

SANITARY SEWER PIPELINE CONSTRUCTION AND REPAIR

SPECIAL NOTICE

The sewer to be constructed under this project will connect to sewer lines that will be in service. It shall be the responsibility of the contractor to proceed with his construction in such a way as to prevent debris, sand, gravel, or sediment, from entering these lines. Any debris, sand, gravel, or sediment, or any other foreign material entering the lines as a result of the contractor's operation shall be removed by the contractor at his expense.

Work on this project shall be done in an orderly manner, and the Contractor shall, unless otherwise directed by the engineer, proceed as follows:

Excavate for and lay main sewer and backfill.

Construct cast-in-place manholes no later than three days after the main line pipe is laid. Pre-cast manholes shall be placed immediately after pipe is laid.

Compact service line and main line trenches.

Perform all required testing.

Clean up site and repair roads in accordance with section on "Restoration of Surface Improvements".

Where the sewer, installation is on a street or road, the Contractor shall maintain the surfaces in a satisfactory condition for traffic until the surfaces are paved and accepted. He shall keep the surfaces sprinkled and free from dust and he shall keep the surfaces graded and smoothed.

MEASUREMENT AND PAYMENT

GENERAL

The method of measurement and payment for the various items comprising the completed work follows: Payment for the items shall be compensation in full for the furnishing of all overhead, labor, material, tools, equipment and appurtenances necessary to complete the work in a good, neat and satisfactory manner as shown on the Plans, or as specified, with all connections, testing, painting, and related work completed. Each item, fixture, piece of equipment, etc., shall be completed with all necessary connections and appurtenances for the satisfactory use of and/or operation of said item. No additional payment will be made for work related to each item, unless specifically noted or specified. Measurement shall be in-place on the completed work, with no allowance for waste.

TRENCH EXCAVATION

Unless specified otherwise, trench excavation, backfill, grading and restoration of surfaces will not be paid for directly as separate items but shall be included in the contract price of the related work.

"T" CONNECTIONS TO MAIN LINE SEWER PIPE

Measurement will be made of the number of each kind, type and size of "T" connections to main line sewer pipe.

The respective unit prices specified to be paid per each connection shall be compensation in full for furnishing and installing the connection.

The length of "T" branch will not be deducted from the length of main line sewer pipe.

MANHOLES

The depth of the manholes for payment purposes shall be the distances from the cover grade given by the Engineer to the invert at that point.

The respective unit prices specified to be paid per each manhole shall be compensation in full for constructing the manholes as specified, and indicated on the Plans; for furnishing and setting frames and covers; for resetting frames and covers after the paving of roads and streets is completed.

Drop manholes will be paid for as manholes.

PIPE

Pipe shall be paid for actual length of pipe installed, by excavation, measured from inside face of manhole to inside face of manhole. All items pertaining to pipe installation, not listed as separate items in the proposal, are included in the price of pipe installation. Casing pipe installed by boring and jacking shall be paid for the actual length of pipe installed and shall include all costs of boring, including but not limited to, excavation and shoring of bore and reception pits, reaction blocks, pilot tubes, etc. Carrier pipe installed in a casing will be measured the same as the casing pipe and paid as a separate item.

CARE OF EXISTING STRUCTURES

Existing power and telephone lines, trees, fences, water pipes, gas lines, sewers or other conduits, embankments, and sundry structures in the vicinity of the work shall be supported and protected from injury by the Contractor during the construction and until the completion of the work. The Contractor shall be liable for all damages done to such structures, as herein provided, and shall save and keep the Owner harmless from any liability or expense for injuries, damages or repairs to same.

CLEANUP

After backfilling and performing surface restoration, the Contractor shall grade all trenches and maintain them during the period of this contract to provide safe travel by the public, free of settlement, mud holes, ruts and high centers.

Upon completion of the work, all excess material, sheeting and debris shall be removed from the site and disposed of by the Contractor. Where backfill is of a rocky nature and there is insufficient fine material to provide a surface comparable to the original surface, the Contractor shall haul in select fine material and restore the surface to its original condition. Where pipelines are

located in streets, roads, fields, or similar areas, the surface over the trench and adjacent to the trench shall be restored to its original conditions.

PROTECTION AND REPAIR OF EXISTING UTILITIES

A thorough attempt has been made to show the type, size, location and number of all utility mains and services; however, no guarantee is made as to the true type, size, location and number of such mains and services. The information was taken from the various utility companies maps and transferred to the plans as accurately as possible. Neither the Owner nor the Engineer shall in any way be responsible for the omission on the plans of any mains or services of whatever nature nor shall they be responsible for any misrepresentation of size, type, number, location or depth. The Contractor shall repair, in a manner satisfactory to the Owner of any utility, main, or service, all mains or services damaged in the process of his work. The Contractor shall notify all owners of utilities when his work is in progress and shall make such arrangements as are necessary to make any emergency repair. The Contractor shall be prepared at all times with labor, equipment, and materials to make repairs on damaged mains or utilities.

No extra compensation will be made for the repair of any service or mains damaged by the Contractor's labor forces or equipment, or for any damage incurred through the neglect or failure of providing protective barriers, lights and other devices or means required to protect such existing utilities.

SURVEY WORK

All construction staking and survey work shall be performed by a land surveyor licensed to practice in the State of Utah. Unless otherwise specified, the Contractor shall provide all construction surveying required to complete the project.

EXCAVATION

GENERAL

Excavation shall include the loosening, removing, loading, transporting, depositing and compacting a final location all materials, wet and dry, necessary to be removed for purposes of construction.

TRENCH EXCAVATION

General: The Contractor shall perform all excavation of every description and of whatever substances encountered, to the alignment and depth shown on the plans or otherwise specified. During excavation, materials suitable for backfilling shall be piled in an orderly manner, a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. Excavated material shall be piled on one side of the trench only, to permit ready access to existing fire alarm boxes, fire hydrants, valves, manholes and other appurtenances. Surface drainage of adjoining areas shall be unobstructed. All excavated materials not required or suitable for backfill shall be removed from the site and wasted as directed by the Engineer.

Such grading shall be done as may be necessary to prevent surface water from flowing into excavations, and any water accumulating therein shall be promptly removed. Under no circumstances

shall water be permitted to rise in unbackfilled and untested trenches until after the pipe has been placed. Any pipe having its alignment or grade changed by floating in a flooded trench shall be re-laid at no additional cost to the Owner.

Excavation shall be by open cut, except that short sections of a trench may be tunneled if, in the opinion of the Engineer, the pipe can be properly installed and backfilled. Crossings under sidewalks may be made by tunneling. If the Contractor elects to remove a portion of the sidewalk, he must use a concrete saw for making neat joints, compact the backfill as specified, and pour a new concrete slab.

Depth of Trench. Trench depths shall be as required for the invert grade or pipe bury shown on the plans or specified elsewhere.

Excavations for trenches in stable native soils, shall extend to a depth of at least four (4) inches and not more than six (6) inches below the bottom of the pipe. Care shall be taken not to excavate below the required depth. A ¾" minus, crushed stone bedding, complying with these specifications, shall be placed and provide a smooth, stable foundation. Trench bottoms shall be hand shaped to provide a "bell hole" at each joint and to provide uniform and continuous bearing for the pipe everywhere else.

Where unstable earth or soft material is encountered in the excavation of the grade of the pipe, a minimum of 12 inches below grade will be removed and backfilled with ¾" minus crushed stone to provide a stable subgrade.

The maximum width of trench, measured at the top of the pipe, shall be as narrow as possible, but not wider than 18 inches or narrower than 6 inches on each side of the sewer pipe.

CHARACTER OF MATERIAL

The Contractor must satisfy himself regarding the character and amount of loam, clay, sand, quicksand, gravel, hard pan, rock, water and other material to be encountered and work to be performed.

CLEARING AND GRUBBING

The site of all excavation, embankments and fills shall be first cleared of buildings, fences, lumber, walls, stumps, brush, weeds, rubbish, trees and loose boulders, which shall be removed and disposed of.

TRENCHES AND TUNNELING

The Contractor shall make all necessary excavation to construct the work shown upon the Plans. Where so indicated on the Plans, or profile, the pipe shall be laid in an open trench, as indicated.

Where pipe is to be laid under highways, waterways or other improvements, tunneling will be permitted, providing all other conditions of these specifications can be met.

If the bottom of the excavation is found to consist of rock or any material that by reason of its hardness cannot be excavated to give a uniform bearing surface, said rock or other material shall be removed to a depth of at least four (4) inches below the bottom of the pipe and refilled to grade.

with ¾" minus crushed stone thoroughly compacted into place, all at the Contractor's expense for labor and material.

Width of Trench: Trenches shall be wide enough to allow workmen adequate space to place and joint the pipe properly. In no case shall the trench width, to one foot above the top of the pipe, be greater than the outside pipe diameter plus eight (18) inches on each side of the pipe, except that additional width will be allowed as required for placing timber supports, sheeting and bracing or trench boxes. Trench supports shall not extend below the top of pipe. Trench walls shall be kept vertical, except that, if the Engineer permits, the walls of the trenches from an elevation one foot above the top of the pipe may be slopped back to prevent the banks from sloughing into the ditch. Where trench widths greater than specified are used, the Contractor may be required to provide special pipe foundations, backfill material and pipe stronger than specified.

LENGTH OF TRENCH

The trench shall be opened not more than one hundred (100) feet in advance of the pipe laying, or construction, nor left unfilled more than one hundred (100) feet in the rear thereof, except as required for testing, unless permitted or ordered by the Engineer. All streets, alleys and driveways shall be provided with crossing ramps until backfilling is completed.

CUTTING PAVEMENT

Where trenches are to be excavated on or across paved streets, alleys or driveways, the pavement shall be cut cleanly to trench line with saw before excavation begins.

BLASTING

Blasting for excavation will be permitted only after securing the approval of the Engineer, and the hours of blasting will be fixed by the Engineer. The Contractors shall use utmost care to protect life and property. All explosives shall be safely and securely stored in compliance with local laws and ordinances, and all such storage places shall be clearly marked "Dangerous Explosives". No explosives shall be left unprotected where they could endanger persons and property.

When blasting rock in trenches, the Contractor shall cover the area to be shot with earth backfill or approved blasting mats that will prevent the scattering of rock fragments outside the excavation. The Contractor will be responsible for all damage to property and injury to persons resulting from biasing or accidental explosions that may occur in connection with his use of explosives. The Contractor's blasting procedures shall conform to Federal, State and local ordinances. The Contractor shall acquire all required permits prior to the start of blasting.

TRENCH BRACING

The sides of all trenches shall be supported by braced sheets piling or shoring, or else the sides of the excavation shall be sloped to the angle of repose of the material being excavated where required by all local, State or Federal requirements. The bracing system shall be designed to resist all loads which might be reasonably expected to occur, including not only those resulting from the weight of the soil, itself, but also those resulting from all transportation facilities, surface or subsurface structures, stored materials, stored or operating construction equipment and previous excavations.

In excavations where the sides are sloped to an angle equal to or less than the angle of repose of the material being excavated, and where such sloping of the sides extends to less than the full depth of the excavation, the sides of the excavation below the sloped sides shall be supported by a bracing system.

Bracing systems shall be constructed in accordance with applicable requirements of local, State and Federal regulations. Where allowed by such regulations, the Contractor may construct steel cribbing which would be moved along with the trenching and pipe laying operations, such cribbing shall be constructed so that it will supply protection equal to the required bracing. Trench bracing shall remain in place until the pipe has been laid, tested for defects and repaired, if necessary, and the crushed stone around it compacted to a depth on one (1) foot over the top of the pipe.

UNAUTHORIZED EXCAVATION

Structure excavation carried beyond or below the lines and grades given by the Engineer shall be refilled, at the expense of the Contractor, with such material and in such manner as may be directed in order to insure the stability of the various structures.

CLEARANCE OF STRUCTURES

The excavation for all structures other than pipe shall be sufficient to leave at least twelve (12) inches in the clear between their outer surfaces and embankments or timbering which may be used to protect them.

REMOVAL OF WATER

The Contractor shall provide and maintain at all times during construction ample means and devices with which to promptly remove and properly dispose of all water entering the excavations or other parts of the work. No concrete or masonry footings, foundations or floors shall be laid in water nor shall water be allowed to rise over them until the concrete or mortar has set at least twenty-four (24) hours. Water shall not be allowed to rise against walls for a period of fourteen (14) days.

The Contractor shall dispose of the water from the work in a suitable manner without damage to adjacent property. No water shall be drained into work built or under construction without prior consent of the Engineer.

Water shall be disposed of in such a manner as not to be a menace to the public health.

EROSION CONTROL AND POLLUTION PREVENTION

The Contractor shall comply with all Federal, State, and local requirements for erosion control and pollution prevention. The Contractor shall meet the conditions of all Construction Permits and implement all pollution prevention and erosion control plans issued for the project.

DISPOSAL OF EXCAVATED MATERIAL

Excavated material shall be disposed of by backfilling trenches and around structures, fills, and grading around the work as may be directed and to the lines and grades given by the Engineer. No excavated material shall be disposed as to cause pressure against newly placed or set masonry.

Excess excavated material not required or useable for backfilling or filling, shall be immediately removed and disposed by the Contractor.

No surplus material shall be dumped on private property unless written permission is furnished by the owner of the property to the Engineer.

BACKFILLING

TRENCH BACKFILL

a. **General:** All trenches shall be backfilled immediately after, alignment and jointing of the pipe has been inspected and approved by the Engineer.

Whenever driven sheeting is used, that portion of the sheeting below the top of the pipe shall not be removed or disturbed. Whenever driven sheeting is used for the protection of the trench walls in water bearing soil. No portion of the sheeting below a level of four feet above the top of the pipe shall be removed.

b. **Backfill Material Above Pipe Zone:** All backfill material shall be free from cinders, ashes, refuse, organic and frozen material, boulders, stones or other material that, in the opinion of the Engineer, is unsuitable. From one foot above the top of the pipe to 6 inches below the ground surface, or to the subgrade elevation for streets or paved surfaces, material containing stones up to 8 inches in the greatest dimension may be used. In all cases the backfill material requirements of the right-of-way owner or governing body shall be met.

c. **Backfill Material - Pipe Zone:** Backfill material 6 inches under the pipe, and around and to one foot over the pipe from bank to bank of trench shall consist of ¾" minus crushed stone conforming to the following gradation:

¾ INCH CRUSHED STONE

<u>Sieve Size</u>	<u>Percent Passing</u>
¾"	90-100
⅜"	20-55
#4	0-10
#8	0-5

A sample of crushed stone meeting the gradation requirements above shall be submitted to the Engineer for approval. Certification of gradation by the crushed stone supplier may also be required by the Engineer.

d. **Placement of Pipe Zone Backfill Material:** Backfill under the pipe shall be placed to the required grade and compacted using a vibrating plate compactor. Bell holes just large enough to accommodate the pipe bell and prevent bearing at the joint shall be excavated. Pipe bedding shall provide uniform and continuous bearing under the pipe. The pipe shall be placed and grade checked. Additional material added to adjust grade shall be compacted.

Backfill around the pipe up to the centerline of the pipe shall be placed in maximum layers of six (6) inches and thoroughly compacted by tamping. Special care shall be taken to assure complete

compaction under the haunches of the pipe. Use a shovel to slice gravel under the haunches of the pipe. Backfill material shall be placed in the trench for its full width on each side simultaneously.

From the centerline of the pipe to a depth of one foot above the top of the pipe, the backfill shall be placed in six (6) inch maximum layers for the full width of the trench and compacted by tamping or by using a vibrating plate compactor.

e. Backfill Above Pipe Zone: After crushed stone has been placed and compacted as specified above, the remainder of the backfill shall be placed. Backfill in this zone may be placed by any method approved by the Engineer, providing such method will not impose excessive concentrated or unbalanced loads which will transmit shock or impact to the buried pipe. Trenches shall be backfilled in continuous horizontal layers eight (8) inches in thickness. Under pavements, or other surface improvements, each layer shall be spread to a uniform thickness and compacted to not less than ninety-five percent (95) of the maximum density at optimum moisture as determined by AASHTO Method T99. In shoulders and other areas, the in-place density shall be a minimum of 90% of the maximum dry density. The Contractor may add water to bring the material to optimum moisture content. In all cases the backfill placement requirements of the right-of-way owner or governing body shall be met.

f. Backfilling for Appurtenances: Select material, consisting of select earth, sand or fine gravel, free from clods, lumps or stones larger than 1¼", shall be used for backfilling around manholes, hydrants and other appurtenances. This backfill shall be deposited so that the appurtenance is not disturbed from its proper alignment, and compacted to the finished grade.

g. Testing: Field density tests of the compacted fill will be taken as required by the right-of-way owner in accordance with the requirements of road cutting permits obtained by the Contractor. These tests will be performed at the Contractor's expense.

h. Slurry Cement Backfill: In special circumstances such as backfilling in areas where existing utilities prevent proper compaction of backfill the Engineer may require slurry cement backfill. Slurry cement backfill shall also be used where required by the right-of-way owner or governing body.

Slurry cement backfill shall consist of a fluid, workable mixture of aggregate, cement and water.

Cement shall be portland cement conforming to ASTM C 150.

Water used for slurry cement backfill shall be free from oil, salts and other impurities which would have an adverse effect on the quality of the backfill material.

At the option of the Contractor, aggregate shall be either (1) material selected from excavation, imported material or a combination thereof, which is free of organic material and other deleterious substances, or (2) commercial quality concrete sand. Material selected from excavation, imported material or a combination thereof, shall meet the following grading:

<u>Sieve Sizes</u>	<u>Percentage Passing</u>
11/2"	100
1"	80 - 100
3/4"	60 - 100
3/8"	50 - 100

No. 4	40 - 80
No. 100Q	10 - 40

The aggregate, cement and water shall be proportioned either by weight or by volume. Not less than 188 pounds of cement shall be used for each cubic yard of material produced. The water content shall be sufficient to produce a fluid, workable mix that will flow and can be pumped without segregation of the aggregate while being placed.

Materials for slurry cement backfill shall be thoroughly machine-mixed in a pugmill, rotary drum, or other approved mixer. Mixing shall continue until the cement and water are thoroughly dispersed throughout the material. Slurry cement backfill shall be placed in the work within one hour after mixing. In cold weather, only non chloride accelerators may be used in the mix.

Slurry cement backfill shall be placed only for that portion of the trench as required by the Engineer or right-of-way governing body. Where necessary, earth plugs shall be compacted at each end of the trench prior to placing backfill to contain the slurry in the designated area.

Slurry cement backfill shall be placed in a uniform manner that will prevent voids in, or segregation of, the backfill, and will not float or shift the pipe. Slurry shall only be placed after the pipe-zone gravel has been placed unless Engineer approves otherwise.

Foreign material which falls into the trench prior to or during placing of the slurry cement backfill shall be immediately removed.

Backfilling over or placing any material over slurry cement backfill shall not commence until 4 hours after the slurry cement backfill has been placed, except that when concrete sand is used for the aggregate and the in-place material is free draining, backfilling may commence as soon as the surface water is gone.

RESTORATION OF SURFACE IMPROVEMENTS

General: The Contractor shall be responsible for the protection and the restoration or replacement of any improvements existing on public or private property at the start of work or placed there during the progress of the work.

Existing improvements shall include but are not limited to permanent surfacing, curbs, ditches, driveways, culverts, fences, walls and landscaping. All improvements shall be reconstructed to equal or better, in all respects, the existing improvements removed.

That portion of all streets, alleys, and private driveways where the surface is removed, broken or damaged by the installation of this improvement shall be resurfaced by the Contractor.

It shall be the responsibility of the Contractor to perform his operations in such a way that the minimum amount of damage will be done to the road surface. Any damage to the road surfaces shall be repaired by the Contractor at his expense.

Care shall be taken to avoid damage to manholes, valve boxes, survey monuments, etc. Any damaged manholes, valve boxes, survey monuments, etc., shall be replaced by the Contractor at his expense. A Salt Lake County permit shall be obtained to remove and replace a survey monument.

Materials and construction for restoration of surface improvements shall conform to the applicable specifications of the right-of-way owner. Contractor shall strictly adhere to all requirements of permits obtained to work in the public way. Where no right-of-way owner or governing authority exists, Contractor shall adhere to the following requirements:

ROAD BASE

Where trenches are excavated through gravel surfaced areas such as roads and driveways, etc., the gravel surface shall be restored and maintained as follows:

- (a) The gravel shall be placed deep enough to provide a minimum of 8 inches of material.
- (b) The gravel shall be placed in the trench at the time it is backfilled. The surface shall be maintained by blading, sprinkling, rolling, adding gravel, etc., to maintain a safe uniform surface satisfactory to the Engineer. Excess material shall be removed from the premises immediately.
- (c) Material for use on gravel surfaces shall be obtained from sound tough durable gravel or rock meeting the following requirements for grading:

Passing	1" sieve	100%
Passing	½" sieve	70-100%
Passing	#4 sieve	41-68%
Passing	#16 sieve	21-41%
Passing	#50 sieve	10-27%
Passing	#200 sieve	4-13%

BITUMINOUS SURFACE

Where trenches are excavated through bituminous surfaced roads, driveways or parking areas, the surface shall be restored and maintained as follows:

- (a) A temporary gravel surface shall be placed and maintained as required in Paragraph 3 above, after the required backfill and compaction of the trench has been accomplished.
- (b) The gravel shall be placed to such depth as to provide a minimum of 8 inches below the pavement and shall be brought flush with the paved surface.
- (c) The area over trenches to be resurfaced shall be graded and rolled with a roller weighing not less than twelve tons, until the subgrade is firm and unyielding. Mud or other soft or spongy material shall be removed and the space filled with gravel and rolled and tamped thoroughly in layers not exceeding 6 inches in thickness. The edges of trenches which are broken down during the making of subgrade shall be removed and trimmed neatly before resurfacing.
- (d) Before any permanent resurfacing is placed, the Contractor shall trim or cut the existing paving to clean, straight lines as nearly parallel to the centerline of the trench as practicable. Said straight lines shall be 30 feet minimum length and no deviations from such lines shall be made except as specifically permitted by the Engineer.
- (e) Existing bituminous paving shall be cut back a minimum of six (6) inches beyond the limits of any excavation or cave-in along the trench so that the edges of the new paving will rest on at least six (6) inches of undisturbed soil.

- (f) As soon as practical, weather permitting, the bituminous surface shall be restored by standard paving practices to a minimum thickness of 3 inches.
- (g) Pavement restoration shall include priming of pavement edges and sub-base with Type MC-70 bituminous material, and placing and rolling plant mix bituminous material to the level of the adjacent pavement surfaces.

CONCRETE SURFACING

All concrete curbs, gutter, sidewalks and driveways shall be removed and replaced to the next joint or scoring line beyond the damaged or broken sections; or in the event that joints or scoring lines do not exist or are three or more feet from the removed or damaged section, the damaged portions shall be removed and reconstructed to neat, plane faces. All new concrete shall match, as nearly as possible, the appearance of adjacent concrete improvements. Where necessary, lampblack or other pigments shall be added to the new concrete to obtain the desired results.

FORMS

Forms for poured concrete manholes shall have an inside and an outside form and may be made of metal, wood or metal-covered wood construction and shall be of such design to prevent distortion and to carry the full load placed against them without bulging, distorting or in any way losing their alignment. Manhole forms shall be made to fit the dimensions of the manholes as detailed on the plans. The Contractor shall submit to the Engineer for approval, details of the Concrete forms he proposes to use.

WATER-TIGHTNESS OF CONCRETE WORK

Water-tight concrete is required in all Class "A" Concrete structures. Any cracks or imperfections developing at any point in the work shall be satisfactorily repaired. Materials and methods used shall be subject to approval by the Engineer.

FINISH

Floors of manholes shall be given a smooth steel trowel finish. Immediately after removal of forms from the walls of manholes, all fins and irregular projections shall be struck flush from all exposed exterior and interior concrete surfaces. Cavities produced by form ties shall be thoroughly cleaned, saturated with water, and carefully filled and pointed with mortar of the same cement sand content as the concrete. Surfaces which have been pointed shall be kept moist for a period of four (4) hours. No other concrete finish is required for formed surfaces.

MANHOLES

General: Plain Portland cement concrete manholes shall be constructed in place or reinforced Portland cement concrete pre-cast manholes shall be installed along the sewer line at points indicated on the plans or as directed by the Engineer. Excavation and concrete shall conform to applicable specification.

FRAMES, COVERS, AND DUST PAN

All manholes frames and covers furnished on this project shall be of the same size and design, and shall be supplied by the same manufacturer. They shall be of uniform quality and free from blowholes, distortion or any other defects.

All material used in castings shall conform to ASTM-48-93 Class 35B. Castings shall meet Federal Specification RR-F-621E. They shall meet H-20 loading requirements. Dust pans shall not be used.

After castings have seasoned sufficiently so that there will be no further distortion due to temperature changes, the cover and ring seat shall be machined so that the entire area of the seat will be in contact with the cover, in any position of the cover on the seat. Frames and covers shall be so constructed and machined so that the parts are interchangeable.

The top surface of each cover shall be cast with a studded pattern including the word "Sewer". Letters and studs shall be raised 3/8 inch. The letter shall be not less than two and one-half (2-2) inches high. Each cover shall be provided with not less than twelve three-fourth (12 3/4) inches diameter ventilating holes. Contractor shall substitute a no-hole lid if directed by the District Engineer.

MANHOLE CONSTRUCTION

Constructed in Place Units: Manholes constructed in place shall be constructed as indicated on the plans and specified herein.

(a) Bases: Manhole bases shall be constructed of concrete to the dimensions indicated on the drawings. Main line sewer pipe and projecting ends of the sewer and pipe studs shall be adequately supported to prevent displacement from line or grade during the construction of the base. All manholes shall have the invert shapes as indicated on the drawings to provide an adequate channel between the inlet and outlet pipes. The entire surface of the manhole invert, including channels and shelves shall be steel-troweled to a smooth, dense surface. Bases shall be poured jointly with the shaft section, for the shaft section shall be set into the base as one unit.

(b) Sections: The walls of the manholes shall be brought to such an elevation that the cast iron ring and cover when set thereon will conform to the grade of the street, or to the grade given by the Engineer. Sections shall be plumb and centered with center line of pipe line and at the exact station as directed by the Engineer, or District personnel.

(c) Inverts: It is intended that all inverts of junction manholes be shaped while the base of the manholes are under construction. The Contractor shall have the choice of continuing the pipe through the manhole, building the invert and later cutting-out the pipe above the mid-point of the pipe; or he may stop the pipes at the inside faces of the manhole and construct the invert to the shape and sizes of pipe as detailed. All inverts shall follow the grades of pipe entering the manholes.

Where manholes are placed on a straight run of pipe, the pipe shall be laid continuous through the manhole. The top of the pipe above the mid-point shall be cut out and removed.

Precast Units: Precast manholes shall be constructed as indicated on the plans and as herein specified.

(1) Bases: Pre-cast bases may be used and shall conform to ASTM C478.

(2) Precast Sections and Cones: The walls of the manholes may be built up of precast sections and shall be brought to such an elevation that the cast iron ring and cover when set there on will conform to the grade of the street, or to the grade given by the Engineer. Manholes shall be plumb and centered with the center line of pipe lines and at the exact station as directed by the Engineer and all joints shall be water-tight.

Precast sections shall be of the design adopted by the District and conform to ASTM C478.

MANHOLE FRAMES, COVERS, DUST PANS, AND INVERT COVERS

Manhole rings shall be set in place on the cone in a bed of cement-sand mortar mixed 1 part cement and 2 parts sand. Concrete grade rings conforming to ASTM C478 shall be used to adjust manhole frames to grade. No more than 12" of concrete grade rings may be used. Cast-iron grade rings or riser rings shall not be used. Adjustment of final grade shall be in accordance with detail drawings included with these specifications.

Frames and covers shall be protected during the backfill and compaction of trenches and during the replacing of road surfaces. Any frames or covers loosened from the shaft shall be reset in cements and mortar and any frames or covers damaged or broken shall be replaced by the Contractor at his expense.

Invert covers shall be constructed of fiberglass or 3/4 inch plywood. These shall be installed in the base of the manhole immediately after the pouring of the manhole and curing of the manhole; and shall remain in place until the final inspection of the system at which time all covers shall be at finish grade and roadway paved. It will be the contractor's responsibility to remove all invert covers and clean manholes before final inspection. Permanent fiberglass invert covers of District approved design are required in off-road manholes or other locations as directed by District Engineer.

DROP MANHOLES

Drop manholes shall be constructed only at the locations shown on the plans and specifically designated by the District Engineer. The drop manhole shall be constructed in accordance with detail drawings included with these specifications.

PIPE

General: Pipe of the kind, type, and sizes shown shall be installed at the location indicated on the plans or as directed by the Engineer.

QUALITY

All pipe to be used shall be new, first quality, durable, free from defects and true to size and dimensions.

Extra Strength Concrete Sewer Pipe shall conform to the requirements of the latest edition of the A.S.T.M. Specifications C14 for concrete pipe 4" through 12" and C76 for pipe over 12". Only acid resistant concrete pipe with demonstrated resistance to sulfuric acid shall be used.

Clay pipe shall be extra strength conforming to latest edition of A.S.T.M. C700 with joint conforming to latest edition of C425.

PVC Pipe shall conform to the following standards: ASTM-D-3262-82 PVC Plastic PS 46; ASTM-D-3034-78 PVC Plastic PSM SDR 35; ASTM-D-3262-82 RPM Plastic.

High Density Polyethylene Pipe, to be used primarily in regulated watershed, shall conform to the following: High density PE4710 and cell classification 445574C/E ASTM-D-3350. Pipe and fittings shall be DR 17 conforming to ASTM F714. HDPE pipe may also be used in non-watershed areas of the District with Engineer's approval.

Ductile Iron Pipe, to be used only in regulated watershed, shall conform to ASTM A746, shall utilize mechanical joints conforming to ANSI C111. Pipe and joints shall be lined and coated with Fusion-Bonded Epoxy (ANSI C115) or polyethylene (ANSI C105).

Installation shall be in accordance with ASTM 3839-79.

COMPLIANCE

The Contractor shall furnish Certificate of Compliance to the specifications from the manufacturer on all types of pipe to be used in the project. The District Engineer will reject any pipe not meeting the above specifications.

PIPE LAYING

General For All Pipe

All pipes shall be laid without grade change from structure to structure with bell end up grade. Pipe shall be laid on an unyielding foundation with a uniform bearing under the full length of the barrel of the pipe. Excavation shall be made under bells to permit jointing of the pipe and prevent point-loading at the joints. The pipe shall be carefully laid true to line and grade. All adjustments to line and grade must be made by scraping away or filling in under the body of the pipe, and not by wedging or blocking up the ends of the pipe.

The ends of each pipe shall abut against the next adjacent pipe in such a manner that there will be no unevenness or gaps along the interior of the pipe.

PIPE INSTALLATION

Polyethylene Pipe installation shall be installed with compaction and materials as specified, but also will be installed at a temperature within 10 degrees F of the temperature of the trench or excavation in which it will be installed. We recommend that the pipe be stored in a cool place (shade) or covered with burlap and continuously kept wet. A contractor may have his own ideas for keeping the temperature of the pipe equivalent to the ground temperature as long as it is installed within 10 degrees F of the ground temperature.

a. Responsibility for Material. The Contractor shall be responsible for all material furnished by him and shall replace at his own expense all such material found defective in manufacture. This shall include furnishing all material and labor required for the replacement of installed material discovered defective prior to final acceptance of the work or during the guarantee period.

The Contractor shall be responsible for the safe storage of material intended for the work until it has been incorporated in the completed project.

b. Handling of Pipe. All pipe furnished by the Contractor shall be delivered and distributed at the site by the Contractor. Pipe, fittings, and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall material be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground. In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. The interior of all pipe and other accessories shall be kept free from dirt and foreign matter at all times. Pipe shall be handled so that no coating or lining will be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a manner satisfactory to the Engineer.

c. Laying Pipe. All pipe shall be laid and maintained to the required lines and grades with fittings, tees and manholes at the required locations and without any joint material protruding into the flow area of the pipe. Proper tools and equipment satisfactory to the Engineer shall be used by the Contractor for the safe and convenient prosecution of the work. All pipe and fittings shall be carefully lowered into the trench in such a manner as to prevent damage to pipe materials and protective coatings and linings. Under no circumstances shall materials be dropped or dumped into the trench. Contractor shall not place pressure on pipe or rock the pipe with the excavator to adjust grade.

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being installed. If the pipe laying crew cannot put the pipe into the trench without introducing earth or foreign material into the pipe, the Engineer may require that before lowering the pipe into the trench, a heavy, tightly-woven canvas bag of suitable size be placed over each end and left there until the connection is made to the adjacent pipe. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a plug or other means approved by the Engineer. The Contractor shall clean and remove all sand, gravel, concrete and cement grout that has entered the lines in the process of construction.

The bottom of the trench shall be shaped to fit the bottom quadrant of the pipe, with holes for couplings just large enough to permit their assembly.

d. Survey Line and Grade for Sewer. Survey line and grade control points will be provided by a licensed surveyor at all horizontal alignment changes (manholes) with a minimum 10 foot offset from the centerline alignment. A minimum of one reference point shall be set 50 feet upstream of manhole to provide grade and alignment check. Engineer may require additional reference points as circumstances dictate.

The Contractor shall constantly check line and grade and in the event they do not meet specified limits described hereinafter, the work shall be immediately stopped, the Engineer notified, and the cause remedied before proceeding with the work.

Measurement for grade shall be taken at the pipe invert and not on the top of the pipe because of the permissible wall thickness variations.

e. Sewer Pipe Laying. Laying of sewer pipe shall be accomplished to line and grade in the trench only after it has been de-watered and the foundation and/or bedding has been prepared in accordance with these specifications. Mud, silt, gravel and other foreign materials shall be kept out of the pipe and off the jointing surfaces.

All pipe laid shall be retained in position by mechanical means or otherwise, as approved by the Engineer, so as to maintain alignment and joint closure until sufficient backfill has been

completed to adequately hold the pipe in place. All pipe shall be laid to conform to the prescribed line and grade shown on the plans, with the limits that follow.

Variance from established line and grade shall not be greater than 0.1 feet at any horizontal alignment change. Engineer shall be notified of any variance greater than specified. Engineer will determine remedy which may include adjustment of established vertical alignment or re-laying of pipe. Contractor shall use newly calibrated pipe laser to align pipe. At a minimum, Contractor shall verify grade and calibration of laser, for each pipe run, by checking pipe elevation at first survey control point out of manhole or at 50 feet out. Engineer shall be notified if grade varies more than 5 percent from that specified.

The sewer pipe, unless otherwise approved by the Engineer, shall be laid upgrade from point of connection on the existing sewer or from a designated starting point. The sewer pipe shall be installed with the bell-end forward or upgrade, unless approved otherwise. When pipe laying is not in progress the forward end of the pipe shall be tightly closed with an approved temporary plug.

f. De-watering. De-watering, sufficient to maintain the ground water level at or below the surface of the trench bottom or base of the bedding course, shall be accomplished prior to pipe laying and jointing, if not prior to excavation and placing of the bedding as called for in other sections of the specifications or special provisions. The de-watering operation, however accomplished, shall be carried out so that it does not destroy or weaken the strength of the soil under or alongside the trench. The normal water table shall be restored to its natural level in such a manner as to not disturb the pipe and its foundations. Clay dams to stop ground water from following sewer trench shall be installed in accordance with detail drawings as directed by the Engineer.

g. Bedding. The pipe bedding shall be placed so that the entire length of the pipe will have full bearing. No blocking of any kind shall be used to adjust the pipe to the grade except when used with embedment concrete. Bell holes shall be dug as required to assure uniform support along the pipe barrel.

Three-quarter inch (3/4") minus crushed stone shall be placed and compacted in accordance with requirements listed above in "BACKFILLING" section under "Backfill Material - Pipe Zone".

i. Plugs and Connections. Plugs, for pipe, stubs, or other open ends which are not to be immediately connected, shall be made of an approved material and shall be secured in place with a joint comparable to the main line joint, or stoppers may be of an integrally cast breakout design.

j. Laying and Jointing Pipe and Fittings. All sewer pipe shall be jointed by means of a flexible gasket which shall be fabricated and installed in accordance with the specifications that follow:

1. Concrete Pipe: Flexible rubber gaskets shall conform to ASTM C443 current revision.
2. PVC Pipe: Flexible rubber gaskets shall conform to ASTM F477 current revision.

Pipe handling after the gasket has been affixed shall be carefully controlled to avoid disturbing the gasket and knocking it out of position, or loading it with dirt or other foreign material. Any gaskets so disturbed shall be removed and replaced, cleaned and re-lubricated if required, before the jointing is attempted.

Care should be taken to properly align the pipe before joints are entirely forced home. During insertion of the tongue or spigot, the pipe shall be partially supported by hand, sling, or crane

to minimize unequal lateral pressure on the gasket. Gasket joints tend to creep apart when the end pipe is deflected and straightened, such movement shall be held to a minimum once the joint is home.

Sufficient pressure shall be applied to making the joint to assure that it is home, as described in the installation instructions provided by the pipe manufacturer. Sufficient restraint shall be applied to the line to assure that joints once home are held, until fill material under and alongside the pipe has been sufficiently compacted. At the end of the work day, the last pipe laid shall be blocked in an effective way to prevent creep during "down time".

JOINTING

Sewer Pipe with rubber gasket joints shall be joined in accordance with installation instructions of the manufacturer.

All pipe with rubber gasket joints shall be fitted properly in place and care taken to avoid twisting the gaskets. As each unit of pipe is laid, a sufficient amount of selected backfill materials shall be placed carefully and tamped thoroughly about the lower portion of the pipe-to hold it firmly in position as specified. If adjustments of the position of a length of pipe are required after it has been laid, it shall be removed and re-jointed as for a new pipe.

"T" CONNECTIONS AND SERVICE LINES

"T" connections to extra strength main line pipe with rubber gasket joint shall be made by installing "T" branches in the line. "T" branches to be the same type pipe and the same type joint as the main line, with the "spur" or nose" to be the same type as the pipe to be used for the service line. Wye connections shall not be used on the main line pipe.

Service Lines shall be installed from the main lines to a point no less than 10' inside the property line at the locations as directed by the Engineer. Applicable provisions of these specifications shall apply to the construction of Service Lines.

At the property end of the sewer service line, the contractor shall install a stopper fitted with a rubber gasket. All sewer laterals shall be marked with line guard magnetic tape installed as per the manufacturer's recommendations. In addition, a 2X4 redwood or pressure lumber marker, 8' in length minimum, shall be installed at the end of the sewer lateral. It shall extend from the plugged end of the lateral vertically to above the surface at least three (3) feet. The length of pipe from the main and the length of the marker shall be clearly labeled with permanent ink at the top of the marker.

"Insert-A-Tee" or approved equal may only be used for taps on an existing main line. For all new construction only factory tees shall be used. The maximum diameter "Insert-A-Tee" which may be used on an 8 inch diameter pipe is 4 inches. For 6" diameter taps on 10 inch diameter and smaller mains; a factory tee shall be spliced into the existing pipe using stainless steel banded flexible couplers with stainless steel shear bands conforming to ASTM C 1173 and ASTM A 240.

POINT REPAIR

For defects in new or existing pipeline construction where a point repair must be made by excavation: All sections of these specifications relating to excavation, materials, backfill, compaction, etc. shall apply. The repair shall be made by uncovering the existing pipe and cutting out the damaged section. Only clean, undamaged pipe shall remain. A new piece of pipe shall be

sized to not leave more than a ¼” gap between the old and the new pipe on each end. The new pipe shall have the same interior diameter as the existing pipe and shall meet the pipe material requirements of these specifications. The repair pipe and the existing pipe shall be joined using stainless steel banded flexible couplers with stainless steel shear bands conforming to ASTM C 1173 and ASTM A 240.

TESTING

After the pipe is laid on main lines and service lines; manholes constructed; backfill and compaction completed, and accepted, the contractor shall measure for infiltration and exfiltration.

TESTS

- a. **Light Test.** After the trench has been backfilled and compacted to one foot above the top of the pipe as specified in the Section entitled "TRENCH BACKFILL", a light test shall be made between manholes to check alignment and grade for displacement of pipe. Except for curved alignments shown on the plans, the completed pipe line shall be such that a true circle of light can be seen from one manhole to the next. If alignment or grade is other than specified and displacement of pipe is found, the Contractor shall remedy such defects at his own expense. A light test may also be required after backfill is completed, if backfilling procedures are such as to damage or displace the line.
- b. **TV Inspection.** At the discretion of the District Engineer or Inspector, District personnel may perform a TV inspection of the pipeline. Any defects discovered in this test shall be repaired by the Contractor his cost.
- c. **Leakage Test.** No sewer line will be finally accepted until leakage tests have been made to assure the Engineer that pipe laying and jointing are satisfactory.

Air Test (Preferred). The Contractor shall utilize low pressure air as a means of testing the sewer mains. The test procedure shall be as described below:

Plug both ends of the pipe under test with airtight plugs and brace adequately to prevent slippage and blowout. One plug shall have an inlet tap or other provision for connecting an air hose.

The air supply hose, connected between the air compressor and the plug, shall have a throttling valve, an air bleed valve, and a high pressure shut-off valve for control. The low pressure side of the throttling valve shall have a tee for a monitoring pressure gauge, protected by a gauge cock. This cock is kept closed except when the pressure loss is being timed.

Air shall be applied slowly to the pipeline until the pressure reaches 4.0 psig. The air supply shall then be throttled so that the internal pressure is maintained between 4.0 and 3.5 psig for at least 2 minutes. During this time, the plugs shall be checked with soap solution to detect any plug leakage.

When the pressure reaches exactly 3.5 psig, a stop watch is started and the time recorded for the pressure to drop to 2.5 psig. The minimum time allowed for this pressure drop shall be computed based on an air loss rate of 2.9 cfm or an air loss rate of 0.0030 cfm per square foot

of inner pipe surface under test, whichever rate gives the least time for the pressure drop. Should the time of pressure drop between 3.5 and 2.5 psig be less than the allowable specified time, the Contractor shall make necessary leakage repairs and repeat the air test.

Water Test (Alternate) A water test may be used as an alternate to an air-test if the groundwater is below the top of the pipe.

The test shall be conducted between adjacent manholes. All service laterals, stubs and fittings within the test section must be plugged or capped to withstand the test pressure. Water is added slowly to the upstream manhole allowing air to escape until the water is at the specified level above the crown of the pipe (typically 3 feet). After absorption into the pipe and manhole has stabilized, the water in the upstream manhole is brought to the test level. At the end of the test period (minimum 1 hour), the drop in water elevation is measured and the water loss and leakage rate are calculated. The allowable leakage from the test section is 200 gallons per inch of diameter per mile of pipe per day when the average head is 3 feet. If the average is greater than 3 feet, the allowable leakage rate is increased by the ratio of the square root of the actual head to the ratio of the square root of the assumed base head, 3 feet.

Manhole joints, at the discretion of the District Engineer or Inspector, shall be checked for leakage by means of vacuum testing. In regulated watershed, all manholes shall pass a vacuum test. In non-watershed areas a water test may be substituted. A water loss no greater than 0.1 gallons per hour per foot of diameter per foot of head shall be allowed.