

SECTION 02955

CURED-IN-PLACE PIPE (CIPP) LINING OF SEWERS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. *Restoration of existing sanitary and/or combined sanitary/storm sewers* by installation of a resin impregnated flexible felt tube into the existing sewer line utilizing a vertical inversion standpipe and hydrostatic head and curing by circulating hot water to produce a hard, impermeable pipe.

1.2 RELATED SECTIONS

- A. Section 12 Bituminous Plant Mix Pavements
- B. Section 98 Slope Protection and Erosion Control
- C. Section 2560 Manholes
- D. Section 02753 Sewer Flow Control
- E. Section 15064 Polyvinyl Chloride (PVC) Sewer and Service Pipe
- F. Section 15562 Point Repairs of Sewers

1.3 REFERENCES

A. *Codes, Specifications, and Standards*

1. Codes, specifications, and standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise shown or specified.
2. All pipe materials incorporated in the project shall have been approved by the Tennessee Department of Environment and Conservation for the application to be used, prior to submittal of bids.

B. American Society for Testing and Materials (ASTM) Standards:

1. D 638 Test Method for Tensile Properties of Plastics
 - a. Tensile Strength: 3000 psi minimum
2. D 790 Test Methods for Flexural Properties of Un-reinforced and Reinforced Plastics and Electrical Insulating Materials
 - a. Flexural Strength: 4,500 psi minimum
 - b. Flexural Modulus: 300,000 psi minimum
3. D 2122 Determining Dimensions of Thermoplastic Pipe and Fittings
4. D 2837 Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
5. F 1216 Rehabilitation of Existing Pipelines and Conduits by Inversion and Curing of a Resin Impregnated Tube

1.4 PRODUCT, MANUFACTURER/INSTALLER QUALIFICATION REQUIREMENTS

A. *Sewer products* are intended to have a 50-year design life. In order to minimize the Owner's risk, only proven products with substantial successful long-term track records will be allowed. All trenchless rehabilitation products and installers shall meet the following criteria:

1. *Products and Installers*

- a. A minimum of 500,000 linear feet or 2,000 manhole-to-manhole line sections of successful wastewater collection system installations in the U.S. must be documented to the satisfaction of the Owner for the proposed liner to be utilized.
- b. The installer must satisfy all insurance, financial, and bonding requirements of the Owner, and must have had at least three (3) years active experience in commercial installation. In addition, the installer must have successfully installed at least 50,000 feet of the product bid in wastewater collection systems. Documentation of these minimum installations must be submitted with the Bid.
- c. Sewer rehabilitation products must provide third party test results supporting the structural performance (short-term and long-term) of the product and such data shall be satisfactory to the Owner. Test samples shall be prepared so as to simulate installation methods and trauma of the product. No product will be approved without independent third party testing verification.

2. *Documentation* for products and installers shall be submitted with the Contractor's bid.

B. *Qualifying Superintendent*

1. The Contractor is required to have at least one qualifying superintendent on the job during construction activities. The qualifying superintendent and crew that will be undertaking the work must meet the experience requirements.
2. The qualified superintendent must have a minimum of five years (career) cured-in-place pipe supervisory field experience and have completed at least three projects containing a total of 10,000 linear feet of 18-inch or larger cured-in-place pipe.
3. Experience of the qualifying superintendent shall be submitted with the bid. All required information, including the project name, owner, contact person, telephone number, diameter and length of pipe, and date completed shall be furnished for each project completed.

1.5 SUBMITTALS

A. *Information to be submitted with Bid* shall include the following:

1. Approval letter from Tennessee Department of Environment and Conservation per Paragraph 1.3 A.2 of these Specifications.
 2. All product, manufacturer/installer qualification information as listed in Paragraph 1.4.
- B. *Submit the following* in accordance with Section 01300, Submittals:
1. Manufacturer's Certificate of Compliance certifying compliance with the applicable specifications and standards.
 2. Certified copies of test reports of factory tests required by the applicable standards and this Section.
 3. Manufacturer's installation instructions and procedures.
 4. Contractor's procedures and materials for service renewal including time and duration of sewer service unavailability.
 5. Liner pipe sizing data.
 6. Sampling procedures and locations for obtaining representative samples of the finished liner.
- C. *A final certificate of compliance* with this specification shall be provided by the manufacturer for all lining material furnished. Tests for compliance by an independent laboratory shall be made according to the applicable ASTM specification and the manufacturer's quality control program.
- D. *Furnish an extended warranty for liner materials* from the Contractor and liner manufacturer for a total of five years from date of final completion. The extended written warranty shall read as noted below and shall be signed by an officer of the installing contractor and an officer of the liner material manufacturer. Each signature shall be notarized.
1. All liner installation shall be warranted to be free from defects in materials and workmanship for a period of five years from final acceptance by the Owner. Should a defect occur during this five-year period that is attributable to the liner installation or materials, the defect shall be repaired at no additional cost to the Owner within one month of written notification to the Contractor.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. *The Contractor shall be responsible* for the delivery, storage, and handling of products. No products shall be shipped to the job site without the approval of the Engineer.
- B. *Keep products safe from damage.* Promptly remove damaged products from the job site. Replace damaged products with undamaged products.

PART 2 - PRODUCTS

2.1 GENERAL

- A. *The finished pipe liner* in place shall be fabricated from materials which when complete are chemically resistant to and will withstand internal exposure to domestic sewage having a pH range of 5 to 11 and temperatures up to 150°F.
- B. *Take all necessary field measurements* of the existing pipe (including diameter, ovality and length) prior to manufacturing liners.
- C. *The minimum length* shall be that deemed necessary by the Contractor to effectively span the distance from the inlet to the outlet of the respective manholes unless otherwise specified. The Contractor shall verify the lengths in the field before manufacturing.
- D. *The liner thickness* shall be sized for a minimum hydrostatic and earth load of 8.0 feet. The earth load and hydrostatic load shall be increased to the manhole depth for bury depths in excess of 8.0 feet unless otherwise noted as shown on the Drawings.
- E. *The liner shall be structurally designed* for a minimum service life of 50 years; fully deteriorated host pipe/direct bury condition; prism loading; 120 lb/cf soil; factor of safety of 2.0; 2% ovality factor; maximum deflection 5%; soil modulus of 1000 psi; lining enhancement factor maximum 5, H-20 live loading, applicable long term modulus reduction factor; and groundwater correction factor of -27.4% applied to the hydrostatic load only.
- F. *The liner shall be furnished to* the following minimum thickness:

Pipe Diameter (inch)	Depth of Sewer Invert (feet)	Cured-In-Place ASTM F 1216 ¹ Min. Thickness (mm)
6 ²	0 to 16	3.0
8	0 to 8	6.0
8	8.1 to 12	6.0
8	12.1 to 16	6.0
8	16.1 to 20	6.0
10	0 to 8	6.0
10	8.1 to 12	6.0
10	12.1 to 16	6.0
10	16.1 to 20	6.0
12	0 to 8	6.0
12	8.1 to 12	6.0
12	12.1 to 16	7.5
12	16.1 to 20	7.5
15	0 to 8	7.5
15	8.1 to 12	7.5
15	12.1 to 16	9.0
15	16.1 to 20	9.0

Pipe Diameter (inch)	Depth of Sewer Invert (feet)	Cured-In-Place ASTM F 1216 ¹ Min. Thickness (mm)
18	0 to 8	7.5
18	8 to 12	9.0
18	12 to 16	10.5
18	16 to 20	12.0

¹Based upon initial CIP modulus of 250,000 psi with 0.50 creep reduction factor.

²For services only.

2.2 CURED-IN-PLACE LINER

- A. *All cured-in-place lining products* shall comply with ASTM F 1216 or intent thereof as determined by the Engineer, minimum finished liner thickness 6mm (except for services).
- B. *The flexible tube* shall be fabricated to a size that when installed will neatly fit (minimum 99.75%) the internal circumference of the existing sanitary sewer lines (including services). Allowance shall be made for circumferential stretching during insertion so that the final cured product is snug against the wall of the host pipe.
- C. *Unless otherwise specified*, the Contractor shall furnish an epoxy vinyl ester resin and catalyst system compatible with the reconstruction inversion process that provides cured physical strengths specified herein.

PART 3 - EXECUTION

3.1 PREPARATION

- A. *The following procedures* shall be adhered to unless otherwise approved by the Owner's representative.
 - 1. The Contractor shall carry out his operations in strict accordance with all OSHA, TOSHA and manufacturer's safety requirements. Particular attention is drawn to those safety requirements involving entering confined spaces.
 - 2. Sewers shall be cleaned of all debris, roots, and other materials that would block proper inversion of the cured-in-place pipe. Inspection of the sewer pipe shall be performed by the Contractor's experienced personnel trained in location breaks and obstacles by CCTV inspection. Utilizing a color video inspection system with data recording capabilities, the entire pipe section to be lined shall be recorded on VHS tape and two (2) copies produced. The video recording shall be done on a standard play@ (SP) speed. The interior of the pipe shall be carefully inspected to determine the location of any conditions, which may prevent the proper installation of the CIPP, and it shall be noted so that these conditions can be corrected after final review and approval of the Engineer. A videotape and suitable log (2 copies each) shall be submitted to the Engineer.
 - a. Sewer service connections shall also be TV inspected, which shall identify all service connections, openings, and condition of service connections to main.

- b. Utilizing high-pressure jet cleaning equipment, several passes are completed to assure that all debris is removed from the pipe. If roots are present, root cutters or mechanical brushes are attached to the jet nozzle and sent through the line to remove all root intrusions. Should equipment be needed to remove debris or heavy roots other than the high-pressure jetting apparatus used with the root cutters or mechanical brushes, additional payment may be authorized by the Engineer.
 - c. Protruding taps or service connections which obstruct or hinder the insertion of the liner shall be removed by remote cutter. Cost of removing protruding pipe shall be included in the unit price bid for CIPP.
 3. Identification and pre-measurement of lateral connections - a 360-degree Pan-and-Tilt view camera shall be used to inspect the pipe traveling upstream. At each connection the operator will stop and turn the camera lens toward the lateral thereby inspecting the first 8 to 12 inches of the lateral connection. If there remains a doubt as to whether or not the connection is live, additional dye and flush tests shall be performed. It will be the responsibility of the Owner's representatives to review this process live or review the video tapes to verify and approve which lateral connections are to be reinstated. The Contractor shall be responsible for determining if connection is active or inactive. For each existing service connection determined by the Contractor to be active, the Contractor shall determine the condition of the service connection to the main, make his recommendation for lateral connection repair, and record both items in his log. All lateral locations will be measured from the back wall (opposing wall) of the basis manhole, typically the downstream manhole.
 4. The Contractor shall provide for the flow of sewage around the section or sections of pipe designated for lining. All costs for bypass pumping and flow control shall be included in the unit price bid for the various sizes of CIPP. (See Section 02753, Sewer Flow Control.)
 5. The Contractor shall clear the line of obstructions such as solids, dropped joints, protruding service connections or collapsed pipe that will prevent the insertion of the liner pipe, as noted on the Drawings and the pre-construction television logs of the sewers. If inspection reveals an obstruction that cannot be removed by conventional sewer cleaning equipment, the Contractor shall make a point repair excavation to uncover and remove or repair the obstruction prior to lining. Pre-lining point repairs will be paid for under the Point Repair Allowance in the Bid Schedule. The Engineer shall approve all new point repair areas prior to the work being performed. Each point repaired shall be negotiated on a case-by-case basis.
 6. Ground water temperatures and ambient temperatures shall not be excessive for the product installation procedures.
- B. *Where practicable, liners can be installed in continuous runs* through manholes where there are two or more continuous sewer segments, especially to connect several short segments with a continuous lining.

3.2 INSTALLATION

A. *General*

1. Installation of the CIPP liner tube shall be in accordance with F1216. Alternative methods of liner insertion, pressurization, and processing may be used for products and processes approved by the ASTM installation procedures as determined by the Engineer. Installation shall be in accordance with manufacturer's recommendations which shall be available for verification by the inspector.
2. The temperature of water discharged to the sewer system from processing liners shall not exceed 150°F maximum or the level allowed by state or local standards.
3. After the liner has been installed, all active, existing services shall be temporarily reinstated to 95% of the original opening. This shall be done without excavation in pavement areas, and in the case of non-man-entry pipes, from the interior of the pipeline by means of a 360-degree television camera and a cutting device that reestablishes the service connection. When a remote cutting device is used and a cleanout is available, then a mini-camera down the service shall also be used to assist the operator in cutting or trimming.
4. At all points where the liner pipe has been excavated and exposed (e.g., in access shafts, service connections, etc.), prepare for the placement of a crushed stone backfill by removing all debris and creating a void below and around the pipe. The width of this void shall not exceed $\frac{4}{3}$ of the liner's outside diameter plus 15 inches, or $\frac{4}{3}$ of the service line's outside diameter plus 15 inches. Use a minimum of 6 inches of $\frac{1}{2}$ to $\frac{3}{4}$ inch crushed stone to provide bedding for the liner and service line. Then place a backfill of crushed stone to a height of 6 inches above the liner and service line. Provide the rest of the backfill from 6 inches above the pipe to grade. If access shaft is in paved area, the entire backfill shall be crushed stone.

B. *Cured-in-Place Liner*

1. The Contractor shall designate a location where the reconstruction tube will be vacuum impregnated prior to installation. The Contractor shall allow the Owner to inspect the materials and "wet out" procedure. A catalyst system compatible with the resin and reconstruction tube shall be used. Sufficient excess resin will be provided to ensure a mechanical bond with the host pipe after curing.
2. The wet out reconstruction tube shall be inserted through an existing manhole or other approved access by means of an inversion process and the application of a hydrostatic head sufficient to fully extend it to the next designated manhole or termination point. The reconstruction tube shall be inserted into the vertical inversion standpipe with the impermeable plastic membrane side out. At the lower end of the inversion standpipe, the reconstruction tube shall be turned inside out and attached to the standpipe so that a leak-proof seal is created. The inversion head will be adjusted to be of sufficient height to cause the impregnated tube to invert from manhole to manhole and hold the tube tight to the pipe wall, produce dimples at side connections and flared ends at the manholes. The use of a lubricant is recommended. Care shall be taken during the elevated curing temperature so as not to overstress the felt fiber.

3. After inversion is completed the Contractor shall supply a suitable heat source and water recirculation equipment. The equipment shall be capable of delivering hot water throughout the section by means of a pre-strung hose to uniformly raise the water temperature above the temperature required to effect a cure of the resin. This temperature shall be determined by the resin/catalyst system employed.
4. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing water supply. Another such gauge shall be placed between the impregnated reconstruction tube and the pipe invert at the remote manhole to determine the temperatures during cure. Water temperature in the line during the cure period shall be recommended by the resin manufacturer.
5. Initial cure shall be deemed to be completed when inspection of the exposed portions of cured pipe appear to be hard and sound and the remote temperature sensor indicates that the temperature is of a magnitude to realize an exotherm. The cure period shall be of a duration recommended by the resin manufacturer, as modified for the cured-in-place inversion process, during which time the recirculation of the water and cycling of the heat exchanger to maintain the temperature continues.
6. The Contractor shall cool the hardened pipe to a temperature below 100°F before relieving the static head in the inversion standpipe. Cool-down may be accomplished by the introduction of cool water into the inversion standpipe to replace water being drained from a small hole made in the downstream end discharging to the sewer. Care shall be taken in the release of the static head so that a vacuum will not be developed that could damage the newly installed pipe.

C. *Sealing and Benches in Manholes*

1. The CIPP shall make a tight fitting seal with the existing pipe(s) in the manhole. Activated oakum band soaked in Scotch Seal 5600 or equal, $\frac{1}{2}$ -inch-diameter, shall be applied circumferentially near the annular space touching the end of the existing pipe and encased with a cementitious mortar. Top half of the pipe shall be neatly cut off and not broken or sheared off at least 4 inches away from the walls. The channel in the manhole shall be a smooth continuation of the pipe(s) and shall be merged with other lines or channel, if any. Channel cross-section shall be U-shaped with a minimum height of $\frac{1}{2}$ pipe diameter to $\frac{3}{4}$ of the pipe diameter for 15 inches and larger. The side of the channels shall be built up with mortar/concrete to provide benches at a maximum of 1 in 12 pitch toward the channel.
2. Cost for sealing and benches in manhole work shall be included in the unit price bid for CIPP.
3. CIPP and the existing pipe in the manhole must be sealed as above before proceeding on to the next manhole section. All manholes shall be individually inspected for liner cut-offs, benches and sealing works.

3.3 POST INSTALLATION

- A. *Where liners of any type are installed* in two or more continuous manhole segments, the liner invert through the intermediate manholes shall be left intact. Final finishing of the installation in those intermediate manholes shall require removal of the top of the

exposed liner and neat trimming of the liner edge where it touches the lip of the manhole bench.

- B. *Portions of any piece of liner material removed* during installation shall be available for inspection and retention by the Owner or the Engineer.
- C. *Reinstate openings* for all drop assemblies after relining mainline sewer. The vertical pipe at a minimum of all outside drop assemblies shall be lined. Drop assemblies inside of manholes are not required to be relined, unless directed by the Engineer.
- D. *Each line segment* lined shall be television inspected as soon as practical after processing to assure complete curing or reforming. Segments not fully conforming to these Specifications must be immediately brought to the Engineer's attention with a proposed method of correction.
- E. *Service Reconnections*. The exact location and number of service connections shall be determined from TV tapes and/or in the field. It shall be the Contractor's responsibility to accurately field locate all existing service connections and determine whether in service or not.
 - 1. The Contractor shall reconnect only active service connections to the liner pipe unless directed otherwise by the Engineer.
 - 2. The Contractor shall be responsible for restoring/correcting without any delay all missed or faulty reconnections, as well as for any damage caused to property owners for not reconnecting all services soon enough or for not giving notice to the owners.
 - 3. All active service connections shall be connected by Remote TV Controlled Cutting Device method unless existing conditions do not allow. Should remote cutting not be feasible, this should be brought to the attention of the Engineer immediately.
 - 4. Size of service connections shall match existing except that the minimum size shall be 4 inches unless otherwise directed by Engineer.
 - 5. Service connections shall be done by TV Controlled Remote Cutting Device. They shall be made by experienced operators so that no blind attempts or holes are made in the liner pipe. Location shall be verified carefully with earlier tapes for accuracy especially where dimples are not defined or clearly ascertained. The Engineer reserves the right to require service connection by excavation if the quality, workmanship and approval rating for remote cut is not satisfactory.
 - 6. The remote cut shall be smooth and circular in nature as seen by a 360-degree TV camera. The hole shall be a maximum of 100 percent and a minimum of 90 percent of the service pipe diameter. It shall be properly aligned and be concentric to the existing connection. Excess, wrong holes or trial cuts shall not be made and must be repaired at no cost to the Owner to the full satisfaction of the Engineer. Defective connections shall be repaired to the Engineer's satisfaction at no extra cost. If a remote cut connection is to be rectified or replaced with connection by excavation, no additional payment will be made to the Contractor.
 - 7. Payment for service reconnections shall be in accordance with the unit prices in the Bid Schedule.

3.4 TESTING AND INSPECTION

- A. *After completing lining and service renewals*, every liner shall be television inspected with a 360-degree integral lighthouse camera as soon as practical to verify proper installation. The rate of travel shall not exceed 30 feet per minute and shall be recorded on a standard play@ (SP) speed. At each service, the camera shall come to a complete stop and the service shall be panned. The footage meter count shall be clearly visible. A log for each segment shall be provided indicating the service location and actual address or parcel of each service renewed. A video inspection VHS tape and log (2 copies of both) of the completed line segments shall be submitted to the Engineer by the Contractor.
- B. *After installation, perform a test* on the sewer line to determine if it is watertight. The renewed line shall be tested prior to reinstalling services. Furnish all necessary equipment to conduct the test. Acceptable methods include a low-pressure air test or a hydrostatic test.

1. Air Test

- a. Pressurize the test section to 4.0 psi and hold above 3.5 psi for not less than 2 minutes. Add air if necessary to keep the pressure above 3.5 psi. At the end of this 2-minute stabilization period, note the pressure (must be 3.5 psi minimum) and begin the timed period. If the pressure drops 0.5 psi in less than the time given in the table below, the section of pipe shall have failed the test.
- b. When the prevailing groundwater is above the sewer being tested, test pressure shall be increased 0.43 psi for each foot that the water table is above the invert of the sewer.

Sewer Size Inches)	Minimum Test Time/100 ft. (Seconds)
8	72
10	90
12	108
15	126
18	144
21	180
24	216
27	252
30	288

- c. If the time for the pressure to drop 0.5 psi is 125 percent or less of the time given in the table, the line shall immediately be repressurized to 3.5 psi and the test repeated.
- d. Services reinstated before the air test shall be considered part of the pipe to which they are connected and no adjustment of test time shall be allowed.
- e. The pressure gauge used shall be supplied by the Contractor and have minimum divisions of 0.10 psi and be oil filled.

2. Hydrostatic Test: The test may be conducted using the existing hydrostatic head provided by the inversion standpipe. The test time shall be provided by the inversion standpipe. The test time shall be thirty minutes during which makeup water shall be added to the standpipe to keep the water level constant. The volume of water added to the inversion standpipe shall not exceed the following:

Size of Sewer (Inches)	Gallons per 30 Minutes Per 100 feet of Sewer
6	0.48
8	0.63
10	0.79
12	0.94
15	1.19
18	1.40
21	1.66

C. *The Contractor shall have an independent testing laboratory analyze finished liner samples taken from manhole cutoffs, service coupons, etc. Samples shall be furnished to the Engineer within 24 hours (or less) after installation for inspection prior to sending to testing laboratory. Contractor shall be responsible for shipping and handling costs associated with sending samples to be tested to the independent testing laboratory. Cost of testing shall be paid at the unit price noted in the Bid Schedule.*

1. One sample shall be taken of the first segment installed.
2. A minimum of two samples shall be taken for each 3,000 LF of liner material installed or for each manufacturing lot, if less.
3. A minimum of two samples per project shall be taken for each type and size of liner furnished.
4. Tests in accordance with ASTM standards for tensile properties, flexural modulus and wall thickness shall be conducted.
5. The Contractor shall determine sampling location and procedures to ensure representative samples are obtained from the finished liner, subject to approval by the Engineer.
6. The Contractor shall furnish removable sizing sleeves to collect liner samples which accurately replicate the host pipe diameter.
7. Test results shall be sent directly to the Engineer from the testing laboratory.

3.5 ACCEPTANCE

- A. *It is the intent of these Specifications that the completed liner with all appurtenances shall be essentially equivalent in final quality and appearance to new sewer installation.*
- B. *The finished liner shall be continuous over the entire segment between manholes and homogenous throughout.*

- C. *The finished liner* shall be fully rounded and as free as commercially practicable from visible defects, including but not limited to damage, deflection, holes, delamination, ridges, cracks, uncured resin, foreign inclusions or other objectionable defects.
- D. *There shall be no visible infiltration* through the liner, around the liner at manhole connections, at service connections, in services, or in cleanouts. Contractor shall be required to repair any visible leaks regardless of the results of an air test.
- E. *Where a defect in the liner* requires removal of a section of the liner, in the Engineer's opinion, the Contractor shall make all repairs as required by the Engineer and shall install a segmental liner, compatible with the liner, to accomplish a continuous finished liner. No separate payment will be made for such defect repair nor for the post-repair segmental liner.

3.6 CLEAN-UP AND RESTORATION

- A. *The Contractor* shall not allow the site of the work to become littered with trash and waste material, but shall maintain the site in a neat and orderly condition throughout the construction period.
- B. *On or before completion*, the Contractor shall clean and remove from the site of the work all surplus and discarded materials, temporary structures, stumps and portions of trees, and debris of any kind. He shall leave the site of work in a neat and orderly condition, similar or equal to that prior to construction.
- C. *Upon completion of cleanup and backfill operations* and before final acceptance by the Owner, the Contractor shall replace and/or restore any trees, shrubbery, fences, driveways, sidewalks, culverts, bridges, houses or buildings and all water, sewer, gas, telephone and electrical lines thereto, and all other private and public property along or adjacent to the work that may have been disturbed by construction operations.
- D. *All private and public property* along or adjacent to the work disturbed by construction operations shall be restored to a condition similar or equal to that existing prior to construction.
- E. *Before final acceptance by the Owner*, the Contractor shall replace and/or restore any water, sewer, drain, and gas lines and appurtenances; electrical, telephone, conduits and wires, both underground and aboveground, and appurtenances; traffic signals, fire and police alarm systems and appurtenances; sidewalks, curbs, gutter, drainage ditches and pavements and all other public utility facilities and appurtenances along or adjacent to the work that may have been disturbed by construction operations.
- F. *Any repairs* required because of unsatisfactory backfill operations shall be at the expense of the Contractor.

3.7 PATENTS

- A. *The Contractor shall warrant* and save harmless the Owner and Engineer against all claims for patent infringement and any loss resulting therefrom.

3.8 PRIVATE SERVICE LINE SHUTDOWN

- A. *When it is necessary to shutdown a private sewer service line while work is in progress and before the service lines are reconnected, the residents and/or businesses shall be notified by the Contractor at least one week prior to the shutdown. No sewer service is to remain shutdown for more than a period of eight hours unless the Contractor provides substitute services for the residents. Commercial sewer services shall be maintained at all times the business is open. No sewage from the services or main line shall be allowed to be discharged on the ground or in waterways. Holding pits or tanks are not allowed unless permitted by TDEC.*
- B. *Contractor shall assume all responsibility for notification to and coordination with all collection system customers connected to the sewer to be rehabilitated whose building sewer laterals will be out of service during the cured-in-place pipe installation, curing and restoration processes. In addition to the one-week written notice, notification shall also be in writing via door hanger, door flier, or U.S. mail given 24 hours in advance of loss of service (excluding weekends and holidays). Notification shall clearly state the purpose of the work, shall advise all affected customers against water usage until the sewer line is placed back in service, and shall clearly state the potential consequences of use of residential wastewater generating facilities during the time when the building sewer service will be out of service (i.e. sewer back-up). The notice shall include a local 24-hour contact telephone number for residents to call if they have questions regarding the work.*

3.9 PROSECUTION OF WORK

- A. *The Contractor is cautioned that only those sewer services that are live and active shall be repaired or reinstated after the sewer main has been lined or replaced due to defects. The Contractor shall note that not all sewer line segments have been televised in their entirety due to obstructions blocking further entry, etc. These obstructions shall be cleared to allow television viewing of the entire segment length before lining is commenced. The number of service connections on some sewer segments may exceed the number of buildings actually served. It is the Contractor's responsibility to determine through dye testing, or other acceptable methods, the services that are live and require reinstatement prior to commencing lining of the sewer main. Services that are confirmed to be inactive shall not be reconnected. Services that are inactive, but reinstated, shall be plugged at the Contractor's expense. Inactive services to vacant parcels shall not be renewed, unless preapproved by the Engineer.*

PART 4 - PAYMENT

4.1 PAYMENT

- A. *Payment for the work included in this section shall be in accordance with the unit prices established in the Bid Schedule for the quantity of work performed. Progress payments shall be made monthly based upon the work performed during that period.*

END OF SECTION