CTSL1000
Application of Internal Linings
PURPOSE AND USE OF PROCESS INDUSTRY PRACTICES

In an effort to minimize the cost of process industry facilities, this Practice has been prepared from the technical requirements in the existing standards of major industrial users, contractors, or standards organizations. By harmonizing these technical requirements into a single set of Practices, administrative, application, and engineering costs to both the purchaser and the manufacturer should be reduced. While this Practice is expected to incorporate the majority of requirements of most users, individual applications may involve requirements that will be appended to and take precedence over this Practice. Determinations concerning fitness for purpose and particular matters or application of the Practice to particular project or engineering situations should not be made solely on information contained in these materials. The use of trade names from time to time should not be viewed as an expression of preference but rather recognized as normal usage in the trade. Other brands having the same specifications are equally correct and may be substituted for those named. All Practices or guidelines are intended to be consistent with applicable laws and regulations including OSHA requirements. To the extent these Practices or guidelines should conflict with OSHA or other applicable laws or regulations, such laws or regulations must be followed. Consult an appropriate professional before applying or acting on any material contained in or suggested by the Practice.

This Practice is subject to revision at any time.

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Appendix A - Figures

Data Forms
   CTSL1000-D001 – Documentation Requirements Sheet
   The following data forms shall be part of this practice only if indicated on the purchaser’s completed Documentation Requirements Sheet.
Fiberglass Mat Reinforcement for New Steel or Existing Steel

CTSL1000-D209 – Internal Lining System
Data Sheet - Epoxy Lining for New Steel or Existing Steel Ballast Tanks on Offshore Structures and Vessels

CTSL1000-D210 – Internal Lining System
Data Sheet - Solvent Free Single Coat Epoxy Novolac Lining for New or Existing Steel

CTSL1000-F – Daily Inspection Report
CTSL1000-T – Inspection and Testing Requirements Sheet
1. **Scope**

This Practice provides requirements for installing industrial linings. This Practice describes the general requirements for surface preparation, environmental control, and the installation and inspection of liquid-applied internal linings to metal substrates. This Practice does not cover sheet linings and application of linings to piping.

2. **References**

Applicable parts of the following Practices, industry codes and standards, and references shall be considered an integral part of this Practice. The edition in effect on the date of contract awards shall be used, except as otherwise noted. Short titles are used herein where appropriate.

2.1 **Process Industry Practices (PIP)**

- PIP VESV1003 – *Special Fabrication Requirements for Welded Vessels and Tanks to be Lined*

2.2 **Industry Codes and Standards**

- American Society for Testing and Materials (ASTM)
  - ASTM D3359 – *Standard Test Methods for Measuring Adhesion by Tape Test*
  - ASTM D4285 – *Standard Test Methods for Indicating Oil or Water in Compressed Air*
  - ASTM D4417 – *Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel*

- International Organization for Standardization (ISO)
  - ISO 2409 – *Paints and Varnishes - Cross-Cut Test*
  - ISO 4624 – *Paints and varnishes - Pull-off Test for Adhesion*
  - ISO 8501-1 – *Preparation of Steel Substrates Before Application of Paints and Related Products - Visual Assessment of Surface Cleanliness - Part 1: Rust Grades and Preparation Grades of Uncoated Steel Substrates and of Steel Substrates After Overall Removal of Previous Coatings*
  - ISO 8503-5 – *Preparation of Steel Substrates Before Application of Paints and Related Products - Surface Roughness Characteristics of Blast-Cleaned Steel Substrates - Part 5: Replica Tape Method for the Determination of the Surface Profile*
2.3 Other References

- National Institute of Occupational Safety and Health (NIOSH)
  - NIOSH Publication No. 92-102 – NIOSH Alert: Request for Assistance in Preventing Silicosis and Deaths from Sandblasting

3. Definitions

CS: Carbon and low-alloy steel

SS: Austenitic stainless steel
nonferrous: Copper, aluminum, and nickel base alloys

owner: The party who owns the facility wherein the lining will be used

purchaser: The party who awards the contract to the supplier. The purchaser may be the owner or the owner’s authorized agent

inspector: The purchaser’s authorized representative with authority to act in the interest of, and on behalf of, the purchaser in quality assurance matters.

supplier: The party responsible for providing and/or installing the lining system

coating manufacturer: Company that supplies/formulates internal coatings for a designated job.

4. Requirements

4.1 Project Scope

4.1.1 Documents required to define the scope of the work are listed on purchaser’s [PIP CTSL1000-D001 Documentation Requirements Sheet].

4.1.2 Systems requiring additional coating specifications beyond this Practice and referenced data sheets shall be in accordance with purchaser’s contract documents.

4.2 Selection Requirements and Internal Lining Systems

4.2.1 [PIP CTSL1000-D002 Lining Selection Criteria Sheet] shall be used for selecting the appropriate coating.

4.2.2 [PIP CTSL1000-D200 Internal Lining System Data Sheet – User Defined] shall be used to define specific requirements for each lining system.

4.3 General

4.3.1 Condition of Surfaces to be Lined

4.3.1.1 [PIP VESV1003] defines the details to be followed in fabricating a vessel that is to be lined.

4.3.1.2 The inspector shall verify that the vessel surfaces to be lined are in accordance with the requirements of [PIP VESV1003].

4.3.2 Conflicts, Exceptions, and Deviations

4.3.2.1 All conflicts between the referenced documents and this Practice shall be submitted in writing to the purchaser for clarification and resolution before proceeding with the lining application.

4.3.2.2 All exceptions, deviations, and substitutions to the requirements specified herein and in referenced documents shall be approved by the purchaser.

4.3.3 Regulations and Material Safety Data Sheets

4.3.3.1 Protective linings shall be in accordance with all applicable federal, state, and local codes and regulations on surface preparation, lining application, storage, handling, safety, and environmental requirements, including the recommendations of [SSPC-PA Guide 10].
4.3.3.2 The latest issue of the lining manufacturer’s product data sheets, application instructions, and Safety Data Sheets (SDS) shall be available at the lining site and complied with during lining operations.

### 4.3.4 Surfaces not Lined

4.3.4.1 The following surfaces shall not be lined, unless otherwise specified:

- a. Nonferrous metals
- b. Galvanized or metallized surfaces
- c. Nonmetallic

4.3.4.2 The following surfaces shall not be lined and shall be protected from surface preparation and lining activity in the area:

- a. Sacrificial anodes
- b. Resilient seal materials

### 4.3.5 Precautions for Stainless Steel and Nonferrous Metals

4.3.5.1 All SS and nonferrous metals shall be protected from blasting, overspray, and linings intended for CS, especially linings that contain zinc.

4.3.5.2 Abrasives for use on SS shall be in accordance with SSPC-AB1 [ISO 11126, natural abrasives (except silica sand), coal furnace slag, and fused aluminum oxide] and shall be free of metals.

4.3.5.3 Linings and solvents for use on SS and nonferrous metals shall be free of substances (e.g., chlorides, sulfur, halogens, or metallic pigments) that can harmfully affect SS or nonferrous metals.

### 4.4 Climatic Condition Control

#### 4.4.1 Factors Affecting Application

4.4.1.1 Temperature

Unless otherwise specified by the lining manufacturer, linings shall not be applied if:

- a. Temperature of steel or lining material is less than 10°C (50°F).
- b. Air temperature is less than 10°C (50°F) or greater than 49°C (120°F).
- c. Surface temperature is expected to drop to 10°C (50°F) or less before lining has cured if low temperature can be detrimental to the lining.

4.4.1.2 Moisture

- a. Linings shall not be applied in rain, snow, fog, or mist.
- b. Linings shall not be applied if steel surface temperature is less than 3°C (5°F) above the dew point.
- c. Linings shall not be applied to surfaces that show visible traces of moisture as condensation or precipitation.
4.4.1.3 **Humidity**

The manufacturer's instructions shall be followed regarding acceptable humidity range for application and curing of moisture-cured linings.

4.4.1.4 **Measure of Ambient Conditions**

a. Measurements of temperature, humidity, and dew point shall be taken inside the equipment to be lined at the beginning of each workday and every 4 hours thereafter or sooner if weather conditions appear to be changing.

b. Dew point temperature shall be determined by sling psychrometer in accordance with ASTM E337 or ISO 4677-2, at the location where work is being performed.

c. A record of these measurements shall be kept, indicating the wet-and dry-bulb temperature, relative humidity, dew point, and surface temperature of the metal of items lined.

4.4.1.5 **Ventilation**

Contractor shall provide ventilation sufficient to maintain a safe atmosphere inside the tank, vessel or other equipment being lined. The ventilation shall also be sufficient for proper curing of the lining.

4.4.2 **Dehumidification**

4.4.2.1 Dehumidification equipment shall, as a minimum, have the capacity to:

a. Depress the air dew point in the equipment being lined to 6°C (10°F) less than ambient temperature within 20 minutes.

b. Affect an air change rate of three times per hour, unless particle loading is unusually high. See SSPC-PA Guide 10 for regulation.

4.4.2.2 If the selected dehumidifier can reduce air dew point by greater than 6°C (10°F), the air change rate can be reduced. If the dehumidifier cannot reduce the dew point by a minimum of 6°C (10°F), more air shall be used.

4.4.2.3 The following critical measurements shall be taken on a regular basis at a frequency to be determined by the purchaser:

a. Ambient dew point (air entering the dehumidifier)

b. Dew point of air leaving the humidifier

c. Dew point of air inside the tank near metal surface

d. Surface temperature of the substrate

4.5 **Surface Preparation**

4.5.1 **Precleaning**

4.5.1.1 Before blasting, oil, tar, grease, salt, and other contaminants shall be removed from the surfaces to be lined.

4.5.1.2 Hydrocarbon removal shall be accomplished by SSPC SPI (ISO 12944-4).
4.5.1.3 Cleaning shall be followed by a freshwater rinse to ensure complete removal of soluble salts and cleaning chemicals.

4.5.1.4 If the entire tank is to be lined, all rafters, supports, and superstructure shall be included in the cleaning process.

4.5.1.5 A “black light” shall be used to locate hydrocarbon contaminants.

4.5.1.6 If lining the bottom of a floating roof tank, before blasting begins, the underside of the roof and 7-feet up the tank wall shall receive a brush blast (SSPC-SP7/NACE No. 4 or ISO Sa 1) to remove contaminants and loose scale.

4.5.1.7 All welds to be coated shall be ground to meet NACE Weld Preparation Designation “C” or better in accordance with NACE SP0178.

4.5.2 Abrasive Blast Cleaning

4.5.2.1 Compressed air supply used for blasting shall be free of water and oil. Adequate separators and traps shall be provided and kept empty. Compressed air shall be tested in accordance with ASTM D4285 at the beginning of each shift, every 4 hours thereafter and after any interruption of compressor operation.

4.5.2.2 Abrasive shall be selected to produce a necessary profile or anchor pattern for lining to be applied. Abrasive shall be free of contaminants, such as water-soluble salts, dirt, clay, oil, and grease.

4.5.2.3 Silica sand or other abrasive substances containing greater than 1 percent crystalline silica shall not be used as an abrasive blasting material. Refer to NIOSH Publication No. 92-102.

4.5.2.4 Blasting shall not be permitted if metal surfaces are less than 3°C (5°F) above the dew point.

4.5.2.5 Abrasive blasting shall meet the level requirements specified in lining system data sheet for each system. Unless specified otherwise in the data sheets, the maximum allowable level of salt contamination after abrasive blasting shall be 2 µg/cm² (20 mg/m²).

4.6 Application

4.6.1 General

4.6.1.1 Lining materials and thicknesses shall be as listed in the lining system data sheets. Only products of one coating manufacturer shall be used within a lining system for each application. Deviations from this policy will require written approval from owner prior to ordering material.

4.6.1.2 Lining materials shall be furnished in the manufacturer’s unopened containers, shall be clearly marked, and shall be kept covered, clean, and protected.

4.6.1.3 Blasted surfaces shall be absolutely clean and dry before the application of the first coat.

4.6.1.4 Spent blast media shall either be removed or adequately covered before lining to prevent contamination of the surface to be lined.
4.6.1.5 Workers shall take precautions (changing or dusting shoes and removing abrasive from pant cuffs) to ensure that cleanliness is maintained throughout the entire lining operation.

4.6.1.6 If the prepared surface becomes dirty or rusty before the first prime coat is applied, the surface shall be recleaned to a degree that was initially specified.

4.6.1.7 When designated on PIP CTSL1000-D200, welds and edges shall be striped with primer by brush application before the application of the first prime coat.

4.6.1.8 Before the application of any coat, damage to the previous coat shall be repaired with a corresponding specified material.

4.6.1.9 Lined surfaces, including striping and repair, shall be thoroughly dry and clean before the application of subsequent coats in accordance with the manufacturer’s recommendation for recoat time.

4.6.1.10 If the allowable dry film thickness range is not defined on PIP CTSL1000-D200, the range defined by the lining manufacturer on the product sheet shall be used.

4.6.1.11 The recoat time between coats shall be that recommended by the manufacturer for any given temperature.

4.6.1.12 Thinning shall not be greater than the maximum allowable volatile organic compound (VOC) level for the lining involved.

4.6.2 Preparation of Lining Materials

4.6.2.1 Lining materials shall be stirred or mechanically agitated to ensure that pigments, vehicles, and activators are thoroughly mixed. If required by the manufacturer, linings shall be continuously stirred by mechanical agitators.

4.6.2.2 Lining materials shall be thinned only with thinner that is recommended by the manufacturer and in quantities that are not greater than the manufacturer’s recommendation.

4.6.2.3 All mixing shall be done in clean containers that are free from traces of grease, paints, and other contaminants. After mixing, the containers shall be kept covered to prevent contamination.

4.6.2.4 The mixing of partial kits is not permitted.

4.6.2.5 Inorganic zinc primers and all pigmented lining materials shall be strained before the application in accordance with the lining manufacturer’s written instructions.

4.6.2.6 Field tinting for color contrast of the primer and midcoat or finish coat is not permitted. Factory tinting is permitted.

4.6.2.7 Pot life shall not be greater than the limits specified by the manufacturer.

4.6.2.8 Materials that have exceeded the lining manufacturer’s recommended shelf life shall not be used.
4.6.3 Thick Film Reinforced Systems

4.6.3.1 Putty/Caulking Application

1. Application may be by spray or putty knife and shall include chine, bottom plate seams, the bottom of sumps, and along the column bases.

2. Putty used shall be compatible with the resin system as recommended by the manufacturer.

3. Large projections and lap joints on welded plates to be lined shall be filled with putty to smooth out the surface and permit complete contact with the laminate system. See Appendix A, Figures 1 and 5.

4. Chine or bottom angle shall be filled with putty and covered to a smooth 75-mm (3-inch) radius to permit contact with the laminate system. See Appendix A, Figure 3.

5. Riveted seams, lap joints, and chine angle plates shall be filled with putty and smoothed out to obtain complete contact with the laminate system. See Appendix A, Figures 2 and 4.

4.6.3.2 Columns, Support Legs, Sumps, Etc.

1. For tanks on which the column base is not fixed or attached to the bottom by welds, a striker plate and resin laminate patch shall be placed under the column base as follows:
   a. Plates shall be installed under fixed roof tanks one at a time. No fixed roof support shall be raised while another is on the jack.
   b. Tack welds and/or guides shall be removed to free the column base and to provide a smooth tank bottom.
   c. The column base shall be jacked up in accordance with instructions that are detailed in Appendix A, Figures 5, 6, and 7.
   d. If a lining system is used without reinforcing, the “lining system” shall be inserted into Step 6 instead of “reinforced laminate” in Appendix A, Figure 5.

2. Striker plate for support legs on floating roof tanks shall be placed as follows:
   a. Tanks typically have a stationary striker plate with a circumferential fillet weld as part of the original construction. See Appendix A, Figures 5, 6, and 7. If this stationary plate is not a part of the design, Step 5 and Step 6 shall be eliminated, and reinforced laminate or lining system shall be applied directly to the blasted and primed steel bottom, ensuring that it extends 300 mm (12 inches) onto the floor. Steps shown in Appendix A, Figure 7 shall then be continued.
   b. The auxiliary striker plate shall be blasted, primed, and placed into wet laminate. Support legs shall be lowered onto the auxiliary striker plate when the resin starts to gel.
c. Hollow legs shall be wrapped with plastic, secured to prevent dripping during the transfer to a temporary support, and then raised.

d. Reinforced laminate or lining system shall extend a minimum of 300 mm (12 inches) in all directions from the striker plate such that there is a 75-mm (3-inch) overlap when the lay-up operation is continued across the floor.

3. Sumps shall receive a reinforcement layer across the bottom, up sides, and 150 mm (6 inches) to 300 mm (12 inches) onto the floor.

4. Additional layers of laminate shall be installed onto the tank bottom as follows:
   a. Under the gage hatch, 1.2 m by 1.2 m (4 ft by 4 ft) area
   b. Fill line outlet, 1.2 m by 1.2 m (4 ft by 4 ft) area
   c. Swing the line arresting chain of floating roof tanks, 1 m by 4 m (3 ft by 12 ft) area

4.6.4 Repair of Linings

4.6.4.1 After inspection, if the lining thickness is deemed to be insufficient, necessary additional lining to achieve the required film thickness shall be applied.

4.6.4.2 If the lining is too thick and detrimental to the integrity of the system, the excess lining shall be sanded off to the required film thickness.

4.6.4.3 If abrasive or other contaminants have contaminated the lining, the lining shall be repaired in accordance with the lining manufacturer’s written recommendation.

4.6.4.4 If improperly mixed linings (e.g., wrong catalyst or no catalyst) are applied, the lining shall be removed and the surface restored to the originally specified condition.

4.6.4.5 Holidays shall be repaired in accordance with the lining manufacturers recommended procedure.

4.7 Inspection

4.7.1 General

4.7.1.1 Inspections and tests shall be performed in accordance with purchaser’s PIP CTSL000-T Inspection and Testing Requirements Sheet to ensure that the surface preparation and lining application are in accordance with the requirements of this Practice.

4.7.1.2 Unless otherwise specified on purchaser’s PIP CTSL1000-T Inspection and Testing Requirements Sheet, the lining shall be holiday free.

4.7.2 Inspection Hold Points

4.7.2.1 Hold Point (H)

1. A hold point (H) is the notification that a shop process is ready for purchaser’s inspection and to hold any further application until inspection has occurred.
2. Hold points shall be provided in accordance with purchaser’s 
*PIP CTSL1000-T* Inspection and Testing Requirements Sheet.

### 4.7.2.2. Witness Point (W)

1. A witness point (W) is an observation by purchaser’s inspector of the actual test as it is being performed. Application may proceed if purchaser’s inspector is not present and was given proper notification.

2. Witness points shall be provided in accordance with purchaser’s 
*PIP CTSL1000-T* Inspection and Testing Requirements Sheet.

### 4.8 Documentation

4.8.1 A *PIP CTSL1000-F* Daily Inspection Report shall be completed for each work shift.

4.8.2 If approved by purchaser, supplier’s forms may be used.

4.8.3 A log shall be maintained of all reports, inspections, and tests including date, time, and results of instrument calibrations.

### 4.9 Shipping, Handling, and Storage

4.9.1 Lined items shall not be handled or moved until all linings have been properly dried or cured in accordance with the lining manufacturer’s instructions.

4.9.2 Lined items shall be handled with equipment (e.g., wide belt slings, web belts, and wide padded skids) selected to prevent damage to the lining.

4.9.3 Handling equipment that can cause damage to the lining shall not be used.

4.9.4 Chains, cables, hooks, tongs, metal bars, and narrow skids shall not be permitted to come in contact with the lining.

4.9.5 Lined items shall be loaded, padded, and secured for transport in a manner such that the lining cannot be damaged in transit.

4.9.6 HDPE flange protectors shall be used to protect lined flange faces. The protectors shall be attached by bolts.
Appendix A - Figures

BOTTOM OR SHELL SEAM DETAIL

FIGURE #1
WELDED SEAM

Riveted Seam

FIGURE #2
RIVETTED SEAM

Welded Chine

FIGURE #3
WELDED CHINE

Riveted Chine

FIGURE #4
RIVETTED CHINE
ROOF SUPPORTS

STEP
1. Jack Up Support Leg
2. Remove Oil, Dirt Contaminates
3. Abrasive Blast SSPC-SP5
4. Prime
5. Apply Putty To Welded Seam Of Striker Plate

FIGURE #5

6. Apply Reinforced Laminant Over Striker Plate & Extend 12" On To The Tank Bottom In All Directions

FIGURE #6

7. Blast & Prime Auxiliary Striker Plate Place Into Wet Laminant
8. Lower Support Leg On Auxiliary Striker Plate When Resin Starts To Gel

FIGURE #7
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<td>DOCUMENTATION REQUIREMENTS SHEET</td>
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### APPLICATION OF INTERNAL LININGS

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<td>DAILY INSPECTION REPORT</td>
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<td>INSPECTION AND TESTING REQUIREMENTS SHEET</td>
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NOTES:
## Application of Internal Linings

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<th>Service</th>
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<th>Generic Coating</th>
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<td>Potable Water</td>
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<td>201</td>
<td>Epoxy (12 to 21 Mils)</td>
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<td>Complete Internal Lining</td>
<td>204 or 205</td>
<td>Epoxy Novolac or Epoxy Phenolic (10 to 18 Mils)</td>
<td>≤82°C (≤180°F)</td>
<td></td>
</tr>
<tr>
<td>Demineralized Water, Boiler Make-Up, Boiler Feed Water, Condensate &amp; Polished Water</td>
<td>Complete Internal Lining</td>
<td>206</td>
<td>Epoxy Novolac or Epoxy Phenolic (10 to 18 Mils)</td>
<td>≤100°C (≤212°F)</td>
<td></td>
</tr>
<tr>
<td>Crude Oil, Saltwater, Brine, Produced Oil &amp; Water</td>
<td>Complete Internal Lining or Tank Bottom Internal Lining as Specified in Procurement Documents</td>
<td>207</td>
<td>Epoxy Novolac Vinyl Ester Lining (~60 Mils)</td>
<td>≤100°C (≤212°F)</td>
<td></td>
</tr>
<tr>
<td>Crude Oil, Produced Oil &amp; Water</td>
<td>Tank Bottom Internal Lining as Specified in Procurement Documents</td>
<td>208</td>
<td>Vinyl Ester, Epoxy, or Epoxy Novolac Reinforced with Glass (~40 to 120 Mils)</td>
<td>≤100°C (≤212°F)</td>
<td></td>
</tr>
<tr>
<td>Ballast Tanks - Oil, fuel, and water</td>
<td>Complete Internal Lining</td>
<td>209</td>
<td>Epoxy (12 to 24 Mils)</td>
<td>≤60°C (≤140°F)</td>
<td></td>
</tr>
<tr>
<td>Liquefied Hydrocarbon Gasses – Butane, Propane, Dry, no H2S, no CO2</td>
<td>Complete Internal Lining</td>
<td>210</td>
<td>Epoxy Novolac or Epoxy Phenolic (10 to 18 Mils)</td>
<td>≤65°C (≤150°F)</td>
<td></td>
</tr>
</tbody>
</table>
**REMARKS:**

1. These linings are applicable for fixed, land based assets only.

2. Potable Water Coating dry film thickness and number of coats shall comply with Lining Manufacturer’s Product Data Sheet requirements to meet NSF Approval. The dry film thickness range and number of coats shown on this document is for general guidance only.

3. The Dry Film Thickness Ranges shown under the GENERIC COATING column on this CTSL1000-D002 form are for general guidance only. See the PIP CTSL1000-D200 forms for each lining system for details.

4. The three coat systems have a 2 to 4 hour pot life and can be applied with conventional spray or airless spray equipment. The single coat systems have a very short pot life and must be applied with more complicated plural component equipment.

5. The Epoxy systems 202 and 203 are more flexible and more resistant to cracking from tank movement or other mechanical damage, such as equipment impacting the outside of the tank. Tanks coated in the shop with one of these Epoxy systems will be more resistant to damage from handling, shipping, and installation.

6. The Epoxy Novolac, Epoxy Phenolic, and Vinyl Ester systems are suitable for higher temperatures and stronger chemicals. Flexibility and impact resistance are usually lowered to obtain these characteristics.

7. Linings shall be selected to withstand the designated cargos at the maximum operating pressure and maximum operating temperature of the tanks, vessels, equipment, or piping. The maximum design pressure and the maximum design temperature may be higher. Lining systems in this standard are intended for use in tanks or vessels operating at pressures less than 3447 kPa (500 psi).

8. Linings for atmospheric pressure tanks for Crude Oil, Produced Oil, Gasoline, Diesel Fuel, Alcohol, MTBE, Distillates, and Aromatic or Aliphatic Hydrocarbons may be installed on the bottom and only three feet up the sides if previous experience demonstrates that corrosion is limited to these areas.

9. If cathodic protection is required, additional requirements may apply.

10. If service is not listed in this table, manufacturer shall be asked for a recommendation.
**APPLICATION OF INTERNAL LININGS**

**ASSOC. PIP:** CTSL1000  
**INTERNAL LINING SYSTEM DATA SHEET - USER DEFINED**  
**PIP CTSL1000-D200**

**DECEMBER 2017**

<table>
<thead>
<tr>
<th>NO.</th>
<th>DATE</th>
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<th>BY</th>
<th>CHECKED</th>
<th>APPROVED</th>
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<tr>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**PROJECT NO.**  
**PROJECT DOCUMENT NO.**

**FACILITY NAME**  
**LOCATION**

**LINING SYSTEM NO.:**

**SYSTEM DESCRIPTION:**

**SERVICE CONDITIONS:**  
**TEMPERATURE:** °F ( °C)  
**PRESSURE:** psig ( kPa)

**PROCESS FLUID:**

**SURFACE PREPARATION:**  
ABRASIVE BLAST TO SSPC SP-5/NACE 1 (SA 3) WITH A PROFILE OF MILS ( µM) TO MILS ( µM)

**SURFACES TO BE LINED:**

**EQUIPMENT:**

**COMPONENT DESCRIPTION:**  
**NOTES:**

**ALL INTERNAL SURFACES**

**TANKS:**

<table>
<thead>
<tr>
<th>COMPONENT DESCRIPTION</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BOTTOM</strong></td>
<td>YES ☐ NO ☐</td>
</tr>
<tr>
<td><strong>SHELL</strong></td>
<td>YES ☐ NO ☐</td>
</tr>
<tr>
<td><strong>ROOF</strong></td>
<td>YES ☐ NO ☐</td>
</tr>
</tbody>
</table>

**SYSTEM**

<table>
<thead>
<tr>
<th>COAT NO.</th>
<th>GENERIC TYPE</th>
<th>APPLICATION METHOD</th>
<th>MINIMUM DFT, MILS (µM)</th>
<th>MAXIMUM DFT, MILS (µM)</th>
<th>SHOP/FIELD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
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</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL:**

| | | | | |
| | | | | |

**APPLICATION METHOD:**  
S=SPRAY; B=BRUSH; R=ROLLER;

**DEHUMIDIFICATION REQUIRED:**  
YES ☐ NO ☐

**MIXING AND THINNING:** MIX ACCORDING TO MANUFACTURER’S INSTRUCTIONS AND SSPC PA-1.

**APPLICATION:** APPLY ACCORDING TO MANUFACTURER’S INSTRUCTIONS AND PIP CTSL1000.

**STRIP COAT REQUIRED:**  
YES ☐ NO ☐

**FORCE CURE REQUIRED:**  
YES ☐ NO ☐  
*(FORCE CURE SHALL CONFORM TO MANUFACTURER’S REQUIREMENTS)*

**JOB STENCIL REQUIRED:**  
YES ☐ NO ☐
<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>COAT 1</th>
<th>COAT 2</th>
<th>COAT 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

**NOTES:**

**REPAIR:**
**APPLICATION OF INTERNAL LININGS**

NSF Epoxy Lining for Potable Water Tanks, Equipment, and Piping

---

**PROJECT DOCUMENT NO.**

**FACILITY NAME**

**LOCATION**

**LINING SYSTEM NO.: 201**

**SYSTEM DESCRIPTION:** NSF epoxy lining for potable water tanks, equipment, and piping.

**SERVICE CONDITIONS:**

- **TEMPERATURE:** ≤60°C (≤140°F)
- **PRESSURE:** ≤ 690 kPa (≤100 psig)

**PROCESS FLUID:** Potable water

**SURFACE PREPARATION:**

Abrasive blast per SSPC-SP 5/NACE NO. 1 (SA 3) with a profile of 50 to 75 µm (2 to 3 mils).

**SURFACES TO BE LINED:** All internal surfaces

**REFERENCES**

The latest edition (or edition indicated) of the following industry standards and references shall be considered an integral part of this Internal Lining System.

- The Society for Protective Coatings (SSPC)
  - SSPC-PA 1, Shop, Field & Maintenance Painting
  - SSPC-SP 2, Hand Tool Cleaning
  - SSPC-SP 3, Power Tool Cleaning
  - SSPC-SP 5/NACE NO. 1, White Metal Blast Cleaning
  - SSPC-SP 11, Power Tool Cleaning to Bare Metal

**EQUIPMENT:** Tanks, pressure vessels, filters, pumps, and other associated equipment

**COMPONENT DESCRIPTION:**

All internal surfaces

---

**TANKS:**

**COMPONENT DESCRIPTION:**

| Bottom    | Yes | ☒ No  | Stripe coat corners, edges, and welds |
| Shell     | Yes | ☒ No  | Stripe coat corners, edges, and welds |
| Roof (fixed or floating) | Yes | ☒ No  | Stripe coat corners, edges, and welds |
| Structural supports | Yes | ☒ No  | Stripe coat corners, edges, and welds |
| Internal equipment and piping | Yes | ☒ No  | Stripe coat corners, edges, and welds |

**SYSTEM**

<table>
<thead>
<tr>
<th>Coat No.</th>
<th>Generic Type</th>
<th>Application Method</th>
<th>Minimum DFT, µm (mils)</th>
<th>Maximum DFT, µm (mils)</th>
<th>Shop/Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Epoxy</td>
<td>S</td>
<td>100 (4.0)</td>
<td>175 (7.0)</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Epoxy (optional)</td>
<td>S</td>
<td>100 (4.0)</td>
<td>175 (7.0)</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Total:</strong> 300 (12.0)</td>
<td>525 (21.0)</td>
<td></td>
</tr>
</tbody>
</table>
**APPLICATION OF INTERNAL LININGS**

NSF Epoxy Lining for Potable Water Tanks, Equipment, and Piping

---

**PROJECT NO.**

**PROJECT DOCUMENT NO.**

**FACILITY NAME**

**LOCATION**

**LINING SYSTEM NO.:** 201

**SYSTEM DESCRIPTION:** NSF epoxy lining for potable water tanks, equipment, and piping.

*Application Method: S=Spray; B=Brush; R=Roller

<table>
<thead>
<tr>
<th>Dehumidification Req’d:</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

Mixing and Thinning: Mix according to manufacturer’s instructions and SSPC-PA 1.

**Application:** Apply according to manufacturer's instructions and PIP CTSL1000.

<table>
<thead>
<tr>
<th>Stripe coat required:</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

Reinforcement requirements (reinforced systems only):

<table>
<thead>
<tr>
<th>Force cure required:</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

(Job cure shall conform to manufacturer’s requirements)

<table>
<thead>
<tr>
<th>Job stencil required:</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**Manufacturer**

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Coat 1</th>
<th>Coat 2</th>
<th>Optional Coat 3</th>
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<tbody>
<tr>
<td></td>
<td>Epoxy</td>
<td>Epoxy</td>
<td>Epoxy</td>
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</tr>
</tbody>
</table>

**Notes:**

This lining system is suitable for continuous service in potable water. It may also be used for firewater, salt water, and untreated water from rivers, lakes, and water wells. Corners and edges of metal to be coated shall be rounded to a minimum of 0.8 mm radius (1/32 in.) or chamfered a minimum of 1.6 mm (1/16 in.) wide at an angle of approximately 45° prior to abrasive blasting. If stripe coating is required, corners, edges, bolts, welds, heavily pitted areas, and other irregularities shall be stripe coated prior to the application of the full prime coat and prior to the application of the full second coat. The total dry film thickness shown on this lining system data sheet is for general guidance only. The number of coats, thickness, and other application details on the lining manufacturer's product data sheets shall be strictly followed to assure compliance with their NSF qualification. Contractor must confirm compatibility of the caulk with the lining manufacturer. An optional third coat may be applied to pitted or otherwise rough tank interiors if necessary to meet the holiday testing requirements.

**Repair:**

For small areas and holidays less than 100 cm² (12.0 in²). If damaged area is down to bare metal, power tool clean per SSPC-SP 11, feather edges, and apply epoxy lining to restore the specified thickness. If damaged area is down to the epoxy, hand tool clean per SSPC-SP 2 and/or power tool clean per SSPC-SP 3, feather edges, and apply epoxy lining to restore the specified thickness. Hand tool or power tool cleaning shall roughen the surface equivalent to sanding with 80 grit sandpaper. Repair coating shall overlap existing coating a minimum of 25 mm (1 in.). Quality control testing, including holiday testing, shall be performed on the repairs. The repair areas shall meet the same requirements as the undamaged lining, except that total coating thickness where the repair coating overlaps the undamaged coating may be up to 50% thicker (maximum 675 µm [27 mils]).
APPLICATION OF INTERNAL LININGS
Two Coat Epoxy Lining for New Steel or Existing Steel with No Pits

<table>
<thead>
<tr>
<th>NO.</th>
<th>DATE</th>
<th>REVISION DESCRIPTION</th>
<th>BY</th>
<th>CHECKED</th>
<th>APPROVED</th>
</tr>
</thead>
</table>

PROJECT NO.  
FACILITY NAME  
LOCATION

LINING SYSTEM NO.: 202  
SYSTEM DESCRIPTION: Two Coat Epoxy Lining for New Steel or Existing Steel with No Pits

SERVICE CONDITIONS:  
TEMPERATURE: ≤50°C (≤122°F)  
PRESSURE: ≤690 kPa (≤100 psig)  
PROCESS FLUID: Oil, diesel, fresh and salt water, hydrocarbon gasses

SURFACE PREPARATION: Abrasive blast per SSPC-SP 5/NACE NO. 1 (SA 3) with a profile of 50 to 75 µm (2 to 3 mils).

SURFACES TO BE LINED: All internal surfaces with some exceptions. See note on Page 2.

REFERENCES  
The latest edition (or edition indicated) of the following industry standards and references shall be considered an integral part of this Lining System.

The Society for Protective Coatings (SSPC)  
SSPC-PA 1, Shop, Field & Maintenance Painting  
SSPC-SP 2, Hand Tool Cleaning  
SSPC-SP 3, Power Tool Cleaning  
SSPC-SP 5/NACE NO. 1, White Metal Blast Cleaning  
SSPC-SP 11, Power Tool Cleaning to Bare Metal

EQUIPMENT: Tanks, pressure vessels, pig launchers, meter provers, other pressure containing equipment

COMPONENT DESCRIPTION:  
NOTES:

All internal surfaces

TANKS:

<table>
<thead>
<tr>
<th>COMPONENT DESCRIPTION:</th>
<th>NOTES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom</td>
<td>Yes No Stripe coat corners, edges, and welds</td>
</tr>
<tr>
<td>Shell</td>
<td>Yes No Stripe coat corners, edges, and welds</td>
</tr>
<tr>
<td>Roof (fixed or floating)</td>
<td>Yes No Stripe coat corners, edges, and welds</td>
</tr>
<tr>
<td>Structural supports</td>
<td>Yes No Stripe coat corners, edges, and welds</td>
</tr>
<tr>
<td>Internal equipment and piping</td>
<td>Yes No Stripe coat corners, edges, and welds</td>
</tr>
</tbody>
</table>

SYSTEM

<table>
<thead>
<tr>
<th>Coat No.</th>
<th>Generic Type</th>
<th>Application Method</th>
<th>Minimum DFT, µm (mils)</th>
<th>Maximum DFT, µm (mils)</th>
<th>Shop/Field</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Epoxy</td>
<td>S</td>
<td>150 (6.0)</td>
<td>200 (8.0)</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Epoxy</td>
<td>S</td>
<td>150 (6.0)</td>
<td>200 (8.0)</td>
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</tr>
<tr>
<td>3.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Total: 300 (12.0)</td>
<td>400 (16.0)</td>
<td></td>
</tr>
</tbody>
</table>

*Application Method: S=Spray; B=Brush; R=Roller
## Application of Internal Linings

**Two Coat Epoxy Lining for New Steel or Existing Steel with No Pits**

### Project Information

- **Project No.:** [Blank]
- **Facility Name:** [Blank]
- **Location:** [Blank]
- **Lining System No.:** 202
- **System Description:** Two Coat Epoxy Lining for New Steel or Existing Steel with No Pits
- **Dehumidification Req’d:** Yes □ No □
- **Mixing and Thinning:** Mix according to manufacturer’s instructions and SSPC-PA 1.
- **Application:** Apply according to manufacturer’s instructions and PIP CTSL1000.
- **Stripe Coat Required:** Yes □ No □
- **Reinforcement Requirements (Reinforced Systems Only):**
- **Force Cure Required:** Yes □ No □ (Force cure shall conform to manufacturer’s requirements)
- **Job Stencil Required:** Yes □ No □

### Manufacturer

<table>
<thead>
<tr>
<th>Coat 1</th>
<th>Coat 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epoxy</td>
<td>Epoxy</td>
</tr>
</tbody>
</table>

### Notes:

This lining system is suitable for continuous service in fresh and salt water, and in aliphatic and aromatic hydrocarbon liquids up to 50°C (150°F) and at pressures up to 100 psi (690 kPa). Gas phase may contain air, nitrogen, hydrocarbon gasses, and no more the 103 kPa (15.0 psia) partial pressure of CO2 and no more than 7 kPa (1 psia) partial pressure of H2S. Corners and edges of metal to be coated shall be rounded to a minimum of 0.8 mm radius (1/32 in.) or chamfered a minimum of 1.6 mm (1/16 in.) wide at an angle of approximately 45° prior to abrasive blasting. Corners, edges, bolts, welds, and other irregularities shall be stripe coated prior to the application of the full prime coat. Linings for atmospheric pressure tanks for Crude Oil, Produced Oil, Gasoline, Diesel Fuel, Alcohol, MTBE, Distillates, and Aromatic or Aliphatic Hydrocarbons may be installed on the bottom and only three feet up the sides if previous experience demonstrates that corrosion is limited to these areas.

### Repair:

For small areas and holidays less than 100 cm² (12.0 in.²): If damaged area is down to bare metal, power tool clean per SSPC-SP 11, feather edges, and apply epoxy lining to restore the specified thickness. If damaged area is down to the epoxy, hand tool clean per SSPC-SP 2 and/or power tool clean per SSPC-SP 3, feather edges, and apply epoxy lining to restore the specified thickness. Hand tool or power tool cleaning shall roughen the surface equivalent to sanding with 80 grit sandpaper. Repair coating shall overlap existing coating a minimum of 25 mm (1 in.). Quality control testing, including holiday testing, shall be performed on the repairs. The repair areas shall meet the same requirements as the undamaged lining, except that total coating thickness where the repair coating overlaps the undamaged coating may be up to 50% thicker (maximum 600 µm [24 mils]).
## APPLICATION OF INTERNAL LININGS

**Single Coat Solvent Free Epoxy Lining for New Steel or Existing Steel with Pits**

<table>
<thead>
<tr>
<th>NO.</th>
<th>DATE</th>
<th>REVISION DESCRIPTION</th>
<th>BY</th>
<th>CHECKED</th>
<th>APPROVED</th>
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</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

### Project Information

- **Project No.:**
- **Project Document No.:**
- **Facility Name:**
- **Location:**
- **Lining System No.:** 203
- **System Description:** Single Coat Solvent Free Epoxy Lining for New Steel or Existing Steel with Pits

### Service Conditions

- **Temperature:** \( \leq 50^\circ C \) \((\leq 122^\circ F)\)
- **Pressure:** \( \leq 690 \) kPa \((\leq 100 \) psig\)
- **Process Fluid:** Oil, diesel, fresh and salt water, hydrocarbon gasses

### Surface Preparation

Abrasive blast per SSPC-SP 5/NACE NO. 1 (SA 3) with a profile of 50 to 75 \( \mu m \) (2 to 3 mils).

### Surfaces to Be Lined

All internal surfaces with some exceptions. See note on Page 2.

### References

The latest edition (or edition indicated) of the following industry standards and references shall be considered an integral part of this Internal Lining System.

- The Society for Protective Coatings (SSPC)
  - SSPC-PA 1, Shop, Field & Maintenance Painting
  - SSPC-SP 2, Hand Tool Cleaning
  - SSPC-SP 3, Power Tool Cleaning
  - SSPC-SP 5/NACE NO. 1, White Metal Blast Cleaning
  - SSPC-SP 11, Power Tool Cleaning to Bare Metal

### Equipment

- Tanks, pressure vessels, pig launchers, meter provers, other pressure containing equipment

### Component Description

<table>
<thead>
<tr>
<th>All internal surfaces</th>
</tr>
</thead>
</table>

### Tanks

- **Bottom:**
  - Yes [x]  No [ ]  Stripe coat corners, edges, and welds
- **Shell:**
  - Yes [x]  No [ ]  Stripe coat corners, edges, and welds
- **Roof (fixed or floating):**
  - Yes [x]  No [ ]  Stripe coat corners, edges, and welds
- **Structural supports:**
  - Yes [x]  No [ ]  Stripe coat corners, edges, and welds
- **Internal equipment and piping:**
  - Yes [x]  No [ ]  Stripe coat corners, edges, and welds

### System

<table>
<thead>
<tr>
<th>Coat No.</th>
<th>Generic Type</th>
<th>Application Method</th>
<th>Minimum DFT, ( \mu m ) (mils)</th>
<th>Maximum DFT, ( \mu m ) (mils)</th>
<th>Shop/Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Optional Epoxy Primer</td>
<td>S</td>
<td>75 (3.0)</td>
<td>150 (6.0)</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>One Coat Epoxy</td>
<td>S</td>
<td>375 (15.0)</td>
<td>625 (25.0)</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td></td>
<td>450 (18.0)</td>
<td>775 (31.0)</td>
<td></td>
</tr>
</tbody>
</table>

*Application Method: S=Spray; B=Brush; R=Roller
APPLICATION OF INTERNAL LININGS

Single Coat Solvent Free Epoxy Lining for New Steel or Existing Steel with Pits

PROJECT NO.  
FACILITY NAME  
LOCATION  
LINING SYSTEM NO.: 203  
SYSTEM DESCRIPTION: Single Coat Solvent Free Epoxy Lining for New Steel or Existing Steel with Pits

Dehumidification Req’d: Yes ☐ No ☐
Mixing and Thinning: Mix according to manufacturer’s instructions and SSPC-PA 1.
Application: Apply according to manufacturer’s instructions and PIP CTSL1000.
Stripe coat required: Yes ☒ No ☐
Reinforcement requirements (reinforced systems only):
Force cure required: Yes ☐ No ☐ (Force cure shall conform to manufacturer’s requirements)
Job stencil required: Yes ☐ No ☐

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Coat 1</th>
<th>Coat 2</th>
<th>Coat 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Optional Epoxy Primer</td>
<td>One Coat Epoxy</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
The optional epoxy primer may be used on pitted steel and may be used for stripe coating or as a holding primer. Follow coating manufacturer's instructions regarding the use of the optional epoxy primer vs. using a squeegee to force the one coat epoxy into pits. Total DFT may be higher than that shown on Page 1 of this data sheet when the optional epoxy primer is used or squeegee of the initial coat is required. The one coat epoxy lining shall have a minimum edge retention of 50%. This lining system is suitable for continuous service in fresh and salt water, and in aliphatic hydrocarbon liquids up to 50°C (122°F) and at pressures up to 690 kPa (100 psi). Gas phase may contain air, nitrogen, hydrocarbon gasses, and no more the 6.9 kPa (1.0 psia) partial pressure of CO2 and no more than 0.69 kPa (0.1 psia) partial pressure of H2S. Corners and edges of metal to be coated shall be rounded to a minimum of 0.8 mm radius (1/32 in.) or chamfered a minimum of 1.6 mm (1/16 in.) wide at an angle of approximately 45° prior to abrasive blasting. Corners, edges, bolts, welds, and other irregularities shall be stripe coated prior to the application of the full prime coat and prior to the application of the full second coat.

Linings for atmospheric pressure tanks for Crude Oil, Produced Oil, Gasoline, Diesel Fuel, Alcohol, MTBE, Distillates, and Aromatic or Aliphatic Hydrocarbons may be installed on the bottom and only four feet up the sides if previous experience demonstrates that corrosion is limited to these areas.

Repair:
For small areas and holidays less than 100 cm² (12.0 ft²): If damaged area is down to bare metal, power tool clean per SSPC-SP 11, feather edges, and apply epoxy lining to restore the specified thickness. If damaged area is down to the epoxy, hand tool or power tool cleaning shall roughen the surface equivalent to sanding with 80 grit sandpaper. Repair coating shall overlap existing coating a minimum of 25 mm (1 in.). Quality control testing, including shall be performed on the repairs. The repair areas shall meet the same requirements as the undamaged lining, except that total coating thickness where the repair coating overlaps the undamaged coating may be up to 50% thicker (maximum 1,000 µm [40 mils]).
## SYSTEM DESCRIPTION:

Two Coat Epoxy Novolac Lining for New Steel or Existing Steel

## SERVICE CONDITIONS:

- **Temperature:** ≤82°C (≤180°F)
- **Pressure:** ≤690 kPa (≤100 psig)
- **Process Fluid:** Oil, water, aromatics, sour hydrocarbon liquids

## SURFACE PREPARATION:

Abrasive blast per SSPC-SP 5/NACE NO. 1 (SA 3) with a profile of 50 to 75 µm (2 to 3 mils).

## SURFACES TO BE LINED:

All internal surfaces with some exceptions. See note on Page 2.

## REFERENCES:

The Society for Protective Coatings (SSPC)
- SSPC-PA 1, Shop, Field & Maintenance Painting
- SSPC-SP 2, Hand Tool Cleaning
- SSPC-SP 3, Power Tool Cleaning
- SSPC-SP 5/NACE NO. 1, White Metal Blast Cleaning
- SSPC-SP 11, Power Tool Cleaning to Bare Metal

### EQUIPMENT:

- Tanks, pressure vessels, pumps, other pressure containing equipment

## COMPONENT DESCRIPTION:

| All internal surfaces |

---

### TANKS:

<table>
<thead>
<tr>
<th>COMPONENT DESCRIPTION</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom</td>
<td>Yes</td>
</tr>
<tr>
<td>Shell</td>
<td>Yes</td>
</tr>
<tr>
<td>Roof (fixed or floating)</td>
<td>Yes</td>
</tr>
<tr>
<td>Structural supports</td>
<td>Yes</td>
</tr>
<tr>
<td>Internal equipment and piping</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### SYSTEM:

<table>
<thead>
<tr>
<th>Coat No.</th>
<th>Generic Type</th>
<th>Application Method</th>
<th>Minimum DFT, µm (mils)</th>
<th>Maximum DFT, µm (mils)</th>
<th>Shop/Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Epoxy Novolac</td>
<td>S</td>
<td>125 (5.0)</td>
<td>175 (7.0)</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Epoxy Novolac</td>
<td>S</td>
<td>125 (5.0)</td>
<td>175 (7.0)</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Total:</strong> 250 (10.0)</td>
<td>350 (14.0)</td>
<td></td>
</tr>
</tbody>
</table>

*Application Method: S=Spray; B=Brush; R=Roller*
## Notes:
The terms epoxy novolac and epoxy phenolic are acceptable alternates as long as the lining material meets the following minimum performance requirements: this lining system is suitable for continuous service in fresh and salt water, and in aliphatic and aromatic hydrocarbon liquids up to 50°C (150°F) and at pressures up to 690 kpa (100 psi). Gas phase may contain air, nitrogen, hydrocarbon gasses, and no more the 103 kpa (15.0 psia) partial pressure of CO2 and no more than 7 kpa (1 psia) partial pressure of H2S.

Corners and edges of metal to be coated shall be rounded to a minimum of 0.8 mm radius (1/32 in.) or chamfered a minimum of 1.6 mm (1/16 in.) wide at an angle of approximately 45° prior to abrasive blasting. Corners, edges, bolts, welds, and other irregularities shall be stripe coated prior to the application of the full prime coat.

Linings for atmospheric pressure tanks for crude oil, produced oil, gasoline, diesel fuel, alcohol, mtsbe, distillates, and aromatic or aliphatic hydrocarbons may be installed on the bottom and only four feet up the sides if previous experience demonstrates that corrosion is limited to these areas.

## Repair:
For small areas and holidays less than 100 cm2 (12.0 in2): if damaged area is down to bare metal, power tool clean per SSPC-SP 11, feather edges, and apply epoxy novolac lining to restore the specified thickness. If damaged area is down to the epoxy, hand tool clean per SSPC-SP 2 and/or power tool clean per SSPC-SP 3, feather edges, and apply epoxy novolac lining to restore the specified thickness. Hand tool or power tool cleaning shall roughen the surface equivalent to sanding with 80 grit sandpaper. Repair coating shall overlap existing coating a minimum of 25 mm (1 in.). Quality control testing, including holiday testing, shall be performed on the repairs. The repair areas shall meet the same requirements as the undamaged lining, except that total coating thickness where the repair coating overlaps the undamaged coating may be up to 50% thicker (maximum 450 µm 18 mils).
### Application of Internal Linings

Solvent Free Single Coat Epoxy Novolac Lining for New or Existing Steel

**LINING SYSTEM NO.:** 205

**SYSTEM DESCRIPTION:** Solvent Free Single Coat Epoxy Novolac Lining for New or Existing Steel

**SERVICE CONDITIONS:**
- **TEMPERATURE:** ≤82°C (≤180°F)
- **PRESSURE:** ≤690 kPa (≤100 psig)
- **PROCESS FLUID:** Oil, water, aromatics, hydrocarbon and acid gasses

**SURFACE PREPARATION:** Abrasive blast per SSPC-SP 5/NACE NO. 1 (SA 3) with a profile of 50 to 75 µm (2 to 3 mils).

**SURFACES TO BE LINED:** All internal surfaces with some exceptions. See note on Page 2.

**REFERENCES**
The latest edition (or edition indicated) of the following industry standards and references shall be considered an integral part of this Internal Lining System.

- The Society for Protective Coatings (SSPC)
  - SSPC-PA 1, Shop, Field & Maintenance Painting
  - SSPC-SP 2, Hand Tool Cleaning
  - SSPC-SP 3, Power Tool Cleaning
  - SSPC-SP 5/NACE NO. 1, White Metal Blast Cleaning
  - SSPC-SP 11, Power Tool Cleaning to Bare Metal

**EQUIPMENT:** Tanks, pressure vessels, pumps, pig launchers, meter provers, other pressure containing equipment

**NOTES:**
LININGS SHALL BE APPLIED IN ACCORDANCE WITH THE DRY FILM THICKNESS SPECIFIED ON THE LINING MANUFACTURER’S PUBLISHED PRODUCT DATA SHEETS.

### System

<table>
<thead>
<tr>
<th>Component Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>All internal surfaces</td>
<td>LININGS SHALL BE APPLIED IN ACCORDANCE WITH THE DRY FILM THICKNESS SPECIFIED ON THE LINING MANUFACTURER’S PUBLISHED PRODUCT DATA SHEETS.</td>
</tr>
</tbody>
</table>

### Tanks

<table>
<thead>
<tr>
<th>Component Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bottom</strong></td>
<td>Yes ☑ No ☐ Stripe coat corners, edges, and welds</td>
</tr>
<tr>
<td><strong>Shell</strong></td>
<td>Yes ☑ No ☐ Stripe coat corners, edges, and welds</td>
</tr>
<tr>
<td><strong>Roof (fixed or floating)</strong></td>
<td>Yes ☑ No ☐ Stripe coat corners, edges, and welds</td>
</tr>
<tr>
<td><strong>Structural supports</strong></td>
<td>Yes ☑ No ☐ Stripe coat corners, edges, and welds</td>
</tr>
<tr>
<td><strong>Internal equipment and piping</strong></td>
<td>Yes ☑ No ☐ Stripe coat corners, edges, and welds</td>
</tr>
</tbody>
</table>

### System

<table>
<thead>
<tr>
<th>Coat No.</th>
<th>Generic Type</th>
<th>Application Method</th>
<th>Minimum DFT, mils (µm)</th>
<th>Maximum DFT, mils (µm)</th>
<th>Shop/Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Optional Epoxy Novolac Primer</td>
<td>S</td>
<td>75 (3.0)</td>
<td>150 (6.0)</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Epoxy Novolac</td>
<td>S</td>
<td>375 (15.0)</td>
<td>625 (25.0)</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Max DFT Will Be Greater If Optional Primer Is Used.</strong></td>
<td>Total:</td>
<td>375 (15.0)</td>
<td>625 (25.0)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Application Method: S=Spray; B=Brush; R=Roller
APPLICATION OF INTERNAL LININGS
Solvent Free Single Coat Epoxy Novolac Lining for New or Existing Steel

PROJECT NO.  PROJECT DOCUMENT NO.  FACILITY NAME  LOCATION

LINING SYSTEM NO.: 205
SYSTEM DESCRIPTION: Solvent Free Single Coat Epoxy Novolac Lining for New or Existing Steel

Dehumidification Req’d: Yes ☐ No ☐
Mixing and Thinning: Mix according to manufacturer’s instructions and SSPC-PA 1.
Application: Apply according to manufacturer’s instructions and PIP CTSL1000.
Stripe coat required: Yes ☐ No ☐
Reinforcement requirements (reinforced systems only):
Force cure required: Yes ☐ No ☐ (Force cure shall conform to manufacturer’s requirements)
Job stencil required: Yes ☐ No ☐

Manufacturer

<table>
<thead>
<tr>
<th>Coat 1</th>
<th>Coat 2</th>
<th>Coat 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optional Epoxy Novolac Primer</td>
<td>Epoxy Novolac</td>
<td></td>
</tr>
</tbody>
</table>

Notes:

The optional epoxy novolac primer may be used on pitted steel and may be used for stripe coating or as a holding primer. Follow coating manufacturer’s instructions regarding the use of the optional epoxy novolac primer vs. using a squeegee to force the one coat epoxy novolac into pits. Total dft may be higher than that shown on page 1 of this data sheet when the optional epoxy primer is used or squeegee of the initial coat is required. This epoxy novolac lining shall have a minimum edge retention of 50%. The terms epoxy novolac and epoxy phenolic are acceptable alternates as long as the lining material meets the following minimum performance requirements: this lining system is suitable for continuous service in fresh and salt water, and in aliphatic and aromatic hydrocarbon liquids up to 65°C (150°F) and at pressures up to 100 psi (690 kpa). Gas phase may contain air, nitrogen, hydrocarbon gasses, and no more the 103 kpa (15.0 psia) partial pressure of CO₂ and no more than 7 kpa (1 psia) partial pressure of H₂S. Corners and edges of metal to be coated shall be rounded to a minimum of 0.8 mm radius (1/32 in.) Or chamfered a minimum of 1.6 mm (1/16 in.) Wide at an angle of approximately 45° prior to abrasive blasting. Corners, edges, bolts, welds, and other irregularities shall be stripe coated prior to the application of the full prime coat Linings for atmospheric pressure tanks for crude oil, produced oil, gasoline, diesel fuel, alcohol, mtbe, distillates, and aromatic or aliphatic hydrocarbons may be installed on the bottom and only three feet up the sides if previous experience demonstrates that corrosion is limited to these areas.

Repair:

For small areas and holidays less than 100 cm² (12.0 in.²): if damaged area is down to bare metal, power tool clean per SSPC-SP 11, feather edges, and apply epoxy novolac lining to restore the specified thickness. If damaged area is down to the epoxy novolac, hand tool clean per SSPC-SP 2 and/or power tool clean per SSPC-SP 3, feather edges, and apply epoxy novolac lining to restore the specified thickness. Hand tool or power tool cleaning shall roughen the surface equivalent to sanding with 80 grit sandpaper. Repair coating shall overlap existing coating a minimum of 25 mm (1 in.). Quality control testing, including holiday testing, shall be performed on the repairs. The repair areas shall meet the same requirements as the undamaged lining, except that total coating thickness where the repair coating overlaps the undamaged coating may be up to 50% thicker.
APPLICATION OF INTERNAL LININGS
Two Coat Epoxy Novolac Lining for New Steel or Existing Steel

SERVICE CONDITIONS:
- TEMPERATURE: ≤100 °C (≤212°F)
- PRESSURE: ≤690 kPa (≤100 psig)
- PROCESS FLUID: Demineralized water, boiler make-up and condensate, polished water

SURFACE PREPARATION:
Abrasive blast per SSPC-SP 5/NACE NO. 1 (SA 3) with a profile of 50 to 75 µm (2 to 3 mils).

SURFACES TO BE LINED: All internal surfaces

REFERENCES
The latest edition (or edition indicated) of the following industry standards and references shall be considered an integral part of this Internal Linings System.

- The Society for Protective Coatings (SSPC)
  - SSPC-PA 1, Shop, Field & Maintenance Painting
  - SSPC-SP 2, Hand Tool Cleaning
  - SSPC-SP 3, Power Tool Cleaning
  - SSPC-SP 5/NACE NO. 1, White Metal Blast Cleaning
  - SSPC-SP 11, Power Tool Cleaning to Bare Metal

EQUIPMENT: Tanks, pressure vessels, pumps, other pressure containing equipment

<table>
<thead>
<tr>
<th>COMPONENT DESCRIPTION:</th>
<th>NOTES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>All internal surfaces</td>
<td></td>
</tr>
</tbody>
</table>

TANKS:

<table>
<thead>
<tr>
<th>COMPONENT DESCRIPTION:</th>
<th>NOTES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom</td>
<td>Yes ☒ No ☐ Stripe coat corners, edges, and welds</td>
</tr>
<tr>
<td>Shell</td>
<td>Yes ☒ No ☐ Stripe coat corners, edges, and welds</td>
</tr>
<tr>
<td>Roof (fixed or floating)</td>
<td>Yes ☒ No ☐ Stripe coat corners, edges, and welds</td>
</tr>
<tr>
<td>Structural supports</td>
<td>Yes ☒ No ☐ Stripe coat corners, edges, and welds</td>
</tr>
<tr>
<td>Internal equipment and piping</td>
<td>Yes ☒ No ☐ Stripe coat corners, edges, and welds</td>
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</tbody>
</table>

SYSTEM

<table>
<thead>
<tr>
<th>Coat No.</th>
<th>Generic Type</th>
<th>Application Method</th>
<th>Minimum DFT, µm (mils)</th>
<th>Maximum DFT, µm (mils)</th>
<th>Shop/Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Epoxy Novolac</td>
<td>S</td>
<td>125 (5.0)</td>
<td>175 (7.0)</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Epoxy Novolac</td>
<td>S</td>
<td>125 (5.0)</td>
<td>175 (7.0)</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total:</td>
<td></td>
<td></td>
<td>250 (10.0)</td>
<td>350 (14.0)</td>
<td></td>
</tr>
</tbody>
</table>
**APPLICATION OF INTERNAL LININGS**
Two Coat Epoxy Novolac Lining
for New Steel or Existing Steel

**PROJECT NO.**

**FACILITY NAME**

**LOCATION**

**LINING SYSTEM NO.:** 206

**SYSTEM DESCRIPTION:** Two Coat Epoxy Novolac Lining for New Steel or Existing Steel

*Application Method: S=Spray; B=Brush; R=Roller

<table>
<thead>
<tr>
<th>Dehumidification Req’d:</th>
<th>Yes</th>
<th>No</th>
<th>Nonapplicable</th>
</tr>
</thead>
</table>

**Mixing and Thinning:** Mix according to manufacturer’s instructions and SSPC-PA 1.

**Application:** Apply according to manufacturer’s instructions and PIP CTSL1000.

**Stripe coat required:** Yes ☒ No ☐ Nonapplicable

**Reinforcement requirements (reinforced systems only):**

**Force cure required:** Yes ☒ No ☐ (Force cure shall conform to manufacturer’s requirements)

**Job stencil required:** Yes ☒ No ☐ Nonapplicable

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Coat 1</th>
<th>Coat 2</th>
<th>Coat 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Epoxy Novolac</td>
<td>Epoxy Novolac</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
THE MAXIMUM ALLOWABLE CHLORIDE CONCENTRATION ON THE SUBSTRATE IMMEDIATELY PRIOR TO THE APPLICATION OF THE FIRST COAT SHALL BE 2 µG/CM². THE TERMS EPOXY NOVOLAC AND EPOXY PHENOLIC ARE ACCEPTABLE ALTERNATES AS LONG AS THE LINING MATERIAL MEETS THE FOLLOWING MINIMUM PERFORMANCE REQUIREMENTS: THIS LINING SYSTEM IS SUITABLE FOR CONTINUOUS SERVICE IN DEMINERALIZED WATER, BOILER MAKE-UP OR BOILER FEED WATER, CONDENSATE, AND POLISHED WATER AT 100°C (212°F). CORNERS AND EDGES OF METAL TO BE COATED SHALL BE ROUNDED TO A MINIMUM OF 0.8 MM RADIUS (1/32 IN.) OR CHAMFERED A MINIMUM OF 1.6 MM (1/16 IN.) WIDE AT AN ANGLE OF APPROXIMATELY 45° PRIOR TO ABRASIVE BLASTING. CORNERS, EDGES, BOLTS, WELDS, AND OTHER IRREGULARITIES SHALL BE STRIPE COATED PRIOR TO THE APPLICATION OF THE FULL PRIME COAT.

**Repair:**
FOR SMALL AREAS AND HOLIDAYS LESS THAN 0.1 M² (12.0 IN.²): IF DAMAGED AREA IS DOWN TO BARE METAL, POWER TOOL CLEAN PER SSPC-SP 11, FEATHER EDGES, AND APPLY EPOXY NOVOLAC LINING TO RESTORE THE SPECIFIED THICKNESS. IF DAMAGED AREA IS DOWN TO THE EPOXY, HAND TOOL CLEAN PER SSPC-SP 2 AND/OR POWER TOOL CLEAN PER SSPC-SP 3, FEATHER EDGES, AND APPLY EPOXY NOVOLAC LINING TO RESTORE THE SPECIFIED THICKNESS. HAND TOOL OR POWER TOOL CLEANING SHALL ROUGHEN THE SURFACE EQUIVALENT TO SANDING WITH 80 GRIT SANDPAPER. REPAIR COATING SHALL OVERLAP EXISTING COATING A MINIMUM OF 25 MM (1 IN.). QUALITY CONTROL TESTING, INCLUDING HOLIDAY TESTING, SHALL BE PERFORMED ON THE REPAIRS. THE REPAIR AREAS SHALL MEET THE SAME REQUIREMENTS AS THE UNDAMAGED LINING, EXCEPT THAT TOTAL COATING THICKNESS WHERE THE REPAIR COATING OVERLAPS THE UNDAMAGED COATING MAY BE UP TO 50% THICKER.
**APPLICATION OF INTERNAL LININGS**

Epoxy Novolac or Epoxy Novolac Vinyl Ester Flake-filled Lining for New Steel or Existing Steel

---

**SERVICE CONDITIONS:**

| TEMPERATURE: | ≤100°C (≤212°F) |
| PRESSURE:    | ≤690 kPa (≤100 psig) |

**PROCESS FLUID:**

Sour crude oil and sour water tanks, pressure vessels and piping

---

**SURFACE PREPARATION:**

Ablative blast per SSPC-SP 5/NACE NO. 3 (SA 3) with a profile of 50 to 100 µm (2 to 4 mils).

---

**SURFACES TO BE LINED:**

All internal surfaces with some exceptions. See note on Page 2.

---

**REFERENCES**

The latest edition (or edition indicated) of the following industry standards and references shall be considered an integral part of this Internal Lining System.

- The Society for Protective Coatings (SSPC)
  - SSPC-PA 1, Shop, Field & Maintenance Painting
  - SSPC-SP 2, Hand Tool Cleaning
  - SSPC-SP 3, Power Tool Cleaning
  - SSPC-SP 5/NACE NO. 1, White Metal Blast Cleaning
  - SSPC-SP 11, Power Tool Cleaning to Bare Metal

**EQUIPMENT:**

- Tanks, pressure vessels, pig launchers, meter provers, other pressure containing equipment

---

**COMPONENT DESCRIPTION:**

All internal surfaces

---

**TANKS:**

<table>
<thead>
<tr>
<th>COMPONENT DESCRIPTION:</th>
<th>NOTES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom</td>
<td>☑ No</td>
</tr>
<tr>
<td>Shell</td>
<td>☑ No</td>
</tr>
<tr>
<td>Roof (fixed or floating)</td>
<td>☑ No</td>
</tr>
<tr>
<td>Structural supports</td>
<td>☑ No</td>
</tr>
<tr>
<td>Internal equipment and piping</td>
<td>☑ No</td>
</tr>
</tbody>
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**SYSTEM**

<table>
<thead>
<tr>
<th>Coat No.</th>
<th>Generic Type</th>
<th>Application Method</th>
<th>Minimum DFT, µm (mils)</th>
<th>Maximum DFT, µm (mils)</th>
<th>Shop/Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Optional Primer</td>
<td>S</td>
<td>50 (2.0)</td>
<td>125 (5.0)</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Epoxy Novolac Vinyl Ester Lining</td>
<td>S</td>
<td>375 (15.0)</td>
<td>750 (30.0)</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Epoxy Novolac Vinyl Ester Lining</td>
<td>S</td>
<td>375 (15.0)</td>
<td>750 (30.0)</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>TOTAL:</td>
<td></td>
<td>800 (32.0)</td>
<td>1625 (65.0)</td>
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*Application Method: S=Spray; B=Brush; R=Roller
APPLICATION OF INTERNAL LININGS
Epoxy Novolac or Epoxy Novolac Vinyl Ester Flake-filled Lining for New Steel or Existing Steel

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Project Document No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Liner System No. | 207                   |

**System Description:** Thick Film Epoxy Novolac or Epoxy Novolac Vinyl Ester Flake-filled Lining for New Steel or Existing Steel

**Dehumidification Req’d:** Yes ☐ No ☐

**Mixing and Thinning:** Mix according to manufacturer’s instructions and SSPC-PA 1.

**Application:** Apply according to manufacturer’s instructions and PIP CTSL1000.

**Stripe coat required:** Yes ☐ No ☐

**Reinforcement requirements (reinforced systems only):**

<table>
<thead>
<tr>
<th>Force cure required</th>
<th>Yes ☐ No ☐ (Force cure shall conform to manufacturer’s requirements)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job stencil required</td>
<td>Yes ☐ No ☐</td>
</tr>
</tbody>
</table>

**Manufacturer**

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Coat 1</th>
<th>Coat 2</th>
<th>Coat 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Optional Primer</td>
<td>Epoxy Novolac Vinyl Ester</td>
<td>Epoxy Novolac Vinyl Ester</td>
</tr>
</tbody>
</table>

**Notes:**
Optional primer may be required on pitted steel and may be used as a holding primer or for stripe coating. Total DFT shall be 750 to 1,500 µm (30 to 60 mils). The coating manufacturer shall designate if their product should be applied in a single coat or in multiple coats. A filler surfacer may be required to fill pits and smooth other irregularities and discontinuities. Consult manufacturer of the chosen lining material for their recommendations. Corners and edges of metal to be coated shall be rounded to a minimum of 0.8 mm radius (1/32 in.) or chamfered a minimum of 1.6 mm (1/16 in.) wide at an angle of approximately 45° prior to abrasive blasting. Corners, edges, bolts, welds, and other irregularities shall be stripe coated prior to the application of the full prime coat and prior to the application of the full second coat. The terms epoxy novolac and epoxy phenolic are acceptable alternates as long as the lining material meets the following minimum performance requirements: this lining system is suitable for continuous service in fresh and salt water, and in aliphatic and aromatic hydrocarbon liquids up to 65°C (150°F) and at pressures up to 100 psi (690 kPa). Gas phase may contain air, nitrogen, hydrocarbon gasses, and no more the 103 kPa (15.0 psia) partial pressure of CO2 and no more than 7 kPa (1 psia) partial pressure of H2S. Linings for atmospheric pressure tanks for Crude Oil, Produced Oil, Gasoline, Diesel Fuel, Alcohol, MTBE, Distillates, and Aromatic or Aliphatic Hydrocarbons may be installed on the bottom and only three feet up the sides if previous experience demonstrates that corrosion is limited to these areas.

**Repair:**
For small areas and holidays less than 100 cm² (12.0 in.²). If damaged area is down to bare metal, power tool clean per SSPC-SP 11, feather edges, and apply epoxy novolac lining to restore the specified thickness. If damaged area is down to the epoxy novolac, hand tool clean per SSPC-SP 2 and/or power tool clean per SSPC-SP 3, feather edges, and apply epoxy novolac lining to restore the specified thickness. Hand tool or power tool cleaning shall roughen the surface equivalent to sanding with 80 grit sandpaper. Repair coating shall overlap existing coating a minimum of 25 mm (1 in.). Quality control testing, including holiday testing, shall be performed on the repairs. The repair areas shall meet the same requirements as the undamaged lining, except that total coating thickness where the repair coating overlaps the undamaged coating may be up to 50% thicker.
APPLICATION OF INTERNAL LININGS
Epoxy Novolac Lining with Fiberglass Mat Reinforcement for New Steel or Existing Steel

SERVICE CONDITIONS:
- TEMPERATURE: ≤100°C (≤212°F)
- PRESSURE: ≤670 kPa (≤100 psig)
- PROCESS FLUID: Sour crude oil and sour water tanks, pressure vessels, and piping

SURFACE PREPARATION: Abrasive blast per SSPC-SP 5/NACE NO. 1 (SA 3) with a profile of 75 to 100 µm (3 to 4 mils).

SURFACES TO BE LINED: Internal surfaces as designated below under “component description.”

REFERENCES
The latest edition (or edition indicated) of the following industry standards and references shall be considered an integral part of this External Coating System.

The Society for Protective Coatings (SSPC)
- SSPC-PA 1, Shop, Field & Maintenance Painting
- SSPC-SP 2, Hand Tool Cleaning
- SSPC-SP 3, Power Tool Cleaning
- SSPC-SP 5/NACE NO. 1, White Metal Blast Cleaning
- SSPC-SP 11, Power Tool Cleaning to Bare Metal

EQUIPMENT:

<table>
<thead>
<tr>
<th>COMPONENT DESCRIPTION</th>
<th>NOTES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>TANKS:</td>
<td></td>
</tr>
<tr>
<td>Bottom</td>
<td>Yes ☒ No ☐</td>
</tr>
<tr>
<td>Shell</td>
<td>Yes ☒ No ☐</td>
</tr>
<tr>
<td>Roof (fixed)</td>
<td>Yes ☒ No ☐</td>
</tr>
<tr>
<td>Roof (floating) and shell above 3 ft</td>
<td>Yes ☒ No ☐</td>
</tr>
<tr>
<td>Internal supports, equipment and piping</td>
<td>Yes ☒ No ☐</td>
</tr>
</tbody>
</table>

SYSTEM

<table>
<thead>
<tr>
<th>Coat No.</th>
<th>Generic Type</th>
<th>Application Method</th>
<th>Minimum DFT, mils (µm)</th>
<th>Maximum DFT, mils (µm)</th>
<th>Shop/Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Optional Primer</td>
<td>S</td>
<td>50 (2.0)</td>
<td>150 (6.0)</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Epoxy Novolac Lining</td>
<td>S</td>
<td>1000 (40.0)</td>
<td>1125 (45.0)</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>1.5 Ounce Glass Mat</td>
<td>S</td>
<td>375 (15.0)</td>
<td>500 (20.0)</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Epoxy Novolac Lining</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total:</td>
<td></td>
<td>1425 (57.0)</td>
<td>1775 (71.0)</td>
<td></td>
</tr>
</tbody>
</table>
**APPLICATION OF INTERNAL LININGS**

Epoxy Novolac Lining with Fiberglass Mat Reinforcement for New Steel or Existing Steel

---

**PROJECT NO.**

**FACILITY NAME**

**LOCATION**

**LINING SYSTEM NO.:** 208

**SYSTEM DESCRIPTION:** Epoxy Novolac Lining with Fiberglass Mat Reinforcement for New Steel or Existing Steel

*Application Method: S=Spray; B=Brush; R=Roller

**Dehumidification Req’d:** Yes ☐ No ☐

**Mixing and Thinning:** Mix according to manufacturer’s instructions and SSPC-PA 1.

**Application:** Apply according to manufacturer’s instructions and PIP CTSL1000.

**Stripe coat required:** Yes ☐ No ☑

**Reinforcement requirements (reinforced systems only):** Install glass mat in wet epoxy novolac lining material, allow to harden, then apply topcoat per MFG instructions.

**Force cure required:** Yes ☐ No ☐ (Force cure shall conform to manufacturer’s requirements)

**Job stencil required:** Yes ☐ No ☐

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Coat 1</th>
<th>Coat 2</th>
<th>Coat 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Optional Primer</td>
<td>Epoxy Novolac or Vinyl Ester</td>
<td>Epoxy Novolac or Vinyl Ester</td>
</tr>
</tbody>
</table>

**Notes:**

Optional primer may be required on pitted steel and may be used as a holding primer or for stripe coating. Total DFT and number of coats may vary from that shown on this lining system Data Sheet No. 210, but it shall be approximately 1,500 µm (60 mils). Comply with the specific requirements of the lining manufacturer for the installation of their material. A filler surfacer may be required to fill pits and smooth other irregularities and discontinuities. Consult the manufacturer of the chosen lining material for their recommendations.

The terms epoxy novolac and epoxy phenolic are acceptable alternates as long as the lining material meets the following minimum performance requirements: this lining system is suitable for continuous service in fresh and salt water, and in aliphatic and aromatic hydrocarbon liquids up to 65°C (150°F) and at pressures up to 100 psi (690 kPa). Gas phase may contain air, nitrogen, hydrocarbon gasses, and no more the 103 kPa (15.0 psia) partial pressure of CO2 and no more than 7 kPa (1 psia) partial pressure of H2S. Corners and edges of metal to be coated shall be rounded to a minimum of 0.8 mm radius (1/32 in.) or chamfered a minimum of 1.6 mm (1/16 in.) wide at an angle of approximately 45° prior to abrasive blasting. Corners, edges, bolts, welds, and other irregularities shall be stripe coated prior to the application of the full prime coat and prior to the application of the full second coat.

**Repair:**

For small areas and holidays less than 100 cm² (12.0 in.²). If damaged area is down to bare metal, power tool clean per SSPC-SP 11, feather edges, and apply epoxy novolac lining with the fiberglass mat and the epoxy novolac topcoat to restore the specified thickness. Consult the lining manufacturer for specific recommendations for preparing the topcoat if wax was used in the topcoat. If damaged area is down to the fiberglass, hand tool clean per SSPC-SP 2 and/or power tool clean per SSPC-SP 3, feather edges, and apply epoxy novolac lining to restore the specified thickness. Hand tool or power tool cleaning shall roughen the surface equivalent to sanding with 80 grit sandpaper. Repair coating shall overlap existing coating a minimum of 25 mm (1 in.). Quality control testing, including holiday testing, shall be performed on the repairs. The repair areas shall meet the same requirements as the undamaged lining, except that total coating thickness where the repair coating overlaps the undamaged coating may be up to 50% thicker.
Epoxy Lining for New Steel or Existing Steel Ballast Tanks on Offshore Structures and Vessels

SYSTEM DESCRIPTION: Epoxy Lining for New Steel or Existing Steel Ballast Tanks on Offshore Structures and Vessels

SERVICE CONDITIONS:
- TEMPERATURE: ≤60°C (≤140°F)
- PRESSURE: ≤345 kPa (≤50 psig)
- PROCESS FLUID: Oil, fuel, fresh and salt water

SURFACE PREPARATION:
Abrasive blast per SSPC-SP 5/NACE NO. 3 (SA 3) with a profile of 50 to 100 µm (2 to 4 mils).

SURFACES TO BE LINED: All internal surfaces

REFERENCES
The latest edition (or edition indicated) of the following industry standards and references shall be considered an integral part of this Internal Lining System.

- The Society for Protective Coatings (SSPC)
  - SSPC-PA 1, Shop, Field & Maintenance Painting
  - SSPC-SP 2, Hand Tool Cleaning
  - SSPC-SP 3, Power Tool Cleaning
  - SSPC-SP 5/NACE NO. 1, White Metal Blast Cleaning
  - SSPC-SP 11, Power Tool Cleaning to Bare Metal

EQUIPMENT: Tanks, braces, structural members

<table>
<thead>
<tr>
<th>COMPONENT DESCRIPTION:</th>
<th>NOTES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>All internal surfaces</td>
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</tr>
</tbody>
</table>

**TANKS:***

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<tr>
<th>COMPONENT DESCRIPTION:</th>
<th>NOTES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom</td>
<td>Yes</td>
</tr>
<tr>
<td>Shell</td>
<td>Yes</td>
</tr>
<tr>
<td>Roof</td>
<td>Yes</td>
</tr>
<tr>
<td>Structural supports</td>
<td>Yes</td>
</tr>
<tr>
<td>Internal equipment and piping</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**SYSTEM COAT NO.:**

<table>
<thead>
<tr>
<th>COAT NO.</th>
<th>GENERIC TYPE</th>
<th>APPLICATION METHOD</th>
<th>MINIMUM DFT, MILS (µM)</th>
<th>MAXIMUM DFT, MILS (µM)</th>
<th>SHOP/FIELD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Epoxy</td>
<td>S</td>
<td>150 (6.0)</td>
<td>200 (8.0)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Epoxy</td>
<td>S</td>
<td>150 (6.0)</td>
<td>200 (8.0)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Total:</strong> 300 (12.0)</td>
<td>400 (16.0)</td>
<td></td>
</tr>
</tbody>
</table>

*Application Method: S=Spray; B=Brush; R=Roller*
Linings System No.: 209

System Description: Epoxy Lining for New Steel or Existing Steel Ballast Tanks on Offshore Structures and Vessels

Dehumidification Req’d: Yes ☐ No ☐

Mixing and Thinning: Mix according to manufacturer’s instructions and SSPC-PA 1.

Application: Apply according to manufacturer’s instructions and PIP CTSL1000.

Stripe coat required: Yes ☐ No ☐

Reinforcement requirements (reinforced systems only):

Force cure required: Yes ☐ No ☐ ☐ (Force cure shall conform to manufacturer’s requirements)

Job stencil required: Yes ☐ No ☐

Manufacturer | Coat 1 | Coat 2 | Coat 3
---|---|---|---
| Epoxy | Epoxy | Epoxy |

Color:

Notes:

This lining system is suitable for continuous service in fresh and salt water, and in aliphatic hydrocarbon liquids up to 140°F (60°C) and at pressures up to 50 psi (345 kPa). Gas phase may contain air, nitrogen, hydrocarbon gasses, engine exhaust for “gas free” system. Corners and edges of metal to be coated shall be rounded to a minimum of 0.8 mm radius (1/32 in.) or chamfered a minimum of 1.6 mm (1/16 in.) wide at an angle of approximately 45° prior to abrasive blasting. Corners, edges, bolts, welds, and other irregularities shall be stripe coated after the application of the full prime coat and prior to the application of the full second coat. Crevices, skip welds, gaps, and pits may be smoothed with epoxy putty per instructions from the lining manufacturer.

Repair:

For small areas and holidays less than 100 cm² (12.0 in.²). If damaged area is down to bare metal, power tool clean per SSPC-SP 11, feather edges, and apply epoxy lining to restore the specified thickness. If damaged area is down to the epoxy, hand tool clean per SSPC-SP 2 and/or power tool clean per SSPC-SP 3, feather edges, and apply epoxy lining to restore the specified thickness. Hand tool or power tool cleaning shall roughen the surface equivalent to sanding with 80 grit sandpaper. Repair coating shall overlap existing coating a minimum of 25 mm (1 in.). Quality control testing, including holiday testing, shall be performed on the repairs. The repair areas shall meet the same requirements as the undamaged lining, except that total coating thickness where the repair coating overlaps the undamaged coating may be up to 50% thicker.
APPLICATION OF INTERNAL LININGS
Solvent Free Single Coat Epoxy Novolac Lining
for New or Existing Steel

<table>
<thead>
<tr>
<th>NO.</th>
<th>DATE</th>
<th>REVISION DESCRIPTION</th>
<th>BY</th>
<th>CHECKED</th>
<th>APPROVED</th>
</tr>
</thead>
</table>

PROJECT NO.  

FACILITY NAME  

LOCATION  

LINING SYSTEM NO.: 210  

SYSTEM DESCRIPTION: Solvent Free Single Coat Epoxy Novolac Lining for New or Existing Steel  

SERVICE CONDITIONS:  

| TEMPERATURE: | ≤65°C (≤150°F) |
| PRESSURE: | ≤3447 kPa (≤500 psig) |

PROCESS FLUID: Propane & Butane tanks, dry, no CO₂ or H₂S.  

SURFACE PREPARATION: Abrasive blast per SSPC-SP 5/NACE NO. 1 (SA 3) with a profile of 50 to 75 µm (2 to 3 mils).  

SURFACES TO BE LINED: All internal surfaces with some exceptions. See note on Page 2.  

REFERENCES  
The latest edition (or edition indicated) of the following industry standards and references shall be considered an integral part of this Internal Lining System.  
The Society for Protective Coatings (SSPC)  
SSPC-PA 1, Shop, Field & Maintenance Painting  
SSPC-SP 2, Hand Tool Cleaning  
SSPC-SP 3, Power Tool Cleaning  
SSPC-SP 5/NACE NO. 1, White Metal Blast Cleaning  
SSPC-SP 11, Power Tool Cleaning to Bare Metal  

EQUIPMENT: Tanks, pressure vessels, pumps, pig launchers, meter provers, other pressure containing equipment  

COMPONENT DESCRIPTION:  
All internal surfaces  

NOTES:  
LININGS SHALL BE APPLIED IN ACCORDANCE WITH THE DRY FILM THICKNESS SPECIFIED ON THE LINING MANUFACTURER’S PUBLISHED PRODUCT DATA SHEETS.  

TANKS:  

<table>
<thead>
<tr>
<th>COMPONENT DESCRIPTION:</th>
<th>NOTES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom</td>
<td>Yes</td>
</tr>
<tr>
<td>Shell</td>
<td>Yes</td>
</tr>
<tr>
<td>Roof (fixed or floating)</td>
<td>Yes</td>
</tr>
<tr>
<td>Structural supports</td>
<td>Yes</td>
</tr>
<tr>
<td>Internal equipment and piping</td>
<td>Yes</td>
</tr>
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SYSTEM  

<table>
<thead>
<tr>
<th>Coat No.</th>
<th>Generic Type</th>
<th>Application Method</th>
<th>Minimum DFT, mils (µm)</th>
<th>Maximum DFT, mils (µm)</th>
<th>Shop/Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Optional Epoxy Novolac Primer</td>
<td>S</td>
<td>75 (3.0)</td>
<td>150 (6.0)</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Epoxy Novolac</td>
<td>S</td>
<td>375 (15.0)</td>
<td>625 (25.0)</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Max DFT Will Be Greater If Optional Primer Is Used.  

Total: 375 (15.0) 625 (25.0)  

*Application Method: S=Spray; B=Brush; R=Roller
APPLICATION OF INTERNAL LININGS
Solvent Free Single Coat Epoxy Novolac Lining
for New or Existing Steel

PROJECT DOCUMENT NO.:

FACILITY NAME

LOCATION

LINING SYSTEM NO.: 210

SYSTEM DESCRIPTION: Solvent Free Single Coat Epoxy Novolac Lining for New or Existing Steel

Dehumidification Req’d:

Yes ☐ No ☐ ☐

Mixing and Thinning: Mix according to manufacturer's instructions and SSPC-PA 1.

Application: Apply according to manufacturer's instructions and PIP CTSL1000.

Stripe coat required:

Yes ☒ No ☐ ☐

Reinforcement requirements (reinforced systems only):

Force cure required:

Yes ☒ No ☐ ☐ (Force cure shall conform to manufacturer’s requirements)

Job stencil required:

Yes ☒ No ☐ ☐

Manufacturer

Coat 1

Optional Epoxy Novolac Primer

Coat 2

Epoxy Novolac

Coat 3


Notes:
The optional epoxy novolac primer may be used on pitted steel and may be used for stripe coating or as a holding primer. Follow coating manufacturer's instructions regarding the use of the optional epoxy novolac primer vs. using a squeege to force the one coat epoxy novolac into pits. Total DFT may be higher than that shown on page 1 of this data sheet when the optional epoxy primer is used or squeege of the initial coat is required. This epoxy novolac lining shall have a minimum edge retention of 50%. The terms epoxy novolac and epoxy phenolic are acceptable alternates as long as the lining material meets the following minimum performance requirements: this lining system is suitable for continuous service in fresh and salt water, and in aliphatic and aromatic hydrocarbon liquids and gasses up to 65°C (150°F) and at pressures up to 500 psi (3447 kpa). Corners and edges of metal to be coated shall be rounded to a minimum of 0.8 mm radius (1/32 in.) Or chamfered a minimum of 1.6 mm (1/16 in.) Wide at an angle of approximately 45° prior to abrasive blasting. Corners, edges, bolts, welds, and other irregularities shall be stripe coated prior to the application of the full prime coat.

Repair:

For small areas and holidays less than 100 cm2 (12.0 in.2): if damaged area is down to bare metal, power tool clean per SSPC-SP 11, feather edges, and apply epoxy novolac lining to restore the specified thickness. If damaged area is down to the epoxy novolac, hand tool clean per SSPC-SP 2 and/or power tool clean per SSPC-SP 3, feather edges, and apply epoxy novolac lining to restore the specified thickness. Hand tool or power tool cleaning shall roughen the surface equivalent to sanding with 80 grit sandpaper. Repair coating shall overlap existing coating a minimum of 25 mm (1 in.). Quality control testing, including holiday testing, shall be performed on the repairs. The repair areas shall meet the same requirements as the undamaged lining, except that total coating thickness where the repair coating overlaps the undamaged coating may be up to 50% thicker.
**APPLICATION OF INTERNAL LININGS**

**DECEMBER 2017**

**INSTRUCTIONS:**

This form shall be completed for each work shift to verify compliance with this practice. Record unsatisfactory work, conditions causing unsatisfactory work, and corrective action. Attach copies of all replica tape readings taken. Attach additional sheets, notes of meetings, or reports as necessary for backup. Submit a copy of all forms and back-up documents to the purchaser’s inspector(s).

**FACILITY NAME/LOCATION:**

**ITEM NAME:**

**PURCHASER/LOCATION:**

**ITEM TAG NO.:**

**JOB NO.:**

**SERVICE:**

**PURCHASE ORDER NO.:**

**UNIT:**

**SUPPLIER/LOCATION:**

**P&ID NO.:**

**SUPPLIER:**

<table>
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<tr>
<th>NO.</th>
<th>DATE</th>
<th>REVISION DESCRIPTION</th>
<th>BY</th>
<th>CHECKED</th>
<th>APPROVED</th>
</tr>
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**REPORT DATE:**

**MATERIAL LINED:** CS SS OTHER:

<table>
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<tr>
<th>CONDITION</th>
<th>START OF BLASTING</th>
<th>START OF WORK</th>
<th>MIDPOINT OF WORK</th>
<th>END OF WORK</th>
</tr>
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</table>

<table>
<thead>
<tr>
<th>TIME</th>
<th>AMBIENT TEMPERATURE</th>
<th>°C</th>
<th>°F</th>
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<tr>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

| | DEW TEMPERATURE | °C | °F |
| |                  |    |    |

| | SUBSTRATE TEMPERATURE | °C | °F |
| |                       |    |    |

**WEATHER CONDITIONS**

**SURFACE PREPARATION:**

**CONDITION OF SURFACE BEFORE BLASTING:**

**METHOD OF REMOVING CONTAMINATION BEFORE BLASTING:**

**BLASTING METHOD:** ABRASIVE TYPE: GRADE:

**DEGREE OF CLEANLINESS OBTAINED:**

**ANCHOR PROFILE:** µm mils

**METHOD OF MEASURING ANCHOR PROFILE:**

**APPLICATION METHOD:**

**METHOD OF SPRAYING:**

**DFT GAGE TYPE AND MODEL:**

**DATE CALIBRATED:**

**LININGS | LINING APPLIED | BATCH NO. | LINING COLOR | THINNER NO./TYPE USED | DFT SPECIFIED | DFT OBTAINED | ACTUAL OVERCOAT INTERVAL (HRS) | LINING MATERIALS USED WITHIN PUBLISHED SHELF LIFE:**
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>COAT 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td>COAT 2</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>COAT 3</td>
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<td></td>
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</tr>
</tbody>
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**COMMENTS:**

**SUPPLIER’S SIGNATURE:**

**INSPECTOR’S SIGNATURE:**
## APPLICATION OF INTERNAL LININGS

**FACILITY NAME/LOCATION:**  
**ITEM NAME:**  
**PURCHASER/LOCATION:**  
**ITEM TAG NO.:**  
**JOB NO.:**  
**SERVICE:**  
**PURCHASE ORDER NO.:**  
**UNIT:**  
**SUPPLIER/LOCATION:**  
**P&ID NO.:**  
**SUPPLIER** /  

1. **PURCHASER** DENOTES PURCHASER OR DESIGNATED REPRESENTATIVE.  
2. **PURCHASER’S INSPECTOR(S) SHALL HAVE THE OPTION TO WITNESS OR REPEAT ANY OF THESE FUNCTIONS AS NECESSARY. ALL MATERIALS, EQUIPMENT, AND WORK SHALL BE AVAILABLE TO THE PURCHASER’S INSPECTOR(S) AT ALL TIMES.**  
3. **PURCHASER’S INSPECTOR(S) SHALL BE GIVEN WRITTEN NOTICE _______ DAYS BEFORE INSPECTION OR TEST.**  
4. **PURCHASER’S INSPECTOR(S) SHALL HAVE ACCESS TO THE WORKSITE DURING THE PROGRESS OF THE WORK, AND THE RIGHT TO CONDUCT ANY INSPECTION OR TESTING DEEMED NECESSARY TO ENSURE THAT THE LININGS ARE PROPERLY APPLIED.**  
5. **THE SUBMISSION OF INSPECTION AND TESTING RESULTS IS A CONDITION OF ACCEPTANCE AND PAYMENT.**

### INSPECTION OR TEST

<table>
<thead>
<tr>
<th>C</th>
<th>W</th>
<th>H</th>
<th>D</th>
<th>DP</th>
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<tbody>
<tr>
<td>YES/NO</td>
<td>YES/NO</td>
<td>YES/NO</td>
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1. **PRE-STARTUP INSPECTION**  
2. **PRE-SURFACE PREPARATION INSPECTION**  
3. **POST-SURFACE PREPARATION INSPECTION**  
4. **PRE-COATING APPLICATION INSPECTION**  
5. **BETWEEN COATS INSPECTION**  
6. **COMPLETED SYSTEM INSPECTION**  
7. **FINAL INSPECTION**

### A. GENERAL

1. **INSPECTION OF LINING OPERATION SHALL BE A PLANNED FUNCTION.**  
2. **THE FOLLOWING PREPARATIONS SHALL BE COMPLETED BEFORE CONDUCTING ANY WORK.**
   
   A. **THE FOLLOWING DOCUMENTS SHALL BE ASSEMBLED:**
   
   1. SPECIFICATIONS  
   2. CODES AND STANDARDS  
   3. COATING MANUFACTURER’S TECHNICAL AND APPLICATION DATA (MOST CURRENT ISSUE)
   B. **TEST EQUIPMENT SHALL BE SUPPLIED IN GOOD WORKING CONDITION AND PROPERLY CALIBRATED. SOME OF THE MOST FREQUENTLY REQUIRED AND USED EQUIPMENT IS:**
   
   1. SURFACE PROFILE COMPARATOR OR TESTEX TAPE  
   2. PSYCHROMETER  
   3. PSYCHROMETRIC TABLES OR CHARTS  
   4. DRY FILM GAUGE AND CALIBRATION BLOCKS  
   5. WET FILM GAGE  
   6. 10X MAGNIFIER  
   7. HOLIDAY DETECTOR – SPONGE AND/OR HIGH VOLTAGE  
   8. COMBUSTIBLE GAS ANALYZER (SNIFER)  
   9. BLACK LIGHT  
   10. SURFACE TEMPERATURE GAGE  
   11. VISUAL STANDARDS FOR BLAST CLEANING  
   12. INSPECTION MIRROR
C. AN INSPECTION PLAN SHALL BE ASSEMBLED THAT OUTLINES, IN CHRONOLOGICAL ORDER, THE SEQUENCE OF ALL INSPECTION ACTIVITIES. FOLLOWING THE INSPECTION PLAN ENSURES THAT EACH PHASE OF THE LINING OPERATION IS INSPECTED BEFORE PROCEEDING WITH THE NEXT PHASE, WHICH ENSURES THAT ANY DEFECTS FOUND ARE CORRECTED.

B. PRE-STARTUP INSPECTION
   1. COATING MATERIALS SUPPLIED SHALL BE CONFIRMED AS CORRECT.
   2. COATING MATERIALS SHALL BE WITHIN PUBLISHED SHELF LIFE FOR COURSE OF OPERATION.
   3. BATCH NUMBERS SHALL BE VERIFIED AND RECORDED.
   4. MATERIALS SHALL BE STORED WITHIN CONDITIONS SPECIFIED.
   5. ABRASIVES USED SHALL BE CLEAN, DRY, AND OF PROPER SIZE TO PRODUCE SPECIFIED SURFACE PROFILE. THEY SHALL MEET REQUIREMENT OF THIS DOCUMENT.
   6. EQUIPMENT AIR SUPPLY TESTING
      A. THE AIR SUPPLY FOR BLAST CLEANING, PNEUMATIC TOOLS, AND SPRAY EQUIPMENT SHALL BE TESTED FOR OIL AND WATER CONTAMINATION IN ACCORDANCE WITH ASTM D4285.
      B. ALL LINES SHALL BE TESTED SEPARATELY.
      C. TESTING SHALL BE PERFORMED AT THE BEGINNING AND END OF EACH WORK SHIFT AND AT NOT LESS THAN 4-HOUR INTERVALS.
      D. IF CONTAMINATION IS DISCOVERED:
          (1) ALL NECESSARY CORRECTIVE ACTIONS SHALL BE MADE AND THE AIR SUPPLY RETESTED.
          (2) SURFACES THAT ARE DETERMINED TO HAVE BEEN BLASTED WITH CONTAMINATED AIR SHALL BE CLEANED WITH SOLVENT AND REBLASTED WITH CLEAN AIR AND ABRASIVE.
          (3) LININGS THAT ARE DETERMINED TO HAVE BEEN APPLIED BY USING CONTAMINATED AIR SHALL BE REMOVED AND REAPPLIED USING CLEAN AIR.

C. PRE-SURFACE PREPARATION INSPECTION
   1. SURFACE PREPARATION SHALL BE SUBJECT TO THE PURCHASER’S INSPECTION AND APPROVAL BEFORE THE APPLICATION OF THE LINING.
   2. BLASTING SHALL PROCEED ONLY AFTER INSPECTION AND APPROVAL BY THE PURCHASER.
   3. GREASE, OIL, OR OTHER CONTAMINANTS SHALL BE IDENTIFIED.
   4. SURFACE IMPERFECTIONS, INACCESSIBLE AREAS, ETC., SHALL BE IDENTIFIED.
   5. CLIMATIC CONDITIONS READINGS:
      A. DEW POINT, RELATIVE HUMIDITY, AND SURFACE TEMPERATURE SHALL BE DETERMINED BEFORE THE SURFACE PREPARATION.
      B. READINGS ARE REQUIRED AT 4-HOUR INTERVALS OR AT OTHER TIME INTERVALS APPROVED BY THE PURCHASER. ALTERNATIVELY, CONTINUOUS MONITORING OF DEW POINT AND RELATIVE HUMIDITY MAY BE PERFORMED USING SYSTEMS ESTABLISHED OR ACCEPTED BY THE PURCHASER.
      C. THE SUBSTRATE TEMPERATURE SHALL BE AT LEAST 3°C (5°F) GREATER THAN THE DEW POINT.
      D. WORK SHALL NOT PROCEED IF THE AMBIENT TEMPERATURE OR RELATIVE HUMIDITY IS OUTSIDE THE REQUIREMENTS OF THIS PRACTICE.
   6. RECIRCULATED SHOT AND GRIT TESTING:
      A. RECIRCULATED SHOT AND GRIT USED FOR ABRASIVE CLEANING SHALL BE TESTED FOR THE PRESENCE OF OIL BY IMMERSING IN WATER AND CHECKING FOR OIL FLOTATION.
      B. TESTS SHALL BE MADE AT THE START OF BLASTING, AT 4-HOUR INTERVALS THEREAFTER, AND AT THE END OF BLASTING.
      C. IF OIL IS EVIDENT:
          (1) CONTAMINATED ABRASIVE SHALL BE REPLACED WITH CLEAN ABRASIVE AND RETESTED BEFORE PROCEEDING.
          (2) ALL STEEL THAT HAS BEEN BLASTED SINCE THE LAST SATISFACTORY TEST SHALL BE REBLASTED.
D. POST-SURFACE PREPARATION INSPECTION
1. ABRASIVE-CLEANED SURFACES SHALL BE INSPECTED FOR PROPER SURFACE CLEANLINESS AND ANCHOR PROFILE USING SSPC OR ISO VISUAL COMPARATORS.
2. SURFACE PREPARATION ANCHOR PROFILE SHALL BE VERIFIED USING EITHER COURSE OR EXTRA-COURSE REPLICA TAPE (AS REQUIRED BY THE PROFILE DEPTH) AND A SPRING-LOADED MICROMETER IN ACCORDANCE WITH ASTM D4417 METHOD C. ANCHOR PROFILE MAY ALSO BE VERIFIED IN ACCORDANCE WITH ISO 8503-5, WHEN APPROVED BY PURCHASER.
3. SSPC-VIS 1-89 OR ISO 8501-1 VISUAL STANDARDS SHALL BE USED FOR CONFIRMING THE DEGREE OF SURFACE CLEANLINESS WHEN THE ADEQUACY OF CLEANING IS IN QUESTION.

E. PRE-COATING APPLICATION INSPECTION
1. DUST, DIRT, BLAST RESIDUE, ETC., SHALL BE REMOVED FROM SURFACE TO BE COATED.
2. SURFACE SHALL NOT BE RE-CONTAMINATED BY OIL, GREASE, FLASH RUSTING, SWEAT MARKS, ETC.
3. AMBIENT CONDITIONS, SURFACE TEMPERATURE, AND DEW POINT SHALL BE WITHIN SPECIFICATIONS.
4. PROPER COATING SHALL BE USED, MIXED, AND THINNED AS SPECIFIED.

F. BETWEEN COATS INSPECTION
1. EACH APPLIED COAT SHALL BE SUBJECT TO THE PURCHASER’S APPROVAL BEFORE THE APPLICATION OF THE NEXT COAT.
2. DRY FILM THICKNESS SHALL BE VERIFIED. DRY FILM THICKNESS (DFT) SHALL BE DETERMINED BY USING METHODS THAT ARE OUTLINED IN SSPC-PA2. COATING THICKNESS MAY ALSO BE MEASURED USING ISO 2178 FOR NON-MAGNETIC COATINGS ON MAGNETIC SUBSTRATES OR ISO 2360 FOR COATINGS ON NON-MAGNETIC SUBSTRATES. HOWEVER, SAMPLING PROCEDURES SHALL FOLLOW SSPC-PA 2.
3. IMPERFECTIONS, SUCH AS OVERSPRAY, PINHOLES, INSUFFICIENT DRY FILM THICKNESS, RUNS, OR SAGS SHALL BE CORRECTED.
4. CURING TIME VERSUS TEMPERATURE SHALL BE AS SPECIFIED.
5. AMBIENT TEMPERATURE CONDITIONS, SURFACE TEMPERATURE, AND DEW POINTS SHALL BE WITHIN SPECIFICATION.
6. DUST, DIRT, OR OTHER CONTAMINANTS SHALL BE REMOVED.
7. PROPER COATING SHALL BE USED, MIXED, AND THINNED AS SPECIFIED.
8. STEP 1 THROUGH STEP 7 SHALL BE REPEATED UNTIL FINAL COAT IS COMPLETE.
9. LINING ADHESION TESTING:
   IF LINING ADHESION OR INTERCOAT ADHESION ARE OF SUSPECT QUALITY, THE ADHESION SHALL BE PERIODICALLY CHECKED AS FOLLOWS:
   A. THE ADHESION TEST METHOD SHALL BE AS AGREED TO BY THE PURCHASER.
   B. ACCEPTABLE ADHESION CLASSIFICATIONS OR PULL-OFF STRENGTHS SHALL BE AS RECOMMENDED BY THE LINING MATERIAL MANUFACTURER AND APPROVED BY THE PURCHASER.
   C. THE ADHESION MAY BE ASSESSED BY MEANS OF A PORTABLE PULL-OFF ADHESION TESTER IN ACCORDANCE WITH ASTM D4541 (ISO 4624) OR ONE OF THE APPROPRIATE TAPE TESTS IN ACCORDANCE WITH ASTM D3359 (ISO 2409).

G. COMPLETED SYSTEM INSPECTION
1. THE COMPLETED LINING SHALL PASS INSPECTION BY THE PURCHASER’S AUTHORIZED INSPECTOR(S).
2. IT IS THE RESPONSIBILITY OF THE SUPPLIER TO CORRECT ANY WORK FOUND NOT TO BE IN ACCORDANCE WITH THE REQUIREMENTS SPECIFIED HEREIN.
3. CURE SHALL CONFORM TO SPECIFICATION.
4. TOTAL DRY FILM THICKNESS SHALL BE VERIFIED. DRY FILM THICKNESS (DFT) SHALL BE DETERMINED BY USING METHODS THAT ARE OUTLINED IN SSPC-PA2. COATING THICKNESS MAY ALSO BE MEASURED USING ISO 2178 OR ISO 2360, AS APPROPRIATE.
5. INTERNAL LININGS SHALL BE 100% HOLIDAY TESTED IN ACCORDANCE WITH NACE SP0188.
6. IMPERFECTIONS SUCH AS OVERSPRAY, PINHOLES, INSUFFICIENT DRY FILM THICKNESS, RUNS, OR SAGS SHALL BE REPAIRED.

H. FINAL INSPECTION
1. ALL REPAIR AND/OR TOUCH-UP WORK SHALL BE COMPLETED.
2. FULL COMPLIANCE WITH THE SPECIFICATION SHALL BE VERIFIED.