UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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SECTION 22 05 83.63

CURED-IN-PLACE PIPE (CIPP) LINING
11/16

NOTE: This guide specification covers the requirements for cured-in-place pipe lining, including applicable industry standards, installation, and performance verification for facility interior [roof drain leader piping from the roof to floor level][cold and hot potable water][drain][electrical conduit][gas][process piping][steam][ventilation][waste water]piping systems.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in the respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

PART 1 GENERAL

NOTE: This section addresses the procedures for the reconstruction of pipelines and conduits, 10 to 244 cm 4 to 96 in. diameter, by the pulled-in-place installation of a resin-impregnated, flexible fabric tube into an existing conduit and secondary inflation of the tube through the inversion of a calibration hose by the use of a hydrostatic head or air pressure. Safety issues relating to the use of this specification should be addressed in a separate section.

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NOTE: Show the following information on the project drawings:

1. Exact Duplication in Terminology: Specifications and drawings come from different computer programs. The terminology describing these items, systems, equipment, and materials comes from different databases. For this reason, ensure that each piece of equipment, or item, or system is identified in the same way in the specification and drawings. Ensure that the same terminology is used in drawings and specifications, in specification sections and drawing sections, and in all drawings.

2. Insert additional items to be shown on the drawings.

****

1.1 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 13A	(2010; Errata 1 2014; Errata 2-3 2015) Specification for Drilling-Fluid Materials

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C950	(2020) Fiberglass Pressure Pipe

ASTM INTERNATIONAL (ASTM)

ASTM D543	(2020) Standard Practices for Evaluating the Resistance of Plastics to Chemical

	Reagents
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics
ASTM D790	(2017) Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM F1216	(2016) Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
ASTM F1743	(2016) Standard Practice for Rehabilitation of Existing Pipeline and Conduits by Pulled-In-Place Installation of Cured-In-Place Thermosetting Resin Pipe (CIPP)

1.2 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Installation Equipment; G[, [____]]

CIPP Lining Tube; G[, [____]]

Pipe Thermoset Epoxy Resin; G[, [____]]

Liner Materials; G[, [____]]

SD-08 Manufacturer's Instructions

CIPP Manufacturer's Written Installation Instructions

SD-11 Closeout Submittals

Report Summarizing The Extent Of the Pipe Lining Performed; G[, [____]]

Pipe Pre-Lining Inspection

Pipe Post-Lining Inspection

Manufacturer's Warranty

Record Drawings

1.3 PROJECT/SITE CONDITIONS

Inspect the line with closed-circuit television (CCTV) and determine the overall condition of the pipe before the pre-conditioning of the pipe.

1.4 WARRANTY

Submit [_____] copies of the signed Manufacturer's Warranty for products within [_____] [days] [weeks] of final completion of the work.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide a new cured-in-place pipe (CIPP) lining system[s] for the [roof drain leader piping from the roof to floor level][cold and hot potable water piping][drain piping][electrical conduit][gas][process piping][steam][ventilation][wastewater piping][_____] that is complete and ready for operation.

Perform the reconstruction using a tube of one or more layers of flexible needle-perforated felt or an equivalent non-woven perforated material, of a specified length not to exceed 18.3 meters 60 feet, and a thermo-set resin with physical and chemical properties appropriate for the

application, in accordance with ASTM F1216. Submit product data for the epoxy resin, liner materials, and installation equipment. Ensure that all drilling fluids conform to API Spec 13A.

2.2 MATERIALS

2.2.1 CIPP Lining Tube

Provide a liner tube consisting of one or more layers of flexible needle-perforated felt or an equivalent non-woven perforated material, continuous in length with uniform wall thickness. Allow overlapping sections in the length of the liner. Ensure that the liner tube can conform to 45- and 90-degree bends, offset joints, bells, and disfigured pipe sections.

Provide an integrated bladder within the felt tube. Ensure that the bladder is made from materials compatible with the felt and resin systems used and can withstand the required installation pressure.

[Provide fiberglass pressure pipe in accordance with AWWA C950.

]2.2.2 CIPP Properties

Provide a CIPP that meets minimum chemical-resistance requirements in accordance with ASTM D543. Conduct a test whereby the CIPP is exposed to the chemical solutions listed in Table 1 at temperatures up to 23.9 degrees C 75 degrees F. Conduct this test for a minimum of one month. Do not accept the CIPP if the values for the CIPP's structural properties show a loss of 20 percent or more from the initial values.

TABLE 1 - CHEMICAL-RESISTANCE REQUIREMENTS	
Chemical Solution Concentration	Percent
Tap Water (pH 6-9)	100.0
Nitric Acid	5.0
Phosphoric Acid	10.0
Sulfuric Acid	10.0
Gasoline	100.0
Vegetable Oil	100.0
Detergent or Soap	0.1

Ensure that the CIPP meets the minimum structural properties listed in Table 2:

TABLE 2 - CIPP INITIAL STRUCTURAL PROPERTIES - ASTM F1743		
Property	ASTM Test Method	Minimum Value
Tensile Strength	ASTM D638	20684 kilopascal

TABLE 2 - CIPP INITIAL STRUCTURAL PROPERTIES - ASTM F1743		
Property	ASTM Test Method	Minimum Value
Flexural Strength	ASTM D790	31026 kilopascal
Short Term Flexural Modulus of Elasticity	ASTM D790	1724 megapascal

TABLE 2 - CIPP INITIAL STRUCTURAL PROPERTIES - ASTM F1743		
Property	ASTM Test Method	Minimum Value
Tensile Strength	ASTM D638	3,000 psi
Flexural Strength	ASTM D790	4,500 psi
Short-Term Flexural Modulus of Elasticity	ASTM D790	250,000 psi

Provide a cured liner with a light blue reflective internal wall color so that a CCTV inspection can show details clearly.

2.2.3 Resin

Provide an epoxy-resin-impregnated, cured tube that is resistant to shrinkage, corrosion, and oxidation resistant to abrasion from solids, grit, and sand in rainwater; and is solvent-free. Use a resin with proven resistance to storm water and ultra-violet light (sunlight) before to installation. Do not use polyester or vinyl ester resins.

Ensure that the proposed resin system does not contain silicones, stearates, or natural waxes that would adversely affect the adhesive properties or other chemical or physical properties of the CIPP liner.

PART 3 EXECUTION

3.1 INSTALLATION

Install the CIPP system, including materials, workmanship, fabrication, assembly, erection, examination, and inspection.

3.1.1 General

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NOTE: Use the first paragraph for roof drains only.
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[Inform the Contracting Officer of a temporary roof drain flow stoppage, for a period typically lasting 2 to 3 days. Provide a by-pass of the collector pipe.

] For access at the bottom of the pipe sections, remove pipe sections near the floor at the point on the vertical rain leader specified in the design drawings.

3.1.2 Deviations

If the pre-installation inspection reveals conditions in the rain leader that are substantially different from those used in the design of wall thickness, liner tube construction, liner tube length, or resin system, notify the Contracting Officer and provide a videotape recording of the existing conditions and design data. Do not proceed without direction from the Contracting Officer.

3.1.3 Pipe Preparation

Precondition the pipe section by cleaning the section and removing corrosion, grease buildup, or other obstructions that may interfere with lining operations.

Leave obstructions in place that are less than 15 percent of the pipe diameter and cannot be removed from the pipe, and line over them.

To ensure that the pipe is ready for lining, use a CCTV to inspect the line immediately before lining and after cleaning is complete.

3.1.4 CIPP Installation Procedure

3.1.4.1 Wet Out

Calculate the amount of resin and catalyst required. Measure and mix the resin and catalyst. Saturate and impregnate the flexible felt tube with the amount of epoxy resin that was estimated before installation. Handle the resin-impregnated flexible tube in a way that retards or prevents resin from setting until the resin is ready for insertion.

3.1.4.2 Insertion

Use the pull in place method to install the liner or bladder system. Pull the liner or bladder system to the specified location in the pipe. Use compressed air to inflate the bladder to a pressure adequate to form the liner so that the liner fits tightly against the internal circumference of the pipe and causes the resin to migrate into pipe joints, voids and defects. Install the liner at low pressure (not to exceed 69 kilopascal 10 psi) in order to prevent damage to the host pipe (or further damage, if damage has already occurred).

3.1.4.3 Curing

Use compressed air to inflate the bladder and leave the liner in place until the resin-curing cycle is complete (within one hour at ambient temperature).

When the curing process is complete, release the pressure and pull out the inflation bladder. Ensure that the cured composite liner remains in place within the host pipe and that the liner provides a smooth bore interior that conforms to the existing pipe[, eliminating rain water leakage]. Ensure that the tube is continuous in length and wall thickness, and that the tube is uniform. If defects that were in the original pipe remain, reline the pipe again.

3.1.4.4 Finish

Ensure that the host pipe has not been left with any barriers, coatings,

or material other than the cured liner tube or resin composite, which is specifically designed for desirable physical and chemical-resistance properties. Remove materials used in the installation, except for the cured liner tube or resin composite. Remove the cured liner tube or resin composite pipes left protruding from the service connection. Ensure that the finished CIPP is continuous and free from visual defects such as inclusions of foreign materials, dry spots, pinholes, and delimitation.

3.1.5 Liner Inspection

Perform a final CCTV inspection to verify that the composite liner has cured and that the integrity of the liner is maintained.

3.2 FIELD QUALITY CONTROL

Test system in accordance with ASTM F1743, as supplemented and modified by the CIPP manufacturer's written installation instructions.

Upon completion, submit DVD records of the pre-lining inspection and post-lining inspection, along with a written report summarizing the extent of the pipe lining performed. Update pipe the lining contract record drawings to reflect the as-built condition after the lining is complete and submit the drawings to the Contracting Officer. The Contracting Officer may review the video and documentation, and may inspect the work site to determine that the scope of work is complete, that the work is satisfactory, and that the site has been returned to its original condition.

3.3 ADJUSTING AND CLEANING

After liner installation has been completed and accepted, clean the entire project area and restore the site to its original condition before work began. Dispose of excess material and debris not incorporated into the permanent installation.

-- End of Section --