SECTION 33 0530

coatings and LININGs FOR UTILITIES

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LANL MASTER SPECIFICATION SECTION

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This template must be edited for each project.  In doing so, specifier must add job-specific requirements.  Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.  Once the choice is made or text supplied, remove the brackets.  The specifications must also be edited to delete specification requirements for processes, items, or designs that are not included in the project - and specifiers’ notes such as these.  Additional tailoring requirements are contained in ESM [Chapter 1](http://engstandards.lanl.gov/ESM_Chapters.shtml#esm1) Section Z10 Att. F, Specifications.

To seek a variance from requirements in the Engineering Standards Manual, contact the Engineering Standards Manual Civil [POC](https://engstandards.lanl.gov/POCs.shtml#civil). Please contact POC with suggestions for improvement as well.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General requirements.

Specification developed for ML-4 projects.  For ML-1, 2, and 3 applications, additional requirements and independent reviews should be added if increased confidence in procurement or execution is desired; see ESM Chapter 1 Section Z10 Specifications and Quality requirements.

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1. GENERAL
	* + 1. SUMMARY
				1. Section Includes:

Field- and factory-applied coating and lining to provide both external and internal corrosion protection for welded and flanged underground black steel piping systems (e.g., water).

Cementitous and asphaltic coatings and linings for black steel and ductile iron pipe.

Joint and component taping.

Holiday and thickness testing.

* + - * 1. Related Sections:

Section 01 2500 - Substitution Procedures

Section 01 3300 - Submittal Procedures

Section 01 4000 - Quality Requirements

[Section 13 4713 - Cathodic Protection]

[Section 23 2113 - Hydronic Piping]

 [Section 33 1000 – Water Utilities]

[Section 33 3000 – Sanitary Sewerage Utilities]

[Section 33 5100 – Natural Gas Distribution]

* + - 1. REFERENCES
				1. General

The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.

* + - * 1. ASTM International

ASTM D149, Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

ASTM D570, Standard Test Method for Water Absorption of Plastics

ASTM D1002, Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)

ASTM D2583, Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor

ASTM G8, Standard Test Methods for Cathodic Disbonding of Pipeline Coatings

ASTM A742/A742M, Standard Specification for Steel Sheet, Metallic Coated and Polymer Precoated for Corrugated Steel Pipe

ASTM G62, Standard Test Methods for Holiday Detection in Pipeline Coatings

* + - * 1. American Water Works Association (AWWA)

AWWA ­C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

AWWA ­C214, Tape Coating Systems for the Exterior of Steel Water Pipelines

* + - * 1. North American Corrosion Engineers (NACE)

NACE Standard SP0394-[2013], Application, Performance, and Quality Control of Plant applied, Fusion-Bonded Epoxy External Pipe Coating

NACE Standard RP0402-[2002], Field Applied Fusion-Bonded Epoxy (FBE) Pipe Coating systems for Girth welds: Application, Performance, and Quality Control

* + - * 1. Society for Protective Coatings (SSPC)

SP3, Power Tool Cleaning

* + - 1. SUBMITTALS
				1. Submit the following documents for review per Section 01 3300, *Submittal Procedures.*

Written Materials Certification

Certification that the coating and lining have been tested and satisfactorily used for direct underground burial in utility and industrial process piping systems for a period of at least five years and will meet the performance and requirements of Article 2.1.

Inspection and Testing

Three certified copies of test procedures, test logs, and test results to show satisfactory completion of testing specified.

For plant-applied, fusion-bonded epoxy external pipe coating, copies of all records from quality control, inspection, and testing per NACE SP0394, within 24 hours of inspection or test.

* + - 1. QUALITY ASSURANCE
				1. Lining and coating work is subject to inspection and testing by LANL, including inspection of facilities, inspection of welding, surface preparation, and holiday and thickness testing of finished coating.
				2. Notify LANL when surface preparation is complete and ready for inspection, and when coating and wrapping is complete and ready for inspection, both in shop and in field.
				3. Coated piping shall not be shipped from the shop, nor shall piping in the field be closed up or backfilled, until coating is approved by LANL.
				4. Repair coating damage, holidays, or other deficiencies to the satisfaction of LANL.

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Factory pre-insulated piping systems (e.g., Perma Pipe, Multi Therm 500, (303) 751- 4100 or Rovanco Corp, (505) 344-7100, may be used as a replacement for corrosion control and/or field insulation with LANL approval. Likewise, solidifying granular pour-in-place insulation such as Gilsulate 500XR may be allowed. Consult LANL and modify Section accordingly.

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1. PRODUCTS
	* + 1. COATING AND LINING MATERIAL
		1. BLACK STEEL PIPE BELOW GRADE. Factory or field-applied coating or field-wrap coating such as Polyken that is suitable for the operating temperature of the piping system.
			1. Factory Applied Corrosion Control Coating: Factory applied fused system consisting of: an adhesive primer layer, with minimum 10-mil thermoplastic elastomer layer and minimum 40-mil polyolefin top layer containing UV protection; or alternate of an epoxy primer layer with minimum 50-mil, high-density polyethylene top layer or an approved equal. Product marking shall be transferred to and stenciled to the outside of the pipe coating. Minimum transferred information shall include: pipe specifications, grade, size, type, and heat number in accordance with the certified material test report and the product marking. Manufacturers:
				1. 3MTM ScotchKoteTM Fusion Bonded Epoxy (FBE) Coating System or LANL-approved equal.
				2. Inside Lining [as applicable]: [cement mortar-lined] [asphaltic lining] [corrosion control thin-film coatings from 0.0254 to 0.254 mm (1 to 10 mils) per Article 3.3]
				3. [Manufacturer and model numbers]
			2. Field-Applied, Fusion-Bonded Epoxy (FBE): Provide manufacturer-recommended primer or LANL-approved equal. Pre-clean pipe per manufacturer’s requirements. FBE system shall be a two-layer system. Maximum thickness 60 mils. Manufacturers:
				1. 3MTM ScotchKoteTM Fusion Bonded Epoxy (FBE) Coating System or LANL-approved equal.
			3. Piping Corrosion Tape for Joints and Fittings: Polyken #934-35 35-mil polyethylene tape or LANL-approved equal. Provide manufacturer-recommended primer (Polyken 1027). Maximum Operating Temperature [XXX]. Pre-clean pipe per tape manufacturer’s requirements. All joints and fittings field-wrapped with a minimum of two layers of 35-mil corrosion tape.
		2. DUCTILE IRON PIPE BELOW GRADE [Specify factory coating suitable for the operating temperature and application of the piping system.]
			1. Outside Coating: [cement mortar-lined with seal coated with asphaltic materials outside coating.] [asphaltic outside coating] [corrosion control thin-film coatings from 0.0254 to 0.254 mm (1 to 10 mils) per Article 3.6]
			2. [Manufacturer and model numbers]
			3. Inside Lining [as applicable]: [cement mortar-lined] [asphaltic lining] [corrosion control thin-film coatings from 0.0254 to 0.254 mm (1 to 10 mils) per Article 3.6]
			4. [Manufacturer and model numbers]
			5. SOURCE QUALITY CONTROL
				1. Shop Tests: The finish coating on epoxy-lined and coated piping and accessories shall be proven satisfactory by the following shop tests which shall be performed by the Subcontractor's independent testing laboratory.

Holiday Tests: Perform an electrical holiday-detection inspection on coated and/or wrapped underground piping systems.

The inspection shall be made by a skilled operator using an electrical holiday detector. Low-voltage, wet-sponge type detectors are not acceptable. Operate the detector unit at the voltage between the electrode and the coated pipe recommended by the coating manufacturer, or approximately 100­V/mil (4­kV/mm) of coating thickness.

Minimize the electrical resistance in the holiday detector's ground-return system, which consists of the ground wire and the coated metal pipe. Where possible, make direct electrical connection between the detector and the metal structure.

Repair holidays to the satisfaction of LANL.

Coating Thickness: Determine the thickness of coated surfaces by use of a magnetic-type thickness gauge.

1. EXECUTION
	* + 1. SURFACE PREPARATION
				1. General:

Joints over which coating is to be applied shall be continuous, solid welded.

Grind welds smooth. Welds shall be free of pits, craters, cracks, porosity, high spots, and pockets.

Form or grind outside corners and edges to a radius of at least 1/16 inch (1.5­mm).

Form, grind, or machine inside corners to provide smooth corners with a radius of at least 1/16 inch (1.5­mm).

Surfaces to be coated shall be clean, free of grease, oil, and finger marks. Use a non-organic solvent approved by LANL for cleaning when required.

* + - * 1. After cleaning, surfaces shall be abrasive cleaned to a minimum commercial blast surface finish in accordance with SSPC­ SP­3.
				2. Apply the lining and coating within three hours of the abrasive blasting operation.
			1. COATING AND LINING APPLICATION
				1. Liquid Epoxy Coating

Apply liquid epoxy coating per manufacturer application instructions. When ambient conditions include precipitation, high winds, or low temperatures precautions should be taken to protect the coating during application and in some instances after application.

* + - * 1. Polyken 934 Cold-applied tape system

Apply Polyken 934 tape system per manufacturer application instructions. When ambient conditions include precipitation, high winds, or low temperatures precautions should be taken to protect the coating during application and in some instances after application.

* + - 1. FIELD QUALITY CONTROL
				1. The finished coating and wrapping on epoxy lined and/or coated piping shall be proven satisfactory by the following field tests which shall be performed by the Subcontractor's independent testing laboratory.
				2. Test coated underground steel piping for holidays:

Test the following buried coated steel piping systems for holidays:

Natural gas.

[List other piping systems].

Follow ASTM G62, *Standard Test Method for Holiday Detection in Pipeline Coatings*. Method A or B shall be used for determining pinholes, voids, or metal particles protruding through the coating. Method B shall be used to verify the thin spots in the coating.

Data report shall conform to ASTM G62. The report shall include the following:

Complete identification of the specimen including:

Names and code number of the coating, pipe diameter, source, production data, and production run number.

For polymeric precoated corrugated steel pipe, the reporting requirements of ASTM A742/A742M shall be used for identification;

Name and type of instrument used, method of standardization, and whether Method A or Method B was used;

If Method B was used, state the test voltage, the method used to calculate the voltage, and the minimum allowable thickness in mils of the test sample.

Perform holiday test in accordance with the following procedure:

After pipe has been welded, joints wrapped, and pipe is ready for lowering into trench, test coating for flaws (holidays). Test coated piping system throughout its length for flaws in coating system by means of a high-potential flaw detector that can impress a maximum of 8,000 volts across coating. One electrode of tester shall maintain complete circumferential contact with coating while transversing entire length of coating system and other electrode shall be the underlying metal pipe. An electrical discharge through coating detected visually or by instrument, shall constitute failure of this test.

Actual working voltage of detector on pipe will depend upon thickness of coating and size of pipe. A thin coating on a large pipe will offer a capacitive load to the detector that will drop the working voltage several thousand volts below the "no-load" voltage. Detector output may also have to be increased to overcome conditions such as extremely dry rock, or sandy soil.

Important!Do not cut ground cable to a shorter length. The length supplied is important to proper operation of the detector. Keep as much of the cable as possible in contact with the earth. Straighten out kinks where possible and do not let it ride up over skids. In dry areas it will help to drag the cable in the ditch where there is more moisture. The pipe should be grounded.

Mark holidays as they are found and repair prior to lowering pipe into trench. Repair holidays in factory coating by removing initial coating and undercoating for a minimum of 4 inches on each side of holiday. Remove coating around holiday and feather edge to pipe wall for sufficient distance to make a satisfactory repair. Apply primer (Polyken 1027) to the holiday to form a bond over the entire surface of the holiday and then spirally wrap pipe with a double layer of half-lapped 35 mil polyethylene tape (Polyken 934) for a minimum of 2 inches on each side of the holiday.

Repair holidays in joint wrappings by removing field applied coating in area of holiday and rewrapping. LANL STR or designated representative will approve all areas of joint coating.

* + - * 1. Coating Thickness: Determine the thickness of field-coated surfaces by use of a magnetic-type thickness gauge.

END OF SECTION

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Do not delete the following reference information:

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THE FOLLOWING STATEMENT is FOR LANL USE ONLY

This Project Specification section is based on LANL Master Specification Section 33 0530, Rev. 0, dated June 28, 2019.