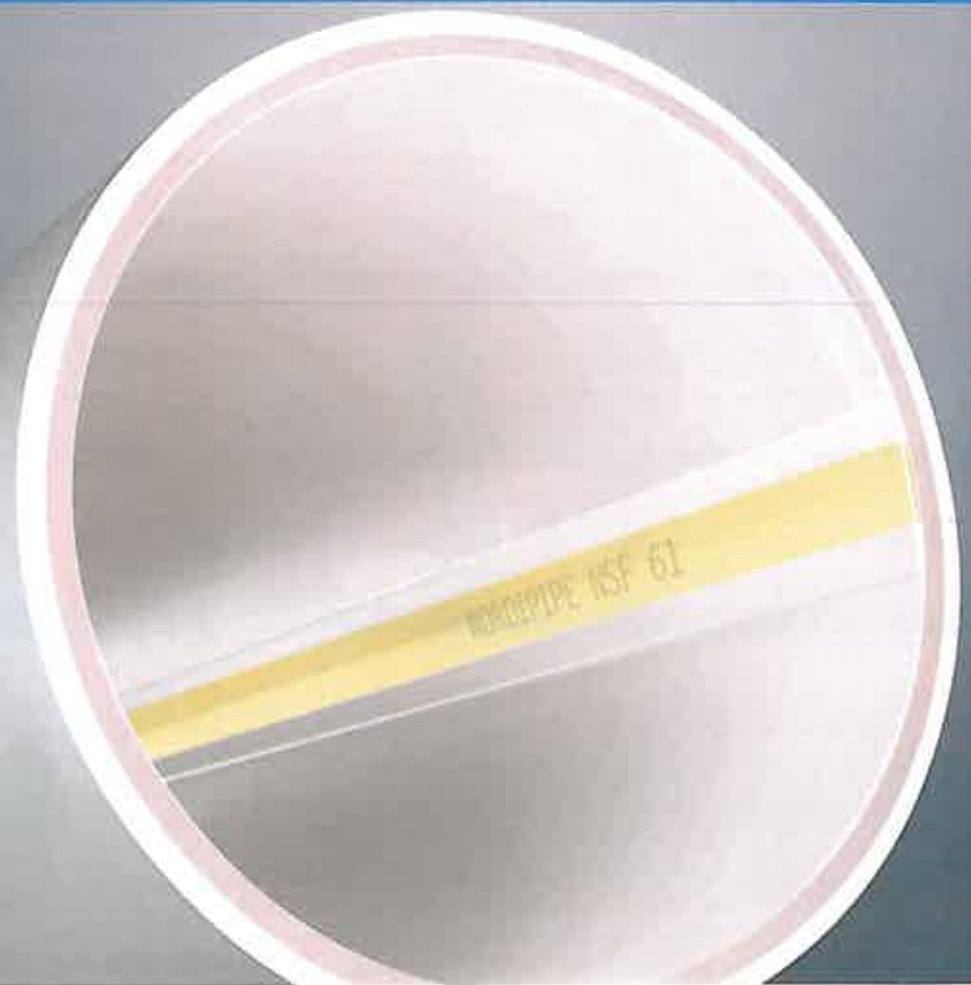


NORDIPIPE™ SPECIFICATIONS

FOR THE REHABILITATION OF POTABLE WATER AND
PRESSURE PIPELINES WITH A GLASS-FIBER REINFORCED
CURED-IN-PLACE PIPE LINING



CURED-IN-PLACE PIPE FOR POTABLE WATER AND PRESSURE PIPELINES

PART 1 - GENERAL

1.01 SUMMARY

- A. It is the intent of this specification to provide for the structural repair and for the corrosion protection of pipelines through the installation of a resin-impregnated flexible tube, which is tightly formed to the original conduit. The resin is cured using either hot water under hydrostatic pressure or steam pressure within the tube. The Cured-In-Place Pipe (CIPP) will be continuous and tight fitting.
- B. The Contractor shall furnish all materials for the cured-in-place pipe (CIPP), in accordance with the provisions of the Contract Documents.
- C. This specification pertains to the lining of the existing 6"– 48" diameter host pipes.

1.02 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM F1216: Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
 - 2. ASTM F1743: Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)
 - 3. ASTM D5813: Cured-in-Place Thermosetting Resin Sewer Pipe
 - 4. ASTM D790: Test Methods for Flexural Properties of Un-reinforced and Reinforced Plastics and Electrical Insulating Materials
 - 5. D2990: Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics
- B. NSF/American National Standards Institute (ANSI):
 - 1. NSF/ANSI 61: Drinking Water Components

1.03 SUBMITTALS

- A. Product Data: Furnish manufacturer's technical data for cured-in-place pipe (CIPP), including installation instructions, independent laboratory test results, and handling and storage instructions prior to installation.
- B. Quality Assurance Submittals:
1. Manufacturer's written letter of certification identifying Contractor as a licensed installer.
 2. ANSI/NSF Standard 61 Certificate for the proposed system where applicable.
 3. Certificate of Compliance with Standards listed in sections 1.2 A. and B.
 4. Video inspection equipment and recording method(s)
 5. Design Calculations prepared and stamp by a Professional Engineer.
 6. Resin yield calculations per unit length for each diameter and thickness of Tubes specified. The calculations should show compliance with 3.02, A., 1., of this specification.
 7. Where applicable, a suitable by-pass and temporary water service plan for affected customers along with the disinfection procedure.

1.04 QUALITY ASSURANCE

1. The pipe lining materials shall be NORDIPIPE™ as manufactured and supplied by SEKISUI NordiTube, Inc. of Hammond, Louisiana or Engineer approved equal. Only structural pipe lining materials in conformance with the requirements of ASTM F1216 shall be considered as an "or equal" for this item.
2. The Contractor and/or his subcontractor must be properly licensed by the liner manufacturer to perform the rehabilitation work.
3. The Contractor and/or his subcontractor shall not have less than 3 years of active experience in the installation of CIPP liners and shall have completed projects of similar size as required for this project.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Tube:

1. Tube: The flexible tube shall consist of one or more layers of absorbent woven or non woven felt fabric or a combination thereof with composite reinforcement material that meets the requirements of ASTM F1216, Section 5.1 or ASTM F1743, Section 5.2.1 The tube shall be constructed to withstand installation pressures and stretch to fit irregular pipe sections.
2. The resin impregnated tube shall have a relatively uniform thickness that when compressed at installation pressures will equal or exceed the calculated minimum design thickness.
3. The tube shall be manufactured to a size that when installed will tightly fit the internal circumference and length of the original pipe. Allowance shall be made for circumferential stretching during inversion.
4. The outside layer of the tube shall be coated with an impermeable, flexible membrane that will contain the resin and be compatible with the resin system used.
5. The tube shall contain no encapsulated elastomeric layers. No dry or unsaturated layers shall be evident after installation.
6. The wall color of the interior pipe surface of CIPP after installation shall be a relatively light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made.
7. Seams shall meet the minimum strength requirements of ASTM D-5813 Subsection 6.1.
8. The tube shall be marked for distance at regular intervals along its entire length, not to exceed 5 feet. Such markings shall include the Manufacturers name or identifying symbol. Where applicable, the tube shall be marked "NSF 61" in accordance with the NSF protocol.

B. Resin:

1. The resin system shall be thermoset polyester, vinyl ester or epoxy system including all required catalysts, initiators or hardeners that when cured within the tube creates a composite that satisfies the requirements of ASTM F1216 and ASTM F1743 and the physical properties of the project. The resin shall produce a CIPP that will comply with the structural and chemical resistance requirements of this specification.

2. The resin for CIPP for potable water applications must be ANSI/NSF 61-approved or equivalent.
3. The resin for raw or non-potable water must meet applicable corrosion resistance requirements.

C. Pressure Rating:

1. The pressure rating of the installed CIPP system shall be suitable for the application per the applicable design mode in ASTM F1216 Appendix X1, Section X1.3.

2.02 STRUCTURAL REQUIREMENTS

- A. The CIPP shall be designed as per ASTM F1216, Appendix X1. Section X.1.3. The CIPP design shall assume no bonding to the original pipe wall.
- B. The layers of the cured CIPP shall be suitably bonded. It shall not be possible to separate any two layers of the CIPP with a probe or point of a knife blade so that layers separate cleanly or the probe or knife blade moves freely between the layers. If the layers separate during field sample testing, new samples will be required to be obtained from the installed pipe. Any reoccurrence may cause rejection of work.
- C. Any layers of the tube that are not saturated with resin prior to insertion into the existing pipe shall not be included in the structural CIPP wall thickness computation.
- D. The initial CIPP structural properties shall meet the minimum values in ASTM F 1216, *TABLE 1 CIPP Initial Structural Properties* or the values as used in the design.

2.03 DESIGN PARAMETERS

- A. The design of the pipe lining shall be based on the following parameters, unless otherwise specified by the Owner:

Diameter	20" nominal ID
Internal Operating Pressure	80 psi
Internal Vacuum, if applicable	14.7 psi
Minimum Operating Temperature	50°F
Soil Depth (above top of pipe)	6-9 feet-verify with test pits
Soil Modulus	1000 psi
Ground Water Depth (above invert)	2 feet
Safety Factor	2
Design Condition	Partially/Fully Deteriorated
Live Loads	H20

MINIMUM PHYSICAL PROPERTIES

Property	ASTM Test Method	Minimum Value*
Flexural Modulus of Elasticity	D790	250,000 psi
Flexural Strength	D790	4,500 psi
Tensile Strength	D638	3,000 psi

**Values are for design conditions @ 75°F (25°C)*

2.04 PERFORMANCE REQUIREMENTS

- A. Chemical Resistance: The CIPP shall meet the chemical resistance requirements of the application. For sewers, the chemical resistance requirements shall meet ASTM F1216, Appendix X2.
- B. Hydraulic Capacity: Overall, the hydraulic cross-section shall be maintained as large as possible. The CIPP shall have a minimum of the full flow capacity of the original pipe before rehabilitation. The calculated flow capacities should be derived by using a commonly accepted roughness coefficient (Hazen Williams) for the liner material and the existing host pipe material taking into consideration of its age and condition.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Cleaning Pipe Lines: The Contractor shall remove all internal debris and tuberculation from the host pipe line that will interfere with the installation of CIPP or be detrimental to the final product. A video inspection shall confirm the adequacy of the cleaning.
- B. Obstructions: All obstructions that could be detrimental to the structural integrity of the pressure pipe shall be noted and brought to the attention of the Buyer.
- C. Appenditures: All valves, tees, services and so on shall be noted on an inspection log. A recorded video inspection is standard practice unless otherwise pre-approved by the Buyer.

3.02 INSTALLATION

- A. CIPP installation shall be in accordance with ASTM F1216, Section 7, or ASTM F1743, Section 6, with the following modifications:
 - 1. Resin Impregnation: The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the loss of resin during installation through irregularities in the original pipe wall.

A vacuum impregnation process should be used that will sufficiently saturate the tube. The leading edge of the resin slug shall be as near to perpendicular to the longitudinal axis of the tube as possible. A roller system shall be used to uniformly distribute and meter the resin throughout the tube.
 - 2. Tube Insertion: The wet out tube shall be positioned in the pipeline using either water or air inversion. The tube should be inverted through an existing manhole or approved access point and fully extend to the next designated manhole or termination point.
 - 3. Temperature gauges shall be placed between the tube and the host pipe insertion and termination locations to monitor the temperatures during the cure cycle.
 - 4. Curing shall be accomplished by utilizing circulated hot water under hydrostatic pressure or air/steam pressure in accordance with the manufacturer's recommended cure schedule.
 - 5. Upon completion of the insertion and curing of the CIPP, NSF/ANSI 61 approved WEKO-Seal type seals will be installed at terminal ends according to the manufacturer's recommendations.

3.03 ACCEPTANCE TESTING

- A. CIPP flat plate samples shall be prepared and physical properties tested in accordance with ASTM F1216 or ASTM F1743 per the manufacturer's recommendations.
- B. Wall thickness of samples shall be determined as described in paragraph 8.1.6 of ASTM F1743. The minimum wall thickness at any point shall not be less than the minimum design wall thickness as calculated in section 2.02 above.
- C. Inspection of the CIPP shall be in accordance with ASTM F1743, Section 8.6.
- D. When required a hydrostatic pressure test shall be performed according to ASTM F1216, Section 8.3.
- E. When required by the Owner of the potable water pipes, a disinfection procedure according to applicable AWWA Standards or local construction standards and a suitable laboratory test conducted on a water sample to confirm compliance.

3.04 ACCEPTANCE

- A. The CIPP shall be deemed acceptable when the installation is performed according to Section 3.02 and the applicable tests according to Section 3.03 are satisfied.