

**CITY OF FARGO SPECIFICATIONS  
CURED IN PLACE PIPE**

**PART 1  
DESCRIPTION OF WORK**

The work to be done under these Specifications shall include all labor, materials, and equipment necessary to provide for the reconstruction of sanitary sewer lines by the installation of a resin impregnated flexible tube, inverted into the existing sewer utilizing a hydrostatic head, air pressure, or other approved method. The tube shall then be cured to form a hard impermeable pipe. When cured the liner shall extend over the designated length of the existing sewer in a continuous tight fitting watertight pipe-within-a-pipe.

The cured in place pipe (CIPP) shall be fabricated from materials which when cured shall be chemically resistant to withstand internal exposure to domestic sewage.

**PART 2**  
**MATERIAL**

2.1. TUBE

The tube shall meet the requirements of ASTM F216 Section 5.1 and 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 length of the original conduit. Allowance should be made for circumferential stretching during the installation process.

2.2. RESIN

The resin shall be a general purpose, unsaturated, styrene based, thermoset resin and catalyst system or an epoxy resin and hardener that is compatible with the inversion process being used. The Resin shall meet the requirements of ASTM F1216 and the following requirements. The resin must be able to cure in the presence of water and the initiation for cure should be less than 180° F (82.2° C).

2.3. STRENGTH

The CIPP shall conform to the following minimum structural standards:

<b>Cured In Place Pipe</b>	<b>Standard</b>	<b>Result</b>
Tensile Stress	ASTM D-638	3,000 PSI
Flexural Stress	ASTM D-790	4,500 PSI
Modulus of Elasticity	ASTM D-790	250,000 PSI

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2.4. MINIMUM THICKNESS

The CIPP shall conform to the following minimum thickness standards:

Pipe Size	Thickness required with 250,000psi <u>Modulus of Elasticity</u>	Thickness required with 400,000psi <u>Modulus of Elasticity</u>
8" pipe	0.178 inches	0.153 inches
10" pipe	0.229 inches	0.196 inches
12" pipe	0.359 inches	0.332 inches

2.5. MINIMUM THICKNESS

The CIPP shall be designed as per ASTM F1216, Appendix XI. The CIPP design shall assume no bonding to the original pipe wall. The long term Flexural Modulus used in the design shall be verified by independent testing (such as the Trenchless Technology Center at Louisiana Tech University). Such long term Modulus values shall not exceed 50% of the short-term values given in Section 2.3 above. The CIPP thickness shall not be less than those shown above in Section 2.4 for the given physical properties.

**PART 3**  
**CONSTRUCTION**

3.1. PROCEDURES

The following installation procedures shall be adhered to unless otherwise approved by the engineer:

*3.1.1. SAFETY*

The installer shall carry out his operations in strict accordance with all OSHA and manufacturers safety requirements. Particular attention is drawn to those safety requirements involving working with scaffolding and entering confined spaces.

*3.1.2. CLEANING OF SEWER LINES AND SEWER OBSTRUCTION*

Prior to installation, the contractor shall clean the line that is to receive the liner. It shall be the responsibility of the installer to clear the sewer of obstructions such as solids, protruding service connections, or collapsed pipe that could prevent insertion of the liner or adherence to the sewer wall. If inspection reveals an obstruction that cannot be removed by conventional sewer cleaning equipment, the contractor shall make a point repair excavation to remove or repair the obstruction. Such excavation shall be approved in writing by the engineer prior to the commencement of the work and shall be considered as a separate pay item

*3.1.3. INSPECTION OF SEWER LINE*

Inspection of the sewer line shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by closed circuit television or man-entry. The interior of the sewer shall be carefully inspected to determine the location of any conditions that may prevent the proper installation of the liner. A videotape and log noting all services and defects shall be submitted to the engineer for future reference.

*3.1.4. BYPASSING SEWAGE*

The contractor shall provide for the flow of sewage around the pipe designated for reconstruction. The bypass shall be made by plugging the line at the upstream end and bypassing the flow downstream or to an adjacent system by pumping or other approved methods. Pumps, plugs and any bypass lines shall be of adequate size and capacity to handle the flow.

*3.1.5. RESIN IMPREGNATION*

The tube should be vacuum-impregnated with resin (wet-out) under controlled conditions. The volume of resin used shall be sufficient to fill all voids in the tube material at nominal thickness and diameter. The volume shall be adjusted by 5-10% 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.

*3.1.6. NOTIFICATION*

The contractor shall notify all parties whose service laterals will be out of commission to advise against water usage until the lateral is reconnected and the sewer back in service.

*3.2. INSTALLATION OF THE LINER*

The contractor shall designate a location where the uncured resin in the original containers and the unimpregnated tube will be vacuum impregnated prior to installation. The installer shall allow the engineer to inspect the materials and "wet out" procedure. A resin and catalyst system compatible with requirements of this method shall be used. The quantities of the liquid thermosetting materials shall be per manufacturer's standards to provide the wall thickness specified.

*3.2.1. INVERSION*

The wet out tube should be inserted through an existing manhole or other approved access by means of an inversion process and the application of a hydrostatic head, air pressure or mechanical means sufficient to fully extend the tube to the next designated manhole or termination point. The tube should be inserted into the vertical inversion standpipe or guide chute with the impermeable plastic membrane side out and attached

with a leak proof seal. The hydrostatic head or air pressure should be adjusted to cause the impregnated tube to invert from the point of inversion to the point of termination, turning the tube inside out and holding the tube tight to the wall, producing dimples at lateral connections. Care shall be taken to avoid overstressing the fabric. The tube manufacturer shall provide information on the maximum allowable tensile stress for the tube.

Before the inversion begins, the tube manufacturer shall provide the minimum pressure required to hold the tube tight against the existing conduit and the maximum allowable pressure so as not to damage the tube. Once the inversion has started, the pressure shall be maintained between the minimum and maximum pressures until the inversion has been completed. If the pressures are not maintained, the tube shall be removed from the sewer.

### *3.2.2. LUBRICANT*

The use of a lubricant during inversion shall be used to reduce friction during inversion. The lubricant shall be a nontoxic, oil-based product that has no detrimental effect on the tube, does not support bacteria growth or affect the general characteristics of the domestic sewage.

### *3.2.3. CURING*

After inversion has been completed, the inversion water shall be uniformly raised above the temperature required to effect a cure of the resin as recommended by the manufacturer. The inversion water shall be recirculated by means of a pump throughout the tube and temperature monitors shall be placed on the ingoing and outgoing lines to determine that the correct temperature is maintained. Additionally a temperature gauge shall be installed between the tube and the pipe invert at the termination point to determine temperatures during cure.

If steam is used to cure the tube, the temperature within the tube shall be uniformly raised by means of steam generating equipment. Temperature gauges shall be placed on the outgoing line and also gauges shall be placed between the tube and invert of the existing pipe at both the upper and lower ends of the sewer to determine the temperature during cure.

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The recommended temperature shall be held for the length of time recommended by the resin manufacturer. Initial cure occurs during heat up and is indicated when the exposed portions of the tube appear to be hard and sound and the remote temperature sensor(s) indicate that the temperature is of a magnitude to realize an exotherm or cure in the resin. The temperature should then be raised to post cure temperatures and held for the duration recommended by the resin manufacturer.

Pressure shall be maintained as per the manufacturer's recommendations to hold the flexible tube tight against the existing sewer. This pressure shall be maintained until the cure has been completed.

The contractor shall provide a continuous log of the designated temperatures and pressures during the time of the cure. The contractor shall also furnish the engineer with the resin manufacturers recommended cure temperatures and pressures prior to the start of the inversion process.

### *3.2.4. COOL DOWN*

The liner pipe shall be cooled down to a temperature below 100° F (113° F for steam cured) before relieving the internal pressure. Cool down may be accomplished by introducing cool water into the section as the water and/or steam is drained off through a small hole in the downstream end. Care must be taken to avoid causing a vacuum that could damage the newly installed pipe.

### 3.3. FINISH

The finished CIPP shall be continuous over the entire length between manholes and be free from visual defects such as foreign inclusions, dry spots, lifts, pinholes or delamination. The new pipe shall be free of leaks and any defects that will affect the integrity or strength of the CIPP shall be repaired at the contractors expense in a manner acceptable to the engineer.

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### 3.4. SEALING CIPP AT MANHOLES

If the CIPP fails to make a tight seal at the manhole walls the contractor shall apply a resin mixture seal at that point. The resin seal shall be compatible with the resin mixture of the CIPP.

### 3.5. SERVICE CONNECTIONS

After the new pipe has been cured in place, the contractor shall reconnect all existing active service connections. This shall be done without excavation by means of a television camera and cutting device or by man entry and a cutting device. The services shall be restored to not less than 90% of their original capacity and shall be free of any sharp edges or protrusions, which could cause paper, rags or debris to accumulate.

### 3.6. INSPECTION

Two CIPP samples shall be prepared for each inversion length between manholes. The samples shall be fabricated from material taken from the tube and the resin/catalyst system used. The samples shall be clamped between flat plates and the mold placed in the downtube when circulating water is used or in the silencer when steam is used. The samples shall be large enough to provide a minimum of five specimens for flexural and tensile testing. After curing, the samples will be submitted to an independent testing firm to meet the requirements of Section 2.3.

**PART 4**  
**GUARANTEE, MEASUREMENT & PAYMENT**

4.1. GUARANTEE

The guarantee shall cover the contract as to workmanship and material for a period of one (1) year from the date of final acceptance and payment.

4.2 MEASUREMENT AND PAYMENT

*4.2.1. CURED IN PLACE PIPE*

The CIPP will be paid on the actual number of feet of the various sizes of liner installed, as measured along the centerline of the existing pipe between the manholes or to the ends of the liner installed. Payment shall include furnishing and installing the liner, curing, sealing at the manholes, cleaning and televising, bypassing of sewage, insertion equipment and all incidentals required to reline the existing sewer main in place and accepted.

*4.2.2. SEWER SERVICE REONNNECTION*

All costs of making sewer service reconnections will be included in the bid price for Reconnect Sewer Service.

*4.2.3. CLEANING AND TELEVISIONING*

Cleaning and televising costs are incidental and shall be included in the unit bid price for the Cured in Place Pipe.

*4.2.4. PUMPING SEWAGE*

All costs associated with the bypassing of the sewage shall be incidental and included in the unit bid price for the Cured in Place Pipe.