

SECTION 063
SPECIFICATIONS – PIPE REHABILITATION

Pipe rehabilitation (also noted as CIPP) shall be completed within sewers by either inverting and curing thermo-setting, resin-impregnated tubes (ASTM F1216) or pulling-in place and curing, using ultraviolet light, resin-impregnated, glass-reinforced plastic (GRP) fabric tubes (ASTM F2019). When there is a conflict between these Specifications and any third-party specification referenced herein, these Specifications shall govern. Construction of cured-in-place pipe (CIPP) using ambient-cured resins shall not be allowed.

Recordings of prior internal, sewer inspections are provided as an informational courtesy only and are not intended to provide a complete or an accurate description of the conditions of the sewers prior to access for the purpose of constructing CIPP. Determination of the condition of the sewers to receive CIPP shall be the responsibility of the Contractor.

1.0 Public Notification

All residences and businesses that may be affected by work performed in the construction of CIPP shall be notified in writing at least forty-eight (48) hours before commencement of work at a site. When requested the Contractor shall promptly notify the Sanitary District of each distribution of notification including the location of the notified residents and businesses.

The District will provide an electronic table of properties that are within defined buffers of sewers to receive CIPP; table attributes will include information about the properties and owners thereof. It is to be understood by the Contractor that such a list is not intended to be a complete listing of those persons required to receive notification. Complete public notification is to be the exclusive responsibility of the Contractor.

The proposed format of all correspondence from the Contractor, to the public, shall be reviewed, and approved, by GPSD before delivery. Notifications to residences and businesses shall include the following:

- an explanation of the work to be performed;
- when the work is anticipated to begin;
- the general location of where the work is to be performed;
- the name and office telephone number of the Contractor representative who is responsible for the administration of the Project;
- the name and twenty-four (24) hour telephone number of the Contractor's supervisor at the work site(s)
- the nature of the inconvenience(s) anticipated to be experienced by the resident/business owner;
- the anticipated duration of the work;
- that the work is being performed on behalf of the Greater Peoria Sanitary District;
- a Sanitary District contact and telephone number as provided by the District; and
- an advisement shall be included stating that the business/resident should make sure that the traps in the affected buildings are functioning properly.

2.0 Sewer Preparation

Sewer preparation for CIPP construction, including, but not limited to, sewer cleaning, shall be performed in accordance with the applicable ASTM Specification referenced above except those portions superseded by these Specifications, including Section 093. The Contractor shall inspect and capture all resulting images of sewers to receive a CIPP immediately before and immediately after the performance of any and all sewer preparation activities. All recorded images shall be provided to GPSD.

3.0 Sewer Inspection

Sewer inspections shall be performed in accordance with Section 093 of these Specifications. As a function of the construction of CIPP within sewers, the purpose of sewer inspections is to:

- Inspect and record the conditions of the sewers in which CIPP is to be constructed,
- Establish the locations of sewer services,
- Establish the presence of unused sewer laterals
- Verify parameters such as the quantities of CIPP to be constructed,
- Verify the quality of the installation of uncured resin-impregnated, glass-reinforced plastic (GRP) fabric tubes prior to initiation of curing.
- Inspect cured CIPP,
- Assist with the reinstatement of sewer service, and
- Inspect sewers after the completion of construction.

The Contractor shall record and submit to GPSD images of any sewer lateral inspections, including accurate documentation of time, date, location of all inspection cameras, and the position of the lateral inspection device relative to mainline sewer inspection device.

CIPP shall be designed based upon accurate measurements of the host sewers. The conformity of constructed CIPP to their host pipes shall not be compromised by inaccurate or imprecise measurements.

- Measurements of sewer diameters obtained remotely using an inspection camera to view a measuring rod shall not be allowed in the design of CIPP;
- The inside diameter of sewers shall be measured at both bookend manholes and around the entire circumference of each pipe to determine the dimension and shape.
- Measured lengths of sewers shall be verified using multiple measurements and measuring methods;
- Measured lengths shall be sufficiently accurate to produce constructed CIPP lengths that span the entire length of the receiving sewer from and to each joint between the pipe and the bookend manholes.
- If the District questions the accuracy of dimensions obtained by the Contractor, the Contractor shall repeat the measurements as often as necessary to obtain satisfactory information without claim for additional compensation or delay. If GPSD determines that any method of measurement used by the Contractor yields inaccurate or generally questionable information, the Contractor shall seek and utilize another method during subsequent measurements.

4.0 Sewer Flow Control

If determined to be necessary by the Contractor, sewer flow control shall be instituted in conformance with Section 093 of these Specifications.

5.0 Cured-in-Place Pipe Construction

5.1 Submittals

Prior to the commencement of any CIPP construction, the Contractor shall be required to provide information to GPSD about all components of CIPP to be constructed and installed as part of the Project, including the following. Repair numbers from the plans should be referenced in the documentation to specify which parameters apply to each specific location.

Manufacturer construction guidelines, curing instructions, and technical information about each tube, resin and initiator, including charts or tables showing limits of all parameters monitored during the curing process relative to time and the size of the CIPP being constructed, including:

- The rate of travel of ultraviolet assemblies through the curing CIPP,
- The cumulative wattage of light sources initiating the curing processes,
- The air pressure within curing CIPP,
- The exothermic curing temperatures, and
- Which measured parameters shall be recorded relative to time and distance from the start of the curing process.

Following installation recorded values of all required curing parameters shall be provided to GPSD.

For all materials being used in the performance of the work, each of the Contractor's crews shall have with them at all times material safety data sheets (MSDS) for all materials in which such information is required. MSDS sheets shall be available for inspection on-site at all times and copies shall be provided by the Contractor to GPSD.

For each CIPP to be constructed, the Contractor shall submit to GPSD design calculations that include proposals of the dimensions including the minimal thickness and diameter. Each design submittal shall reference the applicable repair number from the Project Plans. Design submittals shall be complete and demonstrate conformance with these Specifications including all design calculations, assumptions and values of parameters. For each CIPP to be constructed, the thickness of the constructed CIPP shall not be less than the design thickness resulting from the design calculations. Once submitted by the Contractor, GPSD will review these submittals for general conformance with the project requirements. The Contractor shall address questions or comments and resubmit designs for further review. The Contractor shall be fully responsible for selecting and installing a liner in conformance with the contract documents.

Defects in constructed CIPP shall not be allowed. Examples of defects shall include, but not be limited to, lumps, finning, wrinkling, cracking, blistering, dry spots, incomplete resin cure, and thinning of constructed CIPP. GPSD shall determine the severity of defects and determine any corrective actions that will need to be taken by the Contractor.

5.1 Materials

The materials used in the construction of CIPP shall conform to these Specifications and either ASTM F1216 or ASTM F2019. Materials including resins, pigments, dyes or colorants shall be chosen such that coloring of the installed CIPP will not interfere with visual inspection of the pipe.

5.1.1 Materials Used to Construct CIPP within Gravity Sewers

Materials used to construct CIPP within gravity sewers shall conform to the following:

5.1.1.1 Resins

For CIPP constructed by inverting and curing thermo-setting, resin-impregnated, flexible tubes, resins to be used in the construction of CIPP shall be either isophthalic polyester or vinyl ester based and intended for use in heat-curing systems. For CIPP constructed by pulling-in place and curing, using ultraviolet light, resin-impregnated, glass-reinforced plastic (GRP) fabric tubes, resins to be used in the construction of CIPP shall be either polyester or vinyl ester based and intended for use in ultraviolet-curing systems. Polyester resins shall be filled with inert

materials by the resin manufacturer. Initiator systems to be used shall be compatible with the intended resins.

Unless specified otherwise by GPSD, for CIPP constructed by inverting and curing thermo-setting, resin-impregnated, flexible, tubes, resins shall be selected from the following list:

| Manufacturer | Resin |
|--------------------------|--|
| AOC | Vipel L704-FAP Isophthalic Based Resin |
| | Vipel L721-LTA Series Polyester Resin |
| | Vipel L758-LTI Polyester Resin |
| Interplastic Corporation | COR72-AT-470HT |
| | COR72-AT-477 |
| | COR78-AT-330 |
| | COR78-AT-559 |
| | COR78-AT-579 |
| Ashland | AROPOL LB 1043 series resins |

Where specified by GPSD, the following resins may only be used for CIPP constructed by inverting and curing thermo-setting, resin-impregnated, flexible tubes, in large-diameter sewers:

| Manufacturer | Resin |
|---------------------|---------------------------------------|
| AOC | Vipel L704-FCW Filled ISO Based Resin |

The following resins shall be used for CIPP constructed by inverting and curing thermo-setting, resin-impregnated, flexible tubes, and where it is determined by GPSD that additional corrosion-resistance is necessary:

| Manufacturer | Resin |
|--------------------------|---|
| AOC | Vipel L010-PPA Series Vinyl Ester Resin |
| Interplastic Corporation | CORVE8190 vinyl-ester resin |
| | CORVE8738 vinyl-ester resin |
| Ashland | HETRON Q 6405 series vinyl-ester resins |

Unless specified otherwise by GPSD, for CIPP constructed by pulling-in place and curing, using ultraviolet light, resin-impregnated, glass-reinforced plastic (GRP) fabric tubes, resins shall be selected from the following list:

| Manufacturer | Resin |
|---------------------|---|
| AOC | Vipel L040-LCVG UV Curable, Ultra Low VOC Resin |
| | Vipel L552-LCA-05 Polyester Resin |

5.1.1.2 Tubes

Depending on the allowable method of CIPP construction chosen by the Contractor, tubes into which resin is impregnated shall be constructed in accordance with either ASTM F1216 or ASTM F2019. Methods used to impregnate tubes with resins shall be in accordance with the recommendations of both the tube and resin manufacturers.

The dimensions of constructed tubes shall be chosen by the Contractor to maximize conformity between receiving, host pipes and constructed, cured, CIPP. Thicknesses of constructed and cured CIPP shall not be less than the corresponding, approved, design thicknesses. Annular spacing between constructed CIPP and host pipes shall be minimized. Constructed CIPP shall be continuous and span the entire length of the receiving sewers from manhole to manhole.

5.2 Design of CIPP

Design of CIPP shall meet the minimum design requirements of ASTM F1216 and all referenced documents therein except as modified by these Specifications. For design considerations, unless specified otherwise within the Project Plans or in these Specifications, by default, it will be assumed that all gravity sewer pipes to be rehabilitated by construction of a CIPP exhibit a fully deteriorated gravity pipe condition in accordance with definitions provided in ASTM F1216; however, if specified within the Project Plans or these Specifications, the condition of certain pipes in which CIPP is to be constructed might be specified as partially deteriorated as understood in ASTM F1216. Design of CIPP within pressure sewer pipes shall always assume that the host pipe is fully deteriorated.

The following assumptions shall govern the design the thickness of all CIPP:

- Height of water above the pipe (H_w) equal to the height of soil above the top of the pipe (H) (i.e., a minimum water buoyancy factor of 0.67);
- Height of soil above the top of the pipe (H) shall be the greater of the measurements of the depths of the bookend structures which shall be from the top of the manhole casting at its center to the bottom of the manhole also at its center;
- Soil density of 125 pcf;
- Percent ovality of the host pipe of two (2) percent;
- Factor of safety of two (2);
- Modules of soil reaction of 700 psi;
- Minimum long-term modules of elasticity of 200,000 psi for CIPP constructed by inverting and curing thermo-setting, resin-impregnated, flexible tubes;
- Minimum long-term modules of elasticity of 600,000 psi for CIPP constructed by pulling-in place and curing, using ultraviolet light, resin-impregnated, glass-reinforced plastic (GRP) fabric tubes;
- Utilize a value of the mean inside diameter of the original pipe equal to that used to determine the dimensions of the liner as specified above.

5.2.1 Design of CIPP for Construction within Gravity Sewers

Regarding the design of CIPP within gravity sewers, when the condition of a receiving pipe is defined as fully deteriorated, Equation X1.3 of ASTM F1216 shall govern the determination of the thickness of CIPP to be installed. When the condition of the receiving pipe is defined as partially deteriorated, Equation X1.1 of ASTM 1216 shall govern the determination of the thickness of CIPP to be installed.

5.2.2 Design of CIPP for Construction within Pressure Sewers

CIPP shall not be used for repair of pressure sewers.

5.3 Construction and Handling of Uncured CIPP

Each piece of uncured CIPP shall be clearly marked with its designated repair number prior to delivery to the site. Uncured CIPP shall be transported to the sites of work using means and methods approved by the manufacturers of all components and in accordance with either ASTM F1216 or ASTM F2019, whichever is applicable. Installation of CIPP shall begin within a period of time after impregnation that is acceptable to the component manufacturers; if the initiation of the curing process has begun prior to installation, the uncured CIPP shall be rejected and not allowed to be used as part of the completion of the Project.

5.4 Installation and Curing of CIPP

Installation and curing of CIPP shall proceed only after completion of the following:

- Construction of planned repairs and modifications to be made to the sewer that is to receive a CIPP;
- Notification of all affected residences and businesses;
- Construction of necessary traffic control measures;
- Cleaning and inspection of the sewer that is to receive a CIPP;
- Implementation of necessary and adequate flow controls; and
- Construction of end seal sleeves as specified below.

The Contractor shall proceed with the insertion of an uncured CIPP into a sewer only after the sewer has been inspected for cleanliness and cleaned immediately before the commencement of CIPP insertion.

Where receiving sewers are six- to 36- inches, prior to the introduction of uncured CIPP the Contractor shall construct appropriately sized Insignia end seal sleeves for mainline CIPP as manufactured by LMK Technologies at both ends of the proposed liner in accordance with directions provided by the manufacturer.

For sewers greater than 36" watertight joints between constructed CIPP and adjoining manholes shall be provided by the application of non-shrink grout material over the entire circumference of the joints between the installed CIPP and connecting manholes. A watertight seal shall be provided by filling any space between the host pipe and the installed CIPP and by completely covering the ends of the CIPP at the bookend manholes. The Contractor shall take care to contain the non-shrink grout material such that it does not remain on the internal surface of the installed CIPP or adjoining sewers.

Depending on the allowable method of CIPP construction chosen by the Contractor, installation of uncured CIPP shall be performed using either an inversion process or by pulling-in place the uncured CIPP. Installation shall be in accordance with these Specifications, the instructions of both the resin and tube manufacturers and, depending on the allowable methods of CIPP construction chosen, either ASTM F1216 or ASTM F2019. When in conflict, instructions provided by the resin and tube manufacturers shall govern.

For CIPP constructed by pulling-in place and curing, using ultraviolet light, resin-impregnated, glass-reinforced plastic (GRP) fabric tubes, after inflation of the uncured CIPP, but prior to the commencement of the curing process, the Contractor shall internally inspect the entirety of the uncured CIPP to discover defects that might produce a product not in accordance with these Specifications. For CIPP constructed by inverting and curing thermo-setting, resin-impregnated, flexible tubes, the cure time recommended by the resin manufacturer shall be considered started when the manufacturer's minimum curing temperature is reached throughout the entire installed CIPP.

For CIPP constructed by inverting and curing thermo-setting, resin-impregnated, flexible tubes, prior to the commencement of the curing process, or when directed by GPSD, the Contractor shall install sensors,

including probes, provided by GPSD, into the CIPP being installed. Sensors provided by GPSD are to be installed where directed by GPSD. Sensors provided by GPSD and installed by the Contractor are intended to be in addition to that instrumentation provided by the Contractor and used to determine conditions within and near the CIPP being installed. Sensors provided by GPSD are not intended to be substitutions for nor replace the sensors and instrumentation needed by the Contractor to install CIPP.

After CIPP construction but prior to construction of joints between CIPP and adjoining manholes, CIPP shall be trimmed within manholes that connect to sewers in receipt of CIPP. Relative to the surface of a given bookend manhole, constructed CIPP shall be trimmed parallel to one-inch from the surface of the manhole throughout the entire circumference of the constructed CIPP. Regarding manholes at intermediate locations that neither serve as the installation or ultimate terminus locations during CIPP construction, cured CIPP shall be trimmed parallel to within one-inch of manhole surfaces not throughout the entire circumference of the constructed CIPP but only from the crown of the CIPP to the bench of the subject manhole. Trimmed CIPP within manholes shall not impede the drainage of water off benches and into troughs. Within the subject manhole, if a bench does not exist, the CIPP is to be trimmed to the spring-line of the CIPP. CIPP shall be trimmed and cut without creation of jagged or sharp edges of trimmed CIPP shall be removed by brushing or sanding.

Immediately after CIPP construction, including complete sewer service reinstatements, CIPP shall be cleaned and inspected to the satisfaction of GPSD prior to ending bypass pumping. CIPP construction shall not be complete until such cleaning and inspection has been completed.

5.5 Re-establishing Sanitary Services

Unless directed by GPSD, connections to the host-pipe that are plugged are not to be reinstated and those without are to be reinstated. For the purpose of this Specification, a plugged connection is one that has a plug, cap, or pancake purposely constructed and made part of the connection. GPSD may direct in writing the Contractor not to reinstate an unplugged sewer service connection; prior to acceptance by GPSD of an installed CIPP, the Contractor shall provide a form indicating recognition by both GPSD and the Contractor that the Contractor has been directed by GPSD not to reinstate specific, unplugged connections.

Unless otherwise directed by GPSD in writing, the decision as to the location of services is that of the Contractor, exclusively.

The reestablishment of sewer services shall be completed within twenty-four (24) hours after service discontinuation. Service reestablishment by excavation methods shall not be allowed unless approved by GPSD. Sewer service reestablishments shall be performed by removing ninety-five (95) percent to one-hundred (100) percent of the installed CIPP within the limits of the sewer service openings provided by the host sewer. Removal of installed CIPP beyond the limits of the sewer service openings shall not be allowed.

During the reestablishment of sewer services, the Contractor shall take care not to damage the host sewer including tees, sewer lateral piping or mainline sewer piping. All or part of host sewers to receive CIPP might be constructed of PVC-based materials. Cutting methods and equipment shall be chosen to minimize contact between cutting tools and the host sewer. Cutting, drilling or penetrating host sewers will not be allowed. During the performance of a sewer service reestablishment, the Contractor shall immediately stop all cutting, drilling or brushing operations if it is suspected that their operations are causing damage to the host sewer. All service cutouts shall be captured and removed prior to their entry into the downstream sewer.

Openings in the installed CIPP shall be made smooth and generally conform to the shape and dimensions of the original opening within the host sewer. Jagged cut edges shall not be allowed. Cut edges shall be

made smooth and conformant with the shape and dimensions of the original openings by the Contractor's brushing of cut edges.

5.6 Inspection and Testing of Constructed CIPP

Except as modified within this Specification, inspection and testing of constructed CIPP shall be as required in either ASTM F1216 or ASTM F2019, whichever specification is applicable to the CIPP construction process chosen. The Contractor shall be responsible for the collection of samples performed in consultation with the party responsible for testing. All aspects of testing, including sample collection, sample transport, testing performance and the reporting of results shall be in accordance with the applicable standards.

Gravity pipe leakage testing shall not be required. Determination of the wall thicknesses of all constructed CIPP shall be performed; however, the minimum wall thickness of all constructed CIPP shall be equal to or greater than that designed and submitted to GPSD.

For CIPP constructed by pulling-in place and curing, using ultraviolet light, resin-impregnated, glass-reinforced plastic (GRP) fabric tubes, after completion of CIPP construction, the Contractor shall submit to GPSD information collected during the process of CIPP construction, including rates of travel of the ultraviolet assembly, internal pressures within the uncured and curing CIPP, number of lamps in operation and wall temperatures realized during CIPP construction. Such information shall be collected and recorded throughout the entirety of the process of CIPP construction, from the inflation of the uncured CIPP to the end of curing.

For CIPP constructed by inverting and curing thermo-setting, resin-impregnated tubes, after completion of CIPP construction, the Contractor shall submit to GPSD information collected during the process of CIPP construction, including pressures and temperatures relative to time at manufacturer-required inspection points. Such information shall be collected and recorded throughout the entirety of the process of CIPP construction, from the inflation of the uncured CIPP to the end of curing.

All testing is to be performed by a third-party laboratory approved by GPSD; furthermore, the laboratory shall be accredited by the American Association for Laboratory Accreditation (A2LA) to perform the applicable tests referenced within the latest version of either ASTM F1216 or ASTM F2019, whichever is applicable. Evidence of the qualifications and experience of the testing party shall be submitted by the Contractor to GPSD before work commences. Results of tests performed are to be the property of GPSD, exclusively. The results of testing shall be made available to GPSD as soon as possible so that GPSD may determine the acceptability of the work. Results shall be submitted in a format acceptable to GPSD.

Unless otherwise specified by GPSD within the Project Plans, testing results, acquired in accordance with this Specification, shall be provided for each CIPP construction. At least one sample shall be taken from each CIPP construction unless the testing-party requires more samples to perform the specified testing.

For CIPP constructed within gravity sewer pipes by inverting and curing thermo-setting, resin-impregnated, flexible tubes, the flexural modulus of installed CIPP as determined using sampling and testing methods required in ASTM F1216 shall meet or exceed 350,000 psi and not the minimum value specified in that ASTM Specification. For CIPP constructed within gravity sewer pipes by pulling-in place and curing, using ultraviolet light, resin-impregnated, glass-reinforced plastic (GRP) fabric tubes, the flexural modulus of installed CIPP as determined using sampling and testing methods required in ASTM F1216 shall meet or exceed 750,000 psi and not the minimum value specified in that ASTM Specification.

If GPSD finds the results to be unsatisfactory, GPSD shall choose the method(s) that will be used to correct any unaccepted work. The costs of correction shall be solely that of the Contractor.

6.0 Manhole Access

The Contractor shall be responsible for making accessible all manholes into which access is necessary for the construction of CIPP as specified. Making manholes accessible in advance of CIPP installation shall be performed in accordance with these Specifications except that portion of Section 093 relating to documentation and lamphole and flush tank locating.

Work performed in preparation of CIPP construction, including making manholes accessible, shall not be performed too far in advance of CIPP construction. The Contractor shall be paid only once per manhole for making a manhole accessible.

END OF SECTION