Sewer Pipe. Pipe shall be made of PVC plastic conforming to ASTM D 1784 (Classification 12454C or 13364C).
 - 4) 2 inch through 18 inch diameter sewer forcemains, including individual pressurized house services shall conform to ASTM D1784 Standard Specification for Rigid Polyvinyl Chloride (PVC) compounds (Classification 12454-B) (PVC 1120), and ASTM D-2241. The dimension ration shall be no higher than 25 (DR 25) and conform to A.W.W.A. Standard C900 PVC for pressure pipe. All forcemains or pressure services will be twin gasket (IPS DR 25) pressure pipe.

b. Gaskets

- 1) Push-on joints shall have lubricated gaskets conforming to ASTM D-3212.
- 2) Flanged joints shall have rubber full-face gaskets, 1/16-inch thick.
- 3) Solvent weld joints shall conform to the AWWA C 900.

c. Pipe Bedding

- 1) All pipes and specials laid in open trench excavations shall be bedded in and uniformly supported over their full length on beddings of the type specified herein. Flat-bottomed trenches shall be excavated and dewatered prior to preparing the specified foundation. All work shall be performed in a dry trench.
- 2) All pipes shall be supported on Type II bedding, except as otherwise ordered by the superintendent.
- 3) The trench shall be excavated to a depth of six inches minimum below the bottom of the pipe. Screened gravel bedding shall be furnished and placed in the trench for its full width to support the pipe uniformly at the required line and grade.
- 4) Suitable recesses shall be provided in the bedding to provide adequate clearance for bells, couplings, or similar projections. The bedding shall extend upward around the pipe barrel to form a positive cradle fitting the bottom quadrant (90 degrees) of the pipe barrel providing uniform support along the length of the pipe section at the required line and grade.
- 5) Bedding material shall be spread in six inch layers, and each layer shall be compacted with 20 pound hand tampers or pneumatic tampers until the required total depth of bedding has been built up.
- 6) Where suitable supporting soil or rock stratum occurs at a depth greater than six inches, but less than two feet below the pipe, and where ordered by the superintendent, this foundation shall be modified as follows. The trench shall be excavated to the depth necessary to reach the suitable supporting stratum. Screened gravel bedding shall then be spread in twelve inch layers, and each layer shall be compacted with 20 pound hand or pneumatic tampers. The bedding shall carry vertically from the supporting stratum up to six inches below the bottom of the pipe.

d. Marking Sewer Forcemain Locations

In addition to providing dimensional ties at each horizontal bend all sewer forcemains shall have their locations marked in the following manner:

- 1) Two feet (2') above the pipe the installer shall place a 6-inch wide detectable tracer tape.
- 2) Detectable tracer tape shall consist of a continuous aluminum foil core inseparably bonded on both sides with tough high density cross-laminated plastic films, pigmented with red warning colors. Bond strength of the tracer tape must be such as to prevent pitting or degradation after 300 hours of testing per ASTM B-117.
- 3) Detectable tracer tape shall be the type that can be located by the inductive method and does not require electrical connection to be made to the tape.
- 4) The tape shall be compatible for use with magnetic detectors which are currently in use in the Town. Magnetic locating tape shall be installed on all sewer pipe installed without exception.
- 5) The tape shall be six (6) inches in width and shall have the words "Buried Sewer Line Below" permanently and indelibly printed on it.

Section 3 Separation Requirements Between Sewer and Water Lines

- A. Sewers shall be located at least 10 feet, horizontally, from any existing or proposed water main, except that a deviation from this separation to avoid subsurface structures, including telecommunication chambers, interference of building foundations shall be allowed provided that the sewer is constructed as follows:
 1. Sewer pipe shall be class 52 ductile iron or DR25 PVC pipe for a maximum distance of 75 feet each side of an obstruction.
 2. Joints shall be mechanical type water pressure rated with zero leakage when tested at 25 pounds per square inch for gravity sewers and 1 ½ times working pressure for force mains.
- B. Whenever sewers must cross water mains, the sewer shall be constructed as follows:
 1. Sewer pipe shall be class 52 ductile iron or DR25 PVC pipe for a minimum distance of 9 feet each side of the crossing.
 2. Joints shall be mechanical type water pressure rated with zero leakage when tested at 25 pounds per square inch for gravity sewers and 1 ½ times working pressure for force mains and joints shall not be located within 9 feet of the crossing.

3. Vertical separation of the sewer and water main shall not be less than 18”.
4. When the elevation of the sewer cannot be varied to meet the above requirement, the water main shall be relocated to provide this separation.

Section 4 Manholes shall conform to the following requirements:

- A. Manholes shall be constructed at all changes in slope and alignment, and at intervals not exceeding four hundred (400) linear feet.
- B. Manhole construction shall conform to the New Hampshire Department of Environmental Services Water Supply and Pollution Control Division details for Standard Manhole construction.
- C. The manholes shall be constructed of precast reinforced concrete manhole sections. The sections shall be a minimum of four feet in diameter for pipe sizes up to 24 inches internal diameter and five feet diameter for pipe sizes 24 inches and greater internal diameter. The Sections shall conform the requirements of AASHTO-M199-82. Concrete strength shall be 4000 psi at 28 days and reinforcing steel shall be grade 60 and conform to ASTM A 185-79.
 1. Precast Bases: The bases shall be integrally cast and shall consist of manhole bottom and walls which shall extend a minimum of six inches above the top of the highest flowing sewer. The top of the base section shall be carefully formed to receive the tongue of the barrel section. There shall be a minimum distance of five inches between the invert of the lowest outflowing sewer and the floor of the precast base to provide for the construction of a formed invert and bench wall within the manhole. No more than two lift holes shall be cast into the bases.
 - a. Manholes four feet in diameter shall have a bottom at least six inches thick and a wall at least five inches thick.
 - b. Manholes five and six feet in diameter shall have a bottom at least six inches thick and a wall at least five inches thick.
 - c. Openings in manhole bases for pipe connections shall have Kor-N-Seal gaskets, as manufactured by Nashua Precast Company, boot baskets by Interpace, Inc., or an equivalent, cast integrally in the manhole. Gaskets shall conform to requirements of ASTM C443.
 2. The top of base walls, the ends of reinforced concrete risers and the bottom ends of precast tops shall be so formed that when risers and tops are assembled with the base they will make a continuous manhole. Joints shall be of such design as will permit effective joining and placement without irregularities in the interior wall surface of the manhole.

3. Manhole barrels shall consist of riser and top sections with a minimum wall thickness of five inches. The top section shall be an eccentric conical section with thickened upper walls with the smallest inside diameter equal to 30 inches, to receive the manhole frame and cover. No more than two lift holes shall be cast in each barrel or top section.
4. O-ring gaskets for joints between manhole sections shall conform to ASTM C443.
5. In any approved manhole the complete structure shall be of such material and quality as to withstand loads of 8 tons (H₂O loading) without failure and prevent leakage in excess of one gallon per day vertical foot of manhole, continuously for the life of the structure. A period generally in excess of 25 years is to be understood in both cases
6. All precast sections and bases shall have the date of manufacture, date of leakage test and name or trademark of the manufacturer indelibly marked on the inside wall.

D. Manhole Covers and Frames

1. All castings for manhole covers and frames and other purposes shall be close grained, tough gray iron free from cracks, holes, swells and cold shuts conforming to AASHTO M105, grade 30. The quality shall be such that a blow from a hammer will produce an indentation on a rectangular edge of the casting without flaking the metal. All manhole castings shall be made accurately to the pattern and to the dimensions specified with carefully machined bearing surfaces.
2. Allowances shall be made in the patterns so that specified thicknesses shall not be reduced. All lids which “rock” and do not lie solid after construction is finished will be rejected and shall be replaced by adequate lids. No plugging, burning-in, or filling will be allowed. Covers shall fit the frames on any position. All castings shall be carefully coated, both inside and out, with coal-tar-pitch varnish. The varnish shall be made from a good quality of coal tar, with sufficient oil added to make a smooth coating, tough and tenacious when cold, and not brittle nor with any tendency to scale off.
3. The total weight of each manhole cover and frame shall not be less than 400 pounds. The opening inside diameter shall be 30 inches and the minimum total height shall be seven (7) inches.
4. Weight and dimensional tolerances shall not exceed those permitted by ASTM Standards.
5. The cover shall have the letter “S” or the word “Sewer” in 3-inch letters cast into the top surface.

6. All castings shall be thoroughly cleaned and subject to a careful hammer inspection.

E. Brick

Brick for manhole inverts and manhole cover adjustments shall be made of clay or shale and shall be whole, sound, burnt hard entirely through, straight brick, uniform in structure, with true even faces, free from stones, pebbles, masses of lime, checks and cracks extending into the body of the brick. When struck with a trowel, bricks shall give a clear ringing sound and a fracture shall show uniform and compact structure. Bricks shall comply with ASTM C62 Grade SW.

F. Installation of Manholes

1. Manhole bases shall rest upon and be uniformly supported by a six-inch mat of compacted screened gravel placed over a base of sound, level, undisturbed earth, conforming to ASTM C33, stone size No. 67.
2. Pipes entering precast sections of manholes shall be set securely in the precast opening at the correct line and grade.
3. Manhole sections shall not be set by wedging or placing shims to secure proper level.
4. In construction external drop manholes, the riser and in-coming pipe shall be encased and supported with concrete down to undisturbed earth as shown on the Standard Details. Encasing the riser with brick will not be acceptable. Care shall be taken to have all pipes laid to correct lines and grade before concreting is undertaken.
5. In constructing manholes, all ground water shall be kept away from newly grouted pipe and rings or freshly laid brick work until cement has properly set and until a watertight job is obtained. Manholes which admit ground water after completion shall be repaired.
6. The joints between the concrete manhole sections shall be sealed by rubber gaskets, or other sealing compounds to ensure water tightness of the joints. The type of sealant and joint seal procedure shall be approved by the superintendent.
7. In precast bases the flow channels and bench walls in each manhole shall be carefully formed of mortar and brick to the dimensions shown on the Standard Details in the Appendix.
8. The depth of the flow channel shall be equal to the diameter of the pipe to which it connects. The channel shall be graded to give a smooth, uninterrupted flow through the manhole.

9. Bench walls shall be pitched a minimum of one inch per foot from the inside periphery of the manhole to the edge of the flow channel.

G. Order of Execution

1. Following placement of the manhole base sections as described above, barrel sections and cones of the appropriate combination of heights shall be placed, using manufacturers recommended procedure for sealing the horizontal joints.
2. A leakage test shall then be made as described below.
3. Following satisfactory completion of the leakage test, the frame and cover shall be placed on the top to prevent accidental entry by unauthorized persons, children, animals, etc., until the Contractor is ready to make final adjustment to grade.

H. Masonry Work

1. The top of all precast manholes shall be brought to proper grade for receiving manhole frames by using not more than three courses of brick. Masonry construction shall be performed by experienced and qualified workmen only. All work shall be laid plumb, straight, level, square and true. Brick shall be laid in full beds of mortar and troweled into place. All joints shall be full and not more than one-half inch in thickness. All steps and miscellaneous items specified elsewhere shall be placed and bonded in the masonry. The masonry walls shall be parged on the inside and outside with a one-half inch coat of Portland Cement mortar.
2. Mortar to be used in brickwork, setting manhole frames and parging shall be prepared by thoroughly mixing: one volume of Type II Portland Cement with three volumes of sand and sufficient clean water to produce a rich mass of approved consistency. Mixing mortar on the ground or any paved surface shall not be permitted. Sand to be used in making mortar shall be clean, well graded and shall pass a standard Number 4 sieve.
3. All mortar to be used in joining manhole sections, filling lift holes in risers, and in sealing pipe joints in manholes shall be an approved mixture of sand and cement.
4. Masonry shall not be constructed during cold weather (air temperature below 40 degrees F) unless precautions are observed.

Section 5 Testing Requirements

- A. All sanitary sewers or extensions to sanitary sewers shall satisfy requirements of a final exfiltration test before they will be approved and wastewater flow permitted by the Town. The exfiltration test required herein shall be performed by the property owner, builder, or

developer under the supervision of the **Superintendent** who shall have the responsibility for making the proper and accurate measurements required.

B. Field Testing (Sewerage Force mains)

1. After the pipe has been laid, the pipe shall be subjected to a hydrostatic pressure test in accordance with Section 4 of American Water Works Association (AWWA) Standard C600 Installation of Cast Iron Water Mains at 150 percent of the design operating Total Dynamic Head, but not exceeding the rated working pressure of the pipe. The design operating Total Dynamic Head shall be defined by the superintendent.
2. Tests shall not be made until at least 36 hours after the last joint to be tested has been made, and at least 36 hours after the last concrete thrust or reaction blocking has been cast with high early strength cement, or at least seven days after the last concrete thrust or reaction blocking has been cast with standard concrete.
3. Each section of pipeline shall be slowly filled with water and the specified test pressure measured at the point of lowest elevation shall be applied by means of a pump connected to the pipe in a manner satisfactory to the superintendent. The pump, pipe connection, gauges, pipe taps and all necessary apparatus, shall be furnished by the Contractor. The Contractor shall also provide all necessary assistance for conducting the test. The duration of the test shall be 30 minutes unless otherwise directed by the superintendent. All air must be expelled from the pipeline prior to the test period.
4. During the test, all pipes, fittings, valves, and joints will be carefully examined. If found to be cracked or defective, they shall be removed and replaced by the Contractor with sound material in the manner prescribed. The test shall then be repeated until satisfactory to the superintendent.
5. After the pressure test, the pipe shall be tested for leakage. The pressure during the leakage test shall be at the normal operating pressure. The duration of the pressure test shall be 30 minutes unless otherwise directed by the superintendent. The test shall be conducted in the same manner as the pressure test except that the Contractor shall provide suitable equipment for measuring the amount of leakage.
6. No pipe installation will be accepted until or unless the leakage for the section of line tested is less than the rate of leakage specified in the following table:

Leakage in US Gallons per inch diameter, per mile of pipe, per day at Pressures Stipulated:

Pressure	US
psi	Gallons

150	100
125	91.4
100	81.7
75	70.0
50*	57.7

*Minimum test pressure for all forcemains

7. Should any test of a section of pipeline disclose leakage greater than that permitted, the Contractor shall, at his own expense, locate and repair the defective joints and/or pipe until the leakage is within the permitted allowance.

C. Field Testing (Gravity Sewers)

1. All Portions of the sewer system shall be tested by the use of either water or low-pressure air. Rate of infiltration or exfiltration shall not exceed 100 gallons. per inch of pipe diameter, per mile of pipe, per day.
2. Any gravity sewer or portion thereof which fails field testing shall be repaired or removed and replaced at the Contractor's expense. No exceptions will be made.
3. Each section of installed line may be visually inspected by the Town prior to final testing. The pipe shall be true to both line and grade, shall contain no broken pipe, shall show no leaks, shall show neither obstructions or the projection of connecting pipes into the main pipe, and shall contain no debris or other deposits which shall in any way reduce the full cross-section area of the pipe. Any section of pipe which does not comply with these inspection criteria, as determined by the Town, shall be promptly corrected, replaced, or repaired by the Contractor at his own expense. Such methods as are employed for the correction shall be approved by the Town. When directed by the Town, the Contractor shall remove all debris from manholes and shall thoroughly flush sewers preparatory to testing for water tightness. All sewers, including manholes, service collections and sewer laterals constructed shall be tested under this Section and shall satisfactorily meet the test requirements prior to final acceptance of the work. No exceptions will be permitted from this rule unless in written orders from the Town. The Contractor shall furnish all labor, testing materials and equipment (including plugs and standpipes) etc., and shall perform the tests to the satisfaction of the superintendent. The Contractor shall make his own arrangements for water.
4. Except as otherwise approved by the Superintendent an exfiltration test on each section of completed sewer shall be conducted by the Contractor in the presence of the superintendent. The Contractor shall isolate each test section, and fill the line and upstream manhole with water to a height of four feet above the top of the pipe or four feet above groundwater, whichever is higher, at the highest point of the pipe section under test. Each isolated sewer section shall include the run of main sewer between two manholes, the connection laterals leading to this main

sewer, and the upstream manhole. The exfiltration shall be defined as the amount of water which must be added to maintain the original level. The maximum exfiltration shall not exceed 100 gallons per inch of inside diameter of the main sewer pipe per mile in 24 hours.

5. Exfiltration measurements shall be taken not less than two hours after all test water has been placed in any sewer section and this test period shall be no less than four hours duration.
6. Low pressure air testing of sanitary sewer sections may be used as an alternate for water exfiltration tests. Sewer pipe installations shall be considered free from breakage or significant leakage when tested with low pressure air according to recommended procedure. Contractor shall furnish all necessary equipment to perform the tests including labor.

Equipment used shall meet the following minimum requirements:

- a) Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
- b.) Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
- c.) All air used shall pass through a single control panel.
- d.) Three (3) individual hoses shall be used for the following connections:
 - 1) From control panel to pneumatic plugs for inflation.
 - 2) From control panel to sealed line for introducing toe low pressure air.
 - 3) From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

7. Air Test Procedure

- a) All pneumatic plugs shall be seal tested before being used in the actual test installation. One (1) length of pipe shall be laid on the ground and sealed at both ends to check the pneumatic plugs. Air shall be introduced into the plugs to 25 psg. The pipe shall be pressurized to 5 psg. The plugs shall hold against this pressure without movement of the plugs out of the pipe.
- b) After the manhole to manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psg.

Low pressure air shall be introduced into this sealed line until the air pressure reaches 4 psg greater than the average back pressure of any groundwater that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.

- c) After the stabilization period (3.5 psg minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of the line being tested shall be termed “acceptable” if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psg (greater than the average back pressure of any groundwater that may be over the pipe) shall not be less than the time shown for the given diameters in the following table:

Pipe Diameter (in inches)	Minutes
4	2.5
6	4.0
8	5.0
10	6.5
12	7.5
15	9.5
18	11.5
21	13.5
24	15.5
26	23.0

- d) In areas where groundwater is known to exist, the Contractor shall install a one-half inch diameter capped pipe nipple, approximately 10” long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the Line Acceptance Test, the groundwater shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The hose shall be held vertically and a measurement of the height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings. (For example, if the height of water is 11 1/2 feet, then the added pressure will be 5 psg, and the 2.5 psg increases to 7.5 psg. The allowable drop of one pound and the timing remain the same.)
- e) Air loss shall not exceed 0.0030 cubic feet per minute per square foot of internal pipe surface tested at an average pressure 4.00 psi greater than the back pressure exerted by groundwater that may submerge the pipe under test. If the air rate loss is greater than 0.0030 cubic feet per minute per

square foot of internal pipe surface, the total air loss rate of the test section shall not exceed 2.0 cubic feet per minute.

- f) If leakage exceeds the above criteria, the Contractor, at his own expense, shall make the necessary repairs or required replacement to reduce permanently the leakage to within the specified limits. Testing shall be repeated until the leakage requirements are met.
- g) Deflection testing limits and gauge diameter for plastic pipe.

Acceptance limits for deflection tests of installed flexible sewer pipe, shall be 7-1/2% of average inside diameter. A test shall be conducted after a minimum of thirty days following installation.

- 1) The deflection gauge diameter (G) for this test shall be determined by the following formula:

$$G = 0.925 D \text{ inched (nominal)}$$

where D is the average inside diameter given in the applicable ASTM standard. In the cases where inside diameters are not given they shall be determined by the following formula:

$$D = D1 - 2(1.06) \text{ inches}$$

where t = the minimum solid wall thickness
D1 = the average outside diameter

- 2) 100 percent of installed pipe shall be gauged and the result recorded and the superintendent provided with the results.

D. Field Testing (Sewer Manholes)

1. Preparation for Test

After the manhole has been assembled in place, all lifting holes shall be filled and pointed with an approved nonshrinking mortar. The test shall be made prior to placing the shelf and invert and before filling and pointing the horizontal joints. 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. All pipes and other openings into the manhole shall be suitably plugged.

2. Exfiltration Test Procedure (Hydrostatic)

- a) 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, not 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 as determined by the superintendent, 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. 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 the water added. This amount shall be extrapolated to a 24-hour rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed 1 gallon per vertical foot for a 24-hour period. If the test 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 1 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 the rejection of the manhole.

It shall be the Contractor's responsibility to uncover the manhole as necessary and to disassemble, reconstruct or replace it as directed by the superintendent. The manhole shall then be retested and, if satisfactory, all interior joints and those exterior joints within 6 feet of the surface shall be filled and pointed.

- b) The test may be conducted either before or after backfilling around the manhole. However, if the Contractor elects to backfill prior to testing, for any reason, it shall be at his own risk, and it shall be incumbent upon the Contractor to determine the reason for any failure of the test. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc., that is, it will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete. Furthermore, the Contractor shall take any steps necessary to assure the superintendent that the water table is below the bottom of the manhole throughout the test.

3. Vacuum Testing

Vacuum testing may be performed in lieu of the exfiltration testing for manholes as previously discussed. Prior to testing and after the manhole has been assembled in place, all lifting holes shall be filled and pointed with an approved nonshrinking mortar. The test shall be made prior to placing the shelf and invert and before filling and pointing the horizontal joints. 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. "All pipes and other openings into the manhole shall be

suitably plugged and the foot clamps properly tightened to prevent the boot from being sucked into the manhole.

a) Vacuum Test Criteria

(a) 4'-0 or 5'-0 Diameter manholes.

(1) Initial test pressure – 10”Hg (i.e., 20” Hg absolute)

(2) Test time – 1” Hg drop to 9” Hg in 2 minutes minimum allowable for 0-10’ deep manholes.

2 1/2 minutes allowable for 10’-15’ deep manholes and 3 minutes allowable for 15’-25’ manholes.

(b) If the pressure drop exceeds 1” Hg in 2 minutes the unit shall be repaired and retested.

(c) If the unit fails to meet a 1” Hg drop in 1 minute after repair, the unit shall be water exfiltration tested and repaired as necessary.

(d) Testing using either air or water shall be done whenever possible prior to back filling to assist in locating leaks. Joint repairs by parging are to be done on both outside and inside of the joint to ensure a permanent seal, Vacuum testing draws together the joint and applied high pressure to the elastomeric joint material. Properly placed and sized elastomeric joint material must be used to avoid leakage or to enable sections to be separated if necessary to effect a repair.

Section 6

Any person constructing or causing to be constructed, sewerage works (or any part thereof) or private wastewater disposal facilities must present to the Town a certificate of insurance showing suitable liability insurance before a permit will be issued for construction of same, said certificate to be written for the benefit of the Town and to hold the Town harmless for any damages or any claims which may arise as a result of construction of said facilities.