

**FINAL SPECIAL PROVISIONS FOR
IMPROVE OUR TULSA 2
AREAWIDE SEWER REHABILITATION
FY 2022**

**PROJECT NO. ES 2020-02
ENGINEERING SERVICES DEPARTMENT
CITY OF TULSA, OKLAHOMA**

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TECHNICAL REQUIREMENTS AND SPECIFICATIONS

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SP-1 TECHNICAL REQUIREMENTS AND SPECIFICATIONS
ABANDONMENT OF SEWERS AND STRUCTURES

PART 1 ABANDONMENT OF SEWERS AND STRUCTURES

1.1 GENERAL

- A. Sewers and manholes to be abandoned shall be securely blocked at any points of intake or discharge with a bulkhead or preformed plug and shall be completely filled with clean sand, cellular concrete or flowable fill. The proposed method for filling and blocking the sewer shall be submitted for approval to the Engineer.

1.2 FRAMES AND COVERS

- A. Frames and covers from any structures scheduled for abandonment shall be returned to the City at the specified location.
- B. At a minimum all structures shall be completely removed to a point three (3) feet below the final grade, or the depth noted on the drawings. Sand or flowable fill shall be used to fill the structure.
- C. When located in paved areas, the backfill above the filled structure shall be completed using compacted granular fill.

1.3 MEASUREMENT AND PAYMENT

- A. Payment for plugging and abandoning sanitary sewer lines shall be in accordance with City of Tulsa Standard Specification Paragraph 404.4.1.

END OF SECTION

SP-2 TECHNICAL REQUIREMENTS AND SPECIFICATIONS

PIPE TRANSITIONS

PART 1 GENERAL

- 1.1 Each reach of sewer shall be constructed using the same type of pipe between the structures at each end of the reach. Transitions between pipe types may only be made at the manholes.

END OF SECTION

SP-3 TECHNICAL REQUIREMENTS AND SPECIFICATIONS

DOWEL BARS

PART 1 GENERAL

- 1.1 This work shall consist of the supplying and installation of dowel bars to tie new concrete pavements to existing pavements at all transverse and longitudinal joints or where established as necessary by the Engineer. Smooth dowel bars shall be used on transverse joints and deformed dowel bars on longitudinal joints.

Dowels shall meet the requirements of AASHTO M-31 Grade 40. Dowels shall be $\frac{3}{4}$ " (inch) in diameter with a minimum length of 18" (inches). Spacing of the dowel bars to be at 15" (inches) on center.

Dowel bars shall have a shop or field coat of red lead or zinc chromate for the full length of the bar and shall have a field coat of M-70 on the free end after placement in the existing pavement.

Engineer shall approve method of installation of dowel in existing pavement. The dowel shall be placed 9" ($\frac{1}{4}$ " tolerance) into the existing pavement and tightly secured to prevent movement.

Dowel bars should not be placed in dirty, unprepared holes. Therefore, once holes are drilled, compressed air should be employed to remove dust and debris. After cleaning and prior to dowel insertion, an application of epoxy should be made at the back of hole. It is important that the epoxy is placed at the back of hole so that the material is forced downward during insertion. This will ensure that the anchoring material covers the dowel over the entire embedment-length. Another tip to ensure that the epoxy completely surrounds the dowel is to twist the dowel a minimum of one full turn during insertion.

A retention disk fabricated from plastic is also required to hold the epoxy in the hole during dowel insertion. The disk is extremely effective in ensuring that the dowel is completely surrounded with the anchoring epoxy, because the material cannot escape through the front of the hole. When used, the disk will help encase the dowel and prevent the development of looseness and socketing.

Placement of the dowel bars as provided above will not be measured for payment separately, but shall be included in the pay item for "Remove and Replace" concrete pay items.

END OF SECTION

SP-4 TECHNICAL REQUIREMENTS AND SPECIFICATIONS

OWNER ALLOWANCE

PART 1 GENERAL

1. Work covered by allowance:
 - A. Allowances have been provided in the contract for various work not identified in other bid items. Descriptions and dollar amounts are identified in Form of Bid.
 - B. The allowance shall be used for cost of materials, labor installation and overhead and profit for additional work that is not identified in the Construction Documents/Plans, and not included in the base bid lump sum.
 - C. The allowance shall be used only at the discretion of the City of Tulsa. Any allowance balance remaining at the completion of the project will be credited back to the City of Tulsa on the final Application for Payment submitted by the contractor.
 - D. The Contractor shall provide, to the City of Tulsa Representative, a written request for the use of the allowance, with a schedule of values, and all associated backup information, including any time extension required to perform the work.
 - E. Contractor shall proceed with work included in the allowance only after receiving a written order, from the City of Tulsa Representative, authorizing such work. Proceeding with work in the allowance without a written order from the City of Tulsa Representative will be at the Contractor's cost.

END OF SECTION

SP-5 TECHNICAL REQUIREMENTS AND SPECIFICATIONS

SANITARY SEWER CONSTRUCTION FORM

PART 1 GENERAL

1. Contractor shall complete one (1) Sanitary Sewer Construction Form for each sanitary sewer line that has been rehabilitated or constructed on this project. Sample forms may be obtained from City of Tulsa Sewer Operations.
2. Contractor shall submit forms for all sanitary sewer lines completed with each monthly payment request.
3. Sanitary Sewer Construction Form shall contain at minimum the follow information.
 - a. Project number
 - b. Project name
 - c. Contractor name
 - d. Pay Application number
 - e. Upstream manhole number
 - f. Downstream manhole number
 - g. Sub-centimeter survey coordinates of upstream and downstream manhole
 - h. Footage of pipe measured from manhole to manhole
 - i. Type of rehabilitation or construction method
 - j. New pipe size and material
 - k. Date completed
 - l. Service connection information as follows for each connection
 - i. Property address served
 - ii. Measurement from downstream manhole
 - iii. Clock position of connection
 - iv. Active service or capped for future service
 - v. Type of service connection at main
 - vi. Footage of service pipe installed by contractor from sewer main
 - vii. Size and material of service pipe
 - viii. Type of coupling utilized to connect to customer's existing service pipe
 - ix. Size and material of customer's existing service pipe
 - x. Depth of contractor's connection to customer's existing service pipe
 - xi. Sub-centimeter survey coordinates of property/easement line cleanout (if constructed)
4. No additional payment will be made for completion of Sanitary Sewer Construction Form.

END OF SECTION

SP-6 TECHNICAL REQUIREMENTS AND SPECIFICATIONS
CURED-IN-PLACE PIPE (CIPP)

(This Special Provision replaces Part 410 in the City of Tulsa Standard Specifications and Standard Details)

410.1 DESCRIPTION

410.1.1 It is the intent of this specification to provide for the reconstruction of existing sewer lines by forming a new pipe within an existing deteriorated pipe, which has generally maintained its original shape. The cured-in-place pipe (CIPP) shall provide flow capacity equal to or greater than 100% of the original pipe's flow capacity when considering age and condition. The process is defined as the reconstruction of sewer lines by installation of a thermosetting resin impregnated flexible felt fiber tube coated on one side with polyethylene or polyurethane, which is installed into the existing sewer line utilizing a water column or cooled pressurized air. Curing is accomplished by circulating hot water or steam throughout the length of the inverted tube to cure the thermosetting resin into a hard, impermeable pipe with the polyethylene/polyurethane coating on the interior surface of the new pipe. The pipe shall extend the full length of the original pipe and shall provide a structurally sound, jointless, close fitting and corrosion resistant cured-in-place pipe. A Pulled-In-Place method of installation shall be allowed for pipe diameter sizes 6-inches, 8-inches, 10-inches, and 12-inches.

410.2 REFERENCE SPECIFICATIONS

- 410.2.1 Installation and material tests of cured-in-place pipe (CIPP) must meet the minimum requirements demonstrated in the following ASTM standards:
- 410.2.2 ASTM F-1743 Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-In-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)
- 410.2.3 ASTM F-1216 Standard Practice for the Installation of Cured-in-place Pipe by Inversion Lining
- 410.2.4 ASTM D-638 Test Method for Tensile Properties of Plastics (for pressure pipes only)

Tensile Stress 3,000 psi
ASTM D-790 Test Method of Flexural Properties of Plastics

Flexural Stress	4,500 psi
Flexural Modulus	250,000 psi

410.2.5 Terminology

- 1) Cured-in-place pipe (CIPP) - a hollow cylinder containing a nonwoven or a woven material, or a combination of nonwoven and woven material impregnated with a cured thermosetting resin. Plastic coatings may be included. This pipe is formed within an existing pipe. Therefore, it takes the shape of and fits tightly to the existing pipe.
- 2) Inversion – the process of turning the resin-impregnated tube inside out by the use of water or cooled pressurized air.
- 3) Lift – a portion of the CIPP that has cured in a position such that it has pulled away from the existing pipe wall.
- 4) CIPP liner colors shall be white or very light.

410.3 SUBMITTALS

- 410.3.1 Product Data: Resin, tube material, qualification testing results for laminate sample, resin enhancer, bond enhancer, certification of applicability of resin; sealant/caulking material, resin curing schedule showing time and temperature for each reach, manufacturer’s recommended installation pressures, minimum and maximum reach, and manufacturer’s wetout report.
- 410.3.2 Design Information: Wall thickness design calculations for each pipe section.
- 410.3.3 Inspection Information: Video recordings (DVD) of pre- and post-insertion inspections and full-length temperature sensing report.
- 410.3.4 Qualifications: Documentation for experience of lining manufacturer and installer.
- 410.3.5 Certificate: Affidavit for flat plate samples
- 410.3.6 Public Relations: Notification Fliers.

410.4 QUALIFICATIONS

- 410.4.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three (3) years’ experience.
- 410.4.2 Installer: Company specializing in performing the work of this section and who is licensed and approved by the manufacturer.

Company shall have experience with projects of similar size and complexity as this project.

410.5 MATERIALS

- 410.5.1 Tube - the tube should consist of one or more layers of flexible needled felt or an equivalent nonwoven or woven material capable of carrying resin, withstanding installation pressures and curing temperatures. The tube should be compatible with the resin system used. The material should be able to stretch to fit irregular pipe sections and negotiate bends. The outside layer of the tube should be plastic coated with a material that is compatible with the resin system used. The tube should be fabricated to a size that, when installed, will tightly fit the internal circumference and the length of the original conduit. Allowance should be made for circumferential stretching during inversion.
- 410.5.2 Resin - A general purpose, unsaturated, styrene-based, thermoset resin and catalyst system or an epoxy resin and hardener that is compatible with the inversion process should be used. The resin must be able to cure in the presence of water and the initiation temperature for cure should be less than 180° F (82.2° C). The CIPP system can be expected to have as a minimum the initial structural properties given in Parts 410.2.1, 410.2.2, 410.2.3, and 410.2.4, and Parts 410.4.3, 410.4.4, and 410.4.5. These physical strength properties should be determined in accordance with Section 8 of ASTM F- 1216-93.
- 410.5.3 The minimum length shall be that deemed necessary by the engineer to effectively span the pipelining distance of the necessary manhole section unless otherwise specified. The line lengths shall be verified in the field before impregnation of the tube with resin.
- 410.5.4 The outside of the tube, before installation, shall have an impermeable polyethylene or polyurethane plastic coating. This coating will form the inner layer of the finished pipe and is required for enhancement of corrosion resistance, flow, and abrasion properties.
- 410.5.5 Resin - The resin used shall be high-grade corrosion resistant isophthalic polyester, vinyl ester, or epoxy, specifically designed for the cured-in-place pipe (CIPP) being installed.
- 410.5.6 End Seal – A compression gasket sealing product that swells with the presence of water shall be utilized at the junction of the main and manhole. The end seal is a molded rubber gasket that

provides a full-circle compression seal to a substantial area at the end of a mainline pipe that is rehabilitated by lining. The end seal shall be Insignia™ Hydrophilic End Seal as manufactured by LMK Technologies or approved equivalent. The kit component of the Insignia End Seal includes a tubular sleeve, a mechanical fastener band and anchor screws for sizes 18-inches and larger. The member that creates the end seal is a hydrophilic neoprene rubber of approximately 50 Shore A durometer. The tubular sleeve has a uniform wall thickness and width, and a diameter slightly less than the interior pipe diameter. The hydrophilic neoprene rubber has the following characteristics:

Characteristic	Unit	Value	Test Method
Shore A Hardness	point	50 +/- 5	ASTMD2240
Tensile Strength	psi	1177	ASTMD412
Elongation at Break	%	523	ASTMD412
Specific Gravity		1.2	ASTMD297
Swell Capacity in Water Contact	%	200	GRCS

410.5.7 Caulking/Sealant – Sealant shall be a quick-set epoxy mortar or high viscosity epoxy with good adhesion to the liner and original pipe material.

410.6 FULL-LENGTH TEMPERATURE SENSING

410.6.1 System shall consist of a wire probe with sensors no more than ten (10) feet apart running the length of the pipe section to be lined and a computer with vendor software for monitoring in real-time and recording curing data. Data output will consist of a report indicating the time and temperature at each sensor location. System shall have the ability to monitor the curing from a remote location, and this ability will be made available to the Owner and Engineer. Owner and Engineer will be provided training in how to access the site for remote viewing and an overview of the system. Remote sensing system will be the ZIA System, or approved equal.

410.7 DESIGN

410.7.1 General Requirements of Cured-in-Place Pipe (CIPP) – The finished pipe must be such that when the thermosetting resin cures, the total wall thickness will be a homogeneous and monolithic felt and resin composite matrix that will be chemically resistant to withstand internal exposure to domestic sewage. When cured, the CIPP must form a mechanical bond with the conduit.

410.7.2 The CIPP shall be designed to a minimum wall thickness based on the individual project parameters and the condition of the existing conduit. The pipe design shall have sufficient strength to support all dead loads, live loads and groundwater loads imposed.

410.7.3 The cured lining material shall conform to the minimum structural standards, as listed below.

Linear Material Test Cured Liner	Standard	Results
Tensile Stress	ASTM D 638	3,000 psi
Flexural Stress	ASTM D 790	4,500 psi
Flexural Modulus	ASTM D 790	250,000 psi

410.7.4 CIPP Thickness for two (2) Flexural Modulus Resin Systems

410.7.5 Flexural Modulus – 250,000 psi (short term)

Pipe Diameter (inches)	Max. Depth (feet)	CIPP Thickness (millimeters)	Pipe Diameter (inches)	Max. Depth (feet)	CIPP Thickness (millimeters)
8	8	5.0	15	8	6.0
8	12	5.0	15	12	6.5
8	16	5.0	15	16	7.0
8	20	5.0	15	20	8.0
8	24	6.0	15	24	9.0
8	28	6.0	15	28	9.5
10	8	6.0	18	8	6.5
10	12	6.0	18	12	7.5
10	16	6.0	18	16	8.5
10	20	6.0	18	20	9.5
10	24	6.0	18	24	10.5
10	28	6.0	18	28	11.5
12	8	6.0	24	8	9.0
12	12	6.0	24	12	10.0
12	16	6.0	24	16	11.5
12	20	6.5	24	20	13.0
12	24	7.0	24	24	14.0
12	28	7.5	24	28	15.0

Flexural Modulus – 400,000 psi (short term)

Pipe Diameter (inches)	Max. Depth (feet)	CIPP Thickness (millimeters)	Pipe Diameter (inches)	Max. Depth (feet)	CIPP Thickness (millimeters)
8	8	4.0	15	8	5.5
8	12	4.0	15	12	5.5
8	16	4.0	15	16	6.0
8	20	4.5	15	20	7.0
8	24	4.5	15	24	7.5
8	28	4.5	15	28	8.0
10	8	5.5	18	8	6.0
10	12	5.5	18	12	6.5
10	16	5.5	18	16	7.5
10	20	5.5	18	20	8.5
10	24	5.5	18	24	9.0
10	28	5.5	18	28	9.5
12	8	5.5	24	8	8.5
12	12	5.5	24	12	9.0
12	16	5.5	24	16	10.0
12	20	5.5	24	20	11.0
12	24	6.0	24	24	12.0
12	28	6.5	24	28	12.5

Design Parameters

Fully deteriorated design

Ground Water = 1/2 to 1/3 of soil depth

Long term flexural modulus = 50% of short term

Soil modulus = 700 psi for depth < 10' and 1000 psi for depth > or = to 10'

Safety Factor = 2.0

Ovality = 2.0%

Live Load H2O = 16,000 lbs.

Soil Density = 120 pcf

Poisson's Ratio = 0.3

410.7.6 Independent material tests for compliance with this specification shall be made according to the applicable ASTM standards. Upon request, a certificate of compliance will be provided for all materials furnished under this specification.

410.7.7 The contractor shall submit his price proposal based on the appropriate length, size, and existing pipe parameters designated in the Bid Item or Bid Proposal Section. The deterioration of sewers is an on-going process. Should pre-construction

inspections reveal the sewers to be in substantially different conditions than those in the design considerations, the contractor shall request such changes in reconstruction liner thickness, supporting such requests with design data. The deviation, if approved, shall be reflected by the appropriate addition or reduction in the unit cost for that size as agreed to by the Engineer.

410.8 PRE-INSTALLATION PROCEDURES

410.8.1 The following installation procedures shall be adhered to unless otherwise approved by Engineer.

410.9 SAFETY

410.9.1 CONTRACTOR shall carry out his operations in strict accordance with all OSHA and manufacturer's safety requirements. Particular attention is drawn to those safety requirements involving working with scaffolding and engineering confined spaces.

410.10 INSPECTION

410.10.1 Additional internal inspection as noted on drawings shall be conducted by CONTRACTOR prior to actual construction. Inspection shall be accomplished by means of closed-circuit color television. Supplemental cleaning of the pipes to permit a clear and unobstructed view of the pipe walls will be the responsibility of CONTRACTOR and is considered as incidental to the work.

410.11 CLEANING OF SEWER LINES

410.11.1 Prior to any lining of a pipe so designated, it shall be the responsibility of the CONTRACTOR to remove all internal debris out of the sewer lines in accordance with Section III, "Sewer Line Cleaning" NASSCO Specifications for Sewer Collection System Rehabilitation.

- 1) Sewers shall be cleaned of all debris, roots and other materials that would block proper inversion of the cured-in-place pipe. Utilizing high-pressure jet cleaning equipment, several passes shall be completed to assure that all debris is removed from the pipe. If roots are present, root cutters or mechanical brushes shall be attached to the jet nozzle and sent through the line to remove all root intrusions.
- 2) Owner or Engineer shall approve cleaning prior to liner insertion.

410.11.2 T.V. Inspection

- 1) Sewers shall be CCTV inspected providing both a video recording and written log identifying all service connections and openings. Utilizing a color video inspection system with data recording capabilities, the entire pipe sections shall be recorded on standard transfer media to become the property of the City.
- 2) 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 Engineer to review this process live or review the video to verify and approve which lateral connections are to be reinstated. All lateral locations will be measured from the back wall (opposing wall) of the basis manhole, typically, the downstream manhole.
- 3) Inspection of Pipelines - Inspection of pipelines should be performed by experienced personnel trained in locating breaks, obstacles, and service connections by closed-circuit television or man entry. The interior of the pipeline should be carefully inspected to determine the location of any conditions that may prevent proper installation of the impregnated tube, such as protruding service taps, collapsed or crushed pipe, and reductions in the cross-sectional area of more than 20%. These conditions should be noted so that they can be corrected. A pre-insertion video shall be prepared by the Contractor. Owner or Engineer and Contractor shall be present during pre-insertion inspection to view pipeline. Pipeline shall be dry during the pre-insertion inspection. Contractor to provide at least two (2) hours advance notice to Owner or Engineer for inspection. Inspection shall take place between 7:00 AM and 6:00 PM of the same day unless permitting restrictions dictate otherwise. If flow is resume in pipe prior to lining, a second televising shall be performed with Owner or Engineer present to ensure no debris has been reintroduced into the pipe.

410.12 LINE OBSTRUCTIONS

- 410.12.1 The original pipeline should be clear of obstructions such as solids, dropped joints, protruding service connections, crushed or collapsed pipe, and reductions in the cross-sectional area of more than 20% that will prevent the insertion of the resin-impregnated tube. Protruding service connections shall be removed to prevent dimpling of the finished liner. Maximum allowable protrusion shall be 1/2-inch.

- 410.12.2 The Contractor shall perform all obstruction removals for the sewer section scheduled for relining. The repair shall be an adequate repair for insertion of the resin-impregnated tube. This shall be paid at the bid price for obstruction removal.
- 410.12.3 If the Contractor identifies obstructions that cannot be removed by conventional sewer cleaning equipment, then, with the Engineer's approval, an excavation shall be made to remove the obstruction.
- 410.13 If pre-insertion inspection reveals a condition such as a protruding service connection, dropped joint, or a collapse that will prevent the insertion process or will result in an unacceptable installation, and it cannot be removed by conventional sewer cleaning equipment, defined as high-pressure jetters, root cutter or grinders, then Contractor shall consult with the Engineer before proceeding with the appropriate remedy. If condition resulting in extra effort by the Contractor was not shown on the drawing or revealed to the Contractor at the time of the bid, the work shall be considered as separate pay item by Changer Order.
- 410.14 Infiltration – Minor infiltration is a normal condition sometimes encountered during the CIPP process. It is not a “changed condition” and should not be regarded as a reason for change orders. If in the opinion of the Engineer, infiltration is significant enough to adversely affect the curing process, chemical grouting or other remedies may be required. This additional work will be paid for by the Owner as a Changer Order.
- 410.15 Site Restoration – Areas damaged or modified by the Work for this project shall be repaired or restored to a condition equal to or better than the original condition. Site restoration is incidental to the Work and shall not be regarded as a reason for change orders.
- 410.16 Public Relations – A Public Information and Notification Program shall, as a minimum, require the Contractor to be responsible for contacting homeowners or businesses who will be affected by the construction activities and informing them of the work to be done and the estimated timing for the work. Written notice shall be delivered to each home or business two (2) weeks prior to installation. Notice shall include a local telephone number of the Contractor they can call to discuss the project, and how the homeowner or business will be affected. The written notice must be reviewed by the Owner or Engineer prior to the start of any work.
- A follow-up notice shall be delivered to each home or business connected to the sanitary sewer two (2) days prior to installation. The notice shall instruct occupants to minimize water usage the day of the insertion and fill floor drain traps with water to prevent potential odors.

410.17 BY-PASS OF FLOW AND INTERRUPTION OF SERVICE

- 410.17.1 Contractor, when required, shall provide for the flow of sewage around the section or sections of pipe that are to be lined. The bypass shall be made by plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system. The pump and bypass lines shall be of adequate capacity and size to handle anticipated wet weather flow.
- 410.17.2 All procedures for maintaining flows must meet the approval of the Owner or Engineer. Contractor shall submit a detailed plan of all methods of flow management, in advance of flow interruption.
- 410.17.3 When preparing for making connection to the existing system or other work, which will interrupt service to the utility users, Contractor shall notify the affected user at least 48 hours in advance of service interruption, stating the approximate time and duration of interruption of service. Advance notification shall not extend beyond 72 hours.
- 410.17.4 Public advisory services will be required to notify all parties whose service laterals will be out of commission and to advise against water usage until the mainline is back in service.

410.18 INSTALLATION OF LINES

- 410.18.1 Prior to installation of the liner, the full-length temperature sensing system shall be placed and tested to ensure proper functioning. If more than two sensors in a row or more than 10% of the total sensors are malfunctioning, the entire sensor array shall be replaced and retested. Time and temperature shall be monitored in accordance with manufacturer's recommendations.
- 410.18.2 Resin Impregnation of the CIPP Tube - The Contractor shall designate a location where the tube shall be impregnated or "wet out" with resin, using distribution rollers and a "single-source" vacuum system to thoroughly saturate the tube's felt fiber prior to installation in the field. The impregnated tube shall be free of pinholes, resin voids and other defects. If the cured-in-place pipe is impregnated at the manufacturing plant, it shall be delivered to the job site in a refrigerated truck and remain refrigerated prior to installation to prevent premature curing. A "Pulled-In-Place" method of installation shall be allowed for pipe diameter sizes 6-inches, 8-inches, 10-inches, and 12-inches.
- 410.18.3 The tube should be vacuum-impregnated with resin (wet out) under controlled conditions. The volume of resin used should be sufficient to fill all voids in the tube material at nominal thickness and diameter. The volume should be adjusted by adding 5 to 10% excess resin for the change in resin volume due to polymerization and to allow for any migration of resin into the cracks and joints in the original pipe.

- 410.18.4 Inversion of CIPP Tube - The resin impregnated tube shall be water inverted or cool air pressure-inverted through an existing manhole or other approved access point until it has fully traversed the designated line length and the inversion face breaches the destination manhole or termination point. Thermocouples shall be placed at the top and, if possible, at the bottom interface of both ends of the liner for monitoring temperature during the cure cycle. A "Pulled-In-Place" method of installation shall be allowed for pipe diameter sizes 6-inches, 8-inches, 10-inches, and 12-inches.
- 410.18.5 CIPP Processing (Curing and Cool Down) - The cure cycle and cool down will be dictated with consideration given to actual field conditions and shall be according to the manufacturer's recommendations. The curing temperatures shall be monitored at the heater truck's water inlet and outlet lines. The temperature readings from the truck will be compared to the thermocouples to insure that sufficient heat is being supplied to the system to effect proper cure. Once the pipe has been cured, cool water shall be slowly introduced into the rehabilitated pipe. The water temperature shall be cooled inside of the pipe at a rate of 20 to 30 degrees per hour until the water temperature is within 20 degrees of the ambient temperature. The cool down process will also be affected by actual field conditions and may be modified in cases of severe conditions or below normal ground temperatures. Contractor shall not discharge cooling water to storm sewer system.
- 410.18.6 Termination and Sealing at Manhole Outlets - Termination of the cured-in place pipe at the manhole is completed by trimming the inverted pipe end back within approximately 6-inches of the outlet.
- 1) An end seal per the materials specification shall be installed at the termination of CIPP at the manhole outlet. All roots deposits, and debris should be removed from the pipe with hydraulically powered equipment, high velocity jet cleaners, or mechanically powered equipment as per NASSCO recommended specifications prior to installation of CIPP with end seals. Since the Insignia End Seal product may be used with a variety of rehabilitative pipe liners, the standard installation practices of each individual pipe liner method should be closely followed.
- 410.18.7 Hydraulic Capacity - Overall, the hydraulic profile shall be maintained as large as possible. The CIPP shall have a minimum of the full flow capacity of the original pipe before rehabilitation. Calculated capacities may be derived using a commonly accepted roughness coefficient for the existing pipe material, taking into consideration its age and condition. The roughness coefficient of the CIPP shall be verified by third party test data.

410.19 SERVICE CONNECTIONS

- 410.19.1 After the liner has been cured, Contractor shall reconnect the service connections. All service connections to existing buildings are to be reconnected, except where disconnection is approved by the Engineer. Service connection to a vacated lot shall not be reconnected. If more than one service is found per lot then, the Contractor shall verify that service connections are active by introducing dye into the lines at cleanouts, vent stacks or other access points as approved by the Engineer. Dye testing shall be recorded by CCTV inspection at the location in the main line where the dye appears. All addresses will be noted on log sheets for future reference. Provide the address of all reconnected and disconnected services.
- 410.19.2 It is the intent of the City that all service reconnections be made by external service reconnection in accordance with 410.19.4. Where there is no protruding pipe, cracks, or leaks, or where significant surface obstructions exist service connections shall be internally reinstated as directed by Engineer in accordance with 410.19.3 or 410.19.4.
- 410.19.3 Internal Reconnection: Without excavation, the service connection shall be reinstated by means of a television camera and a cutting device that reestablishes the connection to not less than 90 percent capacity. Service connections shall be cut in with neat and smooth circumferential lines to prevent snagging of debris and/or solids. Contractor shall provide a physical demonstration, in the presence of the Engineer, to show the assurance of a watertight seal of all service connections. Service interruptions to any homes tributary to the sewer line being rehabilitated shall not exceed 24 hours. Internal service reconnections shall not be allowed without prior written approval by the Owner.
- 410.19.4 External Reconnection: Service connections shall be reinstated by excavation and reconnecting the service with an approved saddle, INSERTATEE, or equal. The Contractor shall remove the appropriate amount of carrier pipe to allow the saddle to be directly connected to the outside wall of the CIPP. An epoxy, meeting the manufacturer's recommendations, shall be applied to the saddle to assure a watertight seal between the saddle and CIPP. The saddle shall be secured with stainless steel bands. After the epoxy has set and prior to backfilling, the Contractor shall seal any open annular space between the existing sewer and new liner pipe with a non-shrink grout. The Contractor shall then completely encase the saddle and exposed pipe in concrete. Care shall be used not to damage the CIPP. If damage occurs as a result of the Contractor's operations, the Contractor shall assume all cost associated with the repair of the CIPP.

- 410.19.5 Connections of the saddle fitting to the existing lateral shall be made using elastomeric boots, full-encirclement clamps, or by other method as approved by the Engineer.

410.20 FINAL INSPECTION

- 410.20.1 Upon completion of the installation, the rehabilitated sewer shall be CCTV inspected providing both a video recording and log identifying all service connections and openings. The entire pipe section rehabilitated shall be recorded on standard transfer media with the video becoming the property of the City.
- 410.20.2 CIPP samples shall be prepared and physical properties tested in accordance with ASTM F1216, Section 8.1, using either method proposed. The flexural modulus must meet or exceed the value used in design in Section D (structural requirements for the pipe size and thickness furnished in design.)
- 410.20.3 Leakage testing of the CIPP shall be accomplished during curing while under a positive head. CIPP products in which the pipe wall is cured while not in direct contact with the pressurizing fluid (e.g., a removable bladder) must be tested by an alternative method approved by the Engineer.
- 410.20.4 Visual inspection of the CIPP shall be in accordance with ASTM F1216, Section 8.6.
- 410.20.5 Upon acceptance of the installation work and testing, the Contractor shall restore the project area affected by the operations to a condition at least equal to that existing prior to the work.

410.21 FINAL ACCEPTANCE

- 410.21.1 After installation of the liner, Contractor shall TV inspect the sewer line as specified herein and perform the following test on the sewer line.
- 410.21.2 Testing: After the installation procedures have been performed and curing is complete, but before any service connections are reinstated, Contractor shall conduct a hydrostatic test on the sewer lines to determine if it is watertight.
- 410.21.3 Exfiltration testing of the CIPP shall be performed after it has fully cured and before any other insertions take place. The exfiltration rate shall not exceed 200 U.S. gallons per inch of internal diameter per mile of pipe per day. The test shall be conducted for a minimum of one (1) hour with a minimum of 2-feet of head over the top of the pipe at its upper end. A minimum of three (3) reaches will be tested. Contractor may elect to perform testing before pucker end is cut out, but no allowance will be made for observed pucker leakage. An air test may be used in lieu of

exfiltration test. Test shall be performed in accordance with ASTM F-1417. Test pressure shall be 3.5 psig, and the time pressure drop method will be used. Testing shall take place between 7:00 AM and 6:00 PM unless permitting requirements dictate otherwise.

- 410.21.4 Post-insertion video recording TV log in a format acceptable to the Engineer shall be provided to the Engineer within two (2) weeks of taping. The pipe must be dry and clean during the televising. Camera speed shall not exceed two feet per second. Video quality shall be high. Engineer and Contractor shall be present during the inspection. Provide at least two (2) hours advance notice to Owner or Engineer. Inspection to take place between 7:00 AM and 6:00 PM unless permitting restrictions dictate otherwise.
- 410.21.5 Wrinkle height shall not exceed 2% of the host pipe diameter or ¼", whichever is greater.
- 410.21.6 Cured Pipe Physical Properties: Samples of the cured pipe should have the minimum physical properties (flexural stress, modulus of elasticity, and thickness) recommended herein.
- 410.21.7 Payment for pressure tests, including the furnishing and installing of all equipment and materials, conducting the pressure test, and making all necessary repairs shall be considered as subsidiary to pipeline rehabilitation and will not be paid for directly.

410.22 MEASUREMENT AND PAYMENT

- 410.22.1 Cured-in-Place Pipe shall be paid for at the Contract Unit Prices as follows: The unit price shall cover the entire cost of sewer lining, measured to the nearest 0.1 foot, center of manhole to center of manhole, less one-half (1/2) the diameter of both the upstream and downstream manholes, and include any by-pass pumping and testing.
- 410.22.2 Obstruction Removal shall be paid for at the set unit prices for obstruction removal.
- 410.22.3 Payment for external service connections shall be paid at the unit bid prices for service connections. No additional payment shall be paid for internal service connections unless a tee-liner or similar is installed.
- 410.22.4 Television pre-inspection shall be paid for at the unit price bid per linear foot of pipeline to be inspected. The unit price bid for Television Pre-inspection shall be payment in full for all materials, labor, and equipment necessary for televising the pipe prior to repairing or rehabilitating it. The linear feet paid shall be as measured from the center of the upstream manhole to the center of the downstream manhole. Payment shall only be made once for any manhole-to-manhole pipe segment; no additional

payment shall be made for multiple inspections of the same pipe segment. Payment will not be made until the pre-inspection video has been approved.

- 410.22.5 The cost of post construction television inspection will not be paid for separately but shall be included in the Contract Unit Price of the rehabilitation or replacement being performed. This shall include all costs associated with the television inspection, such as viewing, record logs, and standard transfer media.
- 410.22.6 The prices shall be payment in full for performing and completing the work and for furnishing all labor and materials necessary including excavation and removal of existing structure, trench safety system, pipe lining materials, pipe sealing materials, labor, backfilling, surface restoration, sodding, pavement replacement, sidewalk and driveway replacement, curb and gutter replacement, all testing, and all incidental costs.

END OF SECTION

SP-7 TECHNICAL REQUIREMENTS AND SPECIFICATIONS

MODIFICATION TO CITY OF TULSA STANDARD SPECIFICATION 408 PIPE BURSTING & 409 SLIPLINING

The following modification(s) shall not replace the referenced specifications sections but rather act as an addition to the existing specification located in the City of Tulsa Standard Specifications and Standard Details, dated October 2013.

PART 1 GENERAL

- 1.1 When HDPE pipe is delivered to the jobsite it shall not be exposed to sunlight for more than three (3) weeks. HDPE pipe exposed to sunlight for more than three (3) weeks shall be covered with an opaque protective covering. The pipe shall be left stacked and no more pipe than can be installed in one day shall be strung along the jobsite.
- 1.2 Pipe and fittings shall be joined by one of the following types of thermal fusion per the Manufacturer's recommended procedures: Butt fusion, Saddle fusion or Socket fusion.
- 1.3 Polyethylene pipe and fittings may be joined together or to other materials using electrofusion fittings, flange adapters with back-up rings, mechanical couplings designed for connecting polyethylene pipe and fittings to itself or to another material, or MJ adapters. The manufacturer of the joining device shall be consulted for proper installation procedures.
- 1.4 Polyethylene pipe and fittings joined together using a hydraulically operated heat butt fusion machine, shall utilize a data recording device per ASTM F3124 – STANDARD PRACTICE FOR DATA RECORDING THE PROCEDURE USED TO PRODUCE HEAT BUTT FUSION JOINTS IN PLASTIC PIPING SYSTEMS OR FITTINGS. Each HDPE joint shall be traceable to the fusion operator and equipment. Electrofusion reports of each weld shall be appropriately identified and provided to City of Tulsa Inspector. The reports shall include, as a minimum, the fusion date, time, ambient temperature, fitting type and size, user ID, and the manufacturer of the part.
- 1.5 The Contractor shall be responsible for ensuring all personnel operating heat fusion equipment are qualified Heat Fusion Equipment Operators in accordance with ASTM F3190-16 – STANDARD PRACTICE FOR HEAT FUSION EQUIPMENT (HFE) OPERATOR QUALIFICATION ON POLYETHYLENE (PE) AND POLYAMIDE (PA) PIPE AND FITTINGS. All polyethylene joints shall be thermally butt fused by an HFE Operator. The HFE Operators Card shall be submitted at the Pre-Construction Conference and provided at the request of the Engineer. Certification by a distributor shall not be an acceptable substitute.
- 1.6 PAYMENT: No additional payment shall be made.

END OF SECTION

SP-8 TECHNICAL REQUIREMENTS AND SPECIFICATIONS

MODIFICATION TO CITY OF TULSA STANDARD SPECIFICATION 327 TRAFFIC CONTROL DEVICES

PART 327 - TRAFFIC CONTROL DEVICES

The following modification(s) shall replace the referenced specification section located in the City of Tulsa Standard Specifications and Standard Details, Dated October 2013.

PART 1 GENERAL

1.1 SCOPE

This specification defines the materials required for *Construction Traffic Control* and the payment schedule.

PART 2 TRAFFIC CONTROL DEVICES

2.1 MATERIALS

Traffic control devices shall include safety fencing, barricades, signs, barrels, tube channelizers, warning lights, arrow panels, flagmen and all other relevant devices to perform *Construction Traffic Control*. All devices shall conform to the latest edition of the Manual on Uniform Traffic Control Devices and ODOT Standard Specifications Section 800.02.

PART 3 PAYMENT

3.1 BASIS OF PAYMENT

Payment shall be full compensation for performing the required traffic control for the construction project. The furnishing, installation, and removal of all traffic control devices are to be included in the lump sum for *Construction Traffic Control*.

3.2 PAYMENT SCHEDULE

Payment for this item will be made in two installments, unless the first estimate submitted is also the final estimate, in which case the total will be paid. The first payment of fifty percent of the *Construction Traffic Control* lump sum price will be included in the pay estimate which reflects fifty percent completion of the work.

The remaining value of the *Construction Traffic Control* lump sum will be included on the final pay estimate.

3.3 ADDITIONAL TRAFFIC CONTROL REQUIRED

If additional construction work is added to the original contract, additional payment for *Construction Traffic Control* will be awarded accordingly. The additional payment will be figured by calculating a daily rate based off the original lump sum value. The daily rate will be calculated by dividing the

Construction Traffic Control lump sum value by the number of calendar days in the original contract time.

The additional compensation will be calculated by multiplying the daily rate by the number of additional days required. The additional traffic control payment will be included on the final pay estimate.

END OF SECTION