Coatings

PIP CTSC1000
Application of Coatings to Concrete
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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Table of Contents

1. Scope .................................. 2
2. References .......................... 2
   2.1 Industry Codes and Standards .... 2
   2.2 Other References ................ 2
3. Definitions ........................... 2
4. Requirements ...................... 3
   4.1 Conflicts, Exceptions, Deviations,
       and Substitutions ................... 3
   4.2 Regulations and Safety Data
       Sheets (SDSs) ........................ 3
   4.3 Concrete Surface Preparation ..... 3
   4.4 Coating Application ................. 5
   4.5 Primer/Sealer Application ......... 5
   4.6 Selection Requirements for
       Concrete Structures and Facilities .... 5
   4.7 Inspection ................................ 6

Data Forms

CTSC1000-D1: Documentation Requirements Sheet
CTSC1000-D2: Selection Criteria Sheet - Concrete Coatings Selection Criteria
CTSC1000-D3: Selection Criteria Sheet - Concrete Coatings Selection Criteria - Purchaser Defined
CTSC1000-D11: Concrete Coating Systems: Coating System #1 - Two-Coat Epoxy System
CTSC1000-D12: Concrete Coating Systems: Coating System #2 - One Coat Non-Skid Epoxy System
CTSC1000-D13: Concrete Coating Systems: Coating System #3 - One Coat Coal Tar Epoxy System
CTSC1000-D14: Concrete Coating Systems: Coating System #4 - Epoxy System for Potable Water
CTSC1000-D15: User-Defined Coating System
CTSC1000-T: Inspection and Testing Requirements Sheet - Application of Coatings to Concrete
CTSC1000-F: Daily Inspection Report - Application of Coatings to Concrete

The following data forms shall be part of this Practice only if indicated on the purchaser's completed Documentation Requirements Sheet.
1. **Scope**

This Practice provides requirements to contractors for the application of coatings to concrete. This Practice describes the minimum requirements for surface preparation, coatings application, and coatings selection for concrete surfaces.

2. **References**

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

2.1 **Industry Codes and Standards**

- American Society for Testing and Materials (ASTM)
  - ASTM D 4262 – *Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces*
  - ASTM D 4263 – *Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method*
  - ASTM D 4285 – *Standard Test Method for Indicating Oil or Water in Compressed Air*
  - ASTM E 337 – *Standard Test Method for Measuring Humidity with a Psychrometer*
- Society of Protective Coating (SSPC)
  - SSPA-PA Guide 10 – *Guide to Safety and Health Requirements*
  - SSPC-SP13/NACE No. 6 – *Surface Preparation of Concrete*
  - SSPC PA-1 – *Shop, Field, and Maintenance Painting of Steel*

2.2 **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*
- NSF International (NSF)
  - NSF/ANSI Standard 61 – *Drinking Water System Components – Health Effects*

3. **Definitions**

*laitance*: Milky white deposit on new concrete caused by leaching out of salts or free alkalis

*owner*: Party who owns the facility wherein the coatings will be used
purchaser: Party who awards the contract to the supplier. The purchaser may be the owner or the owner’s authorized agent.

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

supplier: Party responsible for furnishing and/or installing the coating system

4. Requirements

4.1 Conflicts, Exceptions, Deviations, and Substitutions

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

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

4.2 Regulations and Safety Data Sheets (SDS)

4.2.1 Coatings 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.

4.2.2 The latest issue of the coating manufacturer’s product data sheets, application instructions, and SDS shall be available at the coating site. The lining operations shall be in accordance with these documents.

4.3 Concrete Surface Preparation

4.3.1 Surface Requirements

4.3.1.1 Concrete Cure

a. Concrete shall be permitted to cure for a minimum of 28 days before coating.

b. Shorter curing times shall only be permitted if the concrete passes either the moisture content tests or a purchaser-approved alternate test.

4.3.1.2 Concrete Moisture Content

a. A check to determine if the concrete has cured sufficiently for coating may be made in accordance with the Plastic Sheet Method described in ASTM D 4263.

b. One area every 45 m² (500 ft²) of surface shall be tested.

4.3.2 Environmental Conditions during Surface Preparation

4.3.2.1 Surface shall be tested for dryness after rain, water blasting, or fog.
4.3.2.2 Wind conditions shall permit complete cleanup of dust and dirt on areas to be coated.

4.3.3 Texture and Cleanliness of Prepared (Blast-Cleaned or Broom-Finish) Surface

4.3.3.1 New Concrete

New concrete surfaces shall be prepared in accordance with SSPC-SP13/NACE No. 6.

4.3.3.2 Old Concrete

a. Remove all loose concrete, laitance, surface contamination, sealants, and old coatings by abrasive blasting or other mechanical means before making repairs and coating in accordance with SSPC-SP13/NACE No. 6.

b. Chemically contaminated surfaces shall be neutralized and repaired before coating as follows:

1. Remove all loose concrete, laitance, sealants, and old coatings by abrasive blasting. Remove approximately 25 mm (1 inch) of concrete beyond any visible contaminated surface.

2. Neutralize acidic surfaces with an alkaline cleaner such as soda ash (i.e., sodium carbonate) followed by a high-pressure freshwater rinse. Concrete surfaces (e.g., acid waste neutralizing tanks) that have been in prolonged contact with acids require a minimum soak time of 24 hours at a pH of 7 to 8, agitating the solution during soaking. After rinsing, force air dry surfaces for at least 24 hours before making any repairs to the concrete.

3. Neutralize alkaline surfaces by steam cleaning.

4. The pH of the concrete surface shall be tested in accordance with ASTM D 4262. The pH reading obtained shall not be greater than 1.0 pH unit lower or 2.0 pH units higher than readings taken on the freshwater rinse before being applied to the concrete surface.

4.3.4 Repair/Treatment of Cracks

4.3.4.1 Cracks less than 10 mm (1/2 inch) wide shall be filled using an appropriate filler or grout recommended by the coating manufacturer before applying the primer.

4.3.4.2 Cracks over 10 mm (1/2 inch) wide shall be treated as expansion joints.

4.3.5 Treatment of Joints

4.3.5.1 If the filler is to be removed, expansion and construction joints shall be cleaned out and masked off before coating.

4.3.5.2 If the filler is not to be removed, the filler shall be masked off. When all coating is complete, the masking shall be removed and new sealant installed as required.
4.3.6 Repair of Bug Holes and Voids
After preparation and priming, holes and voids shall be filled with appropriate filler recommended by the coatings manufacturer.

4.3.7 Treatment of Corners
Surfaces subject to immersion conditions shall have inside corners rounded by forming a fillet using an appropriate grout or caulk. The corner shall have a minimum 25 mm (1-inch) fillet.

4.4 Coating Application

4.4.1 Environmental Conditions during Coating Application
4.4.1.1 Relative humidity shall be less than 85 percent, unless otherwise recommended by the coating manufacturer and agreed to by the purchaser.
4.4.1.2 Surface temperature shall not be less than 10°C (50°F).
4.4.1.3 Surface temperature shall be greater than 3°C (5°F) above the dew point.
4.4.1.4 Work shall not proceed if the substrate temperature or relative humidity is not in accordance with coating or lining manufacturer’s requirements.
4.4.1.5 Surface shall be dry to the touch before application.
4.4.1.6 Wind conditions shall not cause dust and dirt accumulation on the surface to be coated.
4.4.1.7 Coating shall not commence until concrete temperature has peaked or stabilized. This step applies only to outdoor applications.

4.4.2 Primer/Sealer Application
4.4.2.1 If a primer/sealer is required, filling and coating shall be done after sealing.
4.4.2.2 Application of primer/sealer shall be by spray except for touch-up of small areas (less than 0.1 m² [1 ft²]).

4.4.3 Finishing Coats Application
Finishing coats shall be applied in accordance with the manufacturer's data sheet, taking into consideration the spreading rate and dry film thickness (DFT) requirements.

4.4.4 Repairs
Any visual holidays or pinholes shall be repaired in accordance with the coating manufacturer’s recommendations.

4.5 Selection Requirements and Coating Systems for Concrete Structures and Facilities
4.5.1 As selected on purchaser’s PIP CTSC1000-D1 Documentation Requirements Sheet, PIP CTSC1000-D2 or PIP CTSC1000-D3 Data Sheets shall be used for selecting the appropriate coating.
4.5.2 If selected on purchaser’s *PIP CTSC1000-D1* Documentation Requirements Sheet, *PIP CTSC1000-D11* through *CTSC1000-D14* Data Sheets shall be used to define specific requirements for each coating system.

4.5.3 The coating material manufacturer should recommend all coating system components, suitable for the intended service conditions.

### 4.6 Inspection and Testing

If *PIP CTSC1000-T* is selected on purchaser’s *PIP CTSC1000-D1* Documentation Requirements Sheet:

a. Surface and coatings inspections and tests shall be in accordance with *PIP CTSC1000-T*, and;

b. Inspection hold points shall be in accordance with *PIP CTSC1000-T*.

### 4.7 Documentation

4.7.1 If selected on purchaser’s *PIP CTSC1000-D1* Documentation Requirements Sheet, *PIP CTSC1000-F* Daily Inspection Report shall be used to log the performance of the work.

4.7.2 If approved by purchaser, supplier’s forms may be used in lieu of the *PIP CTSC1000-F* Daily Inspection Report.

### 4.8 Remedial Work

4.8.1 Defects shall be repaired in accordance with the touch-up and repair procedures approved by the purchaser’s inspector.

4.8.2 Damage from inspections (e.g., adhesion testing, wet film thickness tests, etc.) shall be repaired.
## Application of Coatings to Concrete

**CTSC1000**

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**Project No.:** YES  NO

**Facility Name:**

**Location:**

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## Concrete Coating Selection Criteria

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## PURCHASER DEFINED

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<th>REMARKS</th>
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### 6.0 SECONDARY CONTAINMENT (CONSULT MATERIALS ENGINEER)  

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</table>
## DESCRIPTION OF SURFACES TO BE COATED:

- 

## SURFACE PREPARATION:

Prepare surface in accordance with PIP CTSC1000 and manufacturer’s instructions.

## SPECIAL INSTRUCTIONS:

- **Mixing and Thinning:** Mix according to manufacturer’s instructions and SSPC PA-1.
- **Application:** Apply according to PIP CTSC1000 and manufacturer’s instructions.
- **Job Stencil Required:** Yes [ ] No [ ]
- **Repair:**
## Coating System Material

<table>
<thead>
<tr>
<th>Coating System Material</th>
<th>System 1A</th>
<th>System 1B</th>
<th>System 1C</th>
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<tbody>
<tr>
<td>Epoxy Coat 1</td>
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<td>Ancillary Components</td>
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<tr>
<td>Void Filler</td>
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</tr>
<tr>
<td>Primer</td>
<td></td>
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<tr>
<td>Grout</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Joint Filler</td>
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</tbody>
</table>

## Notes:
**DESCRIPTION OF SURFACES TO BE COATED:**

---

**SURFACE PREPARATION:**
Prepare surface in accordance with CTSC1000 and manufacturer’s instructions.

---

**SPECIAL INSTRUCTIONS:**

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

**Application:** Apply according to manufacturer’s instructions and PIP CTSC1000.

**Job Stencil Required:** Yes [ ] No [ ]

---

**Repair:**
### Coating System Material

<table>
<thead>
<tr>
<th>System 2A</th>
<th>System 2B</th>
<th>System 2C</th>
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</thead>
<tbody>
<tr>
<td>Non-Skid Epoxy</td>
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<td></td>
</tr>
</tbody>
</table>

### Ancillary Components

- Void Filler
- Primer
- Grout
- Joint Filler
- Non-Skid Aggregate

### Notes:
**DESCRIPTION OF SURFACES TO BE COATED:**

**SURFACE PREPARATION:**
Prepare surface in accordance with CTSC1000 and manufacturer’s instructions.

**SPECIAL INSTRUCTIONS:**

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

**Application:** Apply according to manufacturer’s instructions and PIP CTSC1000.

**Job Stencil Required:** Yes ☐ No ☐

**Repair:**
## Coating System Material

<table>
<thead>
<tr>
<th></th>
<th>System 3A</th>
<th>System 3B</th>
<th>System 3C</th>
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</thead>
<tbody>
<tr>
<td>Coal Tar Epoxy</td>
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<td></td>
</tr>
</tbody>
</table>

## Ancillary Components

- Void Filler
- Primer
- Grout
- Joint Filler

## Notes:
DESCRIPTION OF SURFACES TO BE COATED:

SURFACE PREPARATION:
Prepare surface in accordance with CTSC1000 and manufacturer’s instructions.

SPECIAL INSTRUCTIONS:

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

Application: Apply according to manufacturer’s instructions and PIP CTSC1000.

Job Stencil Required: Yes ☐ No ☐

Repair:
## Epoxy System for Potable Water

### Coating System Material

<table>
<thead>
<tr>
<th>System</th>
<th>System 4A</th>
<th>System 4B</th>
<th>System 4C</th>
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</thead>
<tbody>
<tr>
<td>Epoxy - Potable Water</td>
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### Ancillary Components

- Void Filler
- Primer
- Grout
- Joint Filler

### Notes:
<table>
<thead>
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<th>SURFACE PREPARATION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepare surface in accordance with CTSC1000 and manufacturer’s instructions.</td>
</tr>
</tbody>
</table>

**SPECIAL INSTRUCTIONS:**

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

**Application:** Apply according to manufacturer’s instructions and PIP CTSC1000.

**Job Stencil Required:** Yes ☐ No ☐
<table>
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<th>Coating System Material</th>
<th>System</th>
<th>System</th>
<th>System</th>
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<tbody>
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</table>

Ancillary Components:
|                         |        |        |
|                         |        |        |
|                         |        |        |
|                         |        |        |

Notes:
### Requirements

#### A. General

1. Inspection of coating and 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)

---

### Inspection and Testing Requirements Sheet

<table>
<thead>
<tr>
<th>No.</th>
<th>Date</th>
<th>Revision Description</th>
<th>By</th>
<th>Approved</th>
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**Facility Name/Location:**

**Item Name:**

**Item Tag No.:**

**Service:**

**Purchaser/Location:**

**Purchaser Order No.:**

**Unit:**

**Supplier/Location:**

**Supplier Order/Serial Nos.:**

---

1. Purchaser denotes Purchaser or Designated Representative.
2. Purchaser reserves the right to witness all aspects of manufacturing; review and reject manufacturing equipment, testing equipment, test procedures, and test results; and reject product not meeting specification.
3. Purchaser may perform additional testing, inspection, or both.
4. The submission of inspection and testing results is a condition of acceptance and payment.

<table>
<thead>
<tr>
<th>C</th>
<th>W</th>
<th>D</th>
<th>DP</th>
<th>Remarks</th>
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</thead>
<tbody>
<tr>
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</tbody>
</table>

---

**Inspection or Test:**

1. Pre-Start Up 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

---

**Purchaser shall be given written notice _____ days before inspection or test.**
b. Test equipment shall be assembled onsite 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) Wet film gage
   (5) 10X magnifier
   (6) Combustible gas analyzer (sniffer)
   (7) Black light
   (8) Surface temperature gauge
   (9) Visual standards for blast cleaning
   (10) Inspection mirror

c. The test equipment shall be available for use by purchaser in conducting surveillance of the work.

d. 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 will be inspected before proceeding to the next phase, which ensures that any defects found are corrected.

3. COMPRESSED AIR QUALITY

   a. The quality of the compressed air shall be tested in accordance with ASTM D4285.

   b. Before using compressed air, the quality of the air downstream of the separators shall be tested by blowing the air onto a clean, white blotter or cloth for 1 minute to check for any contamination, oil, or moisture.

   c. Quality tests shall be performed at the following times:
      (1) At the beginning of each work shift
      (2) At four (4) intervals during each shift
      (3) After any interruption of the air compressor operation
      (4) As required by the purchaser

   d. The air shall be used only if the test indicates no visible contamination.

   e. If contaminants are evident, the equipment deficiencies shall be corrected and the air stream shall be retested.

   f. Separators shall be drained continuously.

   g. Air lines shall be individually tested before use.

   h. If originally applied by using contaminated air, the coatings and lining systems shall be removed and reapplied using clean air.

B. PRE-START-UP 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 in accordance with coating manufacturer’s recommendations.

5. Abrasive used shall be clean, dry, and of proper size to produce specified surface profile.

C. PRESURFACE PREPARATION INSPECTION

1. Grease-free chalk shall be used to identify areas that are not in accordance with PIP CTSC1000.

2. Grease, oil, or other contaminants shall be identified.

3. Surface imperfections, inaccessible areas, etc., shall be identified.

4. Ambient conditions, surface temperatures, and dew point shall be in accordance with PIP CTSC1000.
D. POSTSURFACE PREPARATION INSPECTION

Degree of cleaning and surface profile shall be in accordance with PIP CTSC1000.

E. PRECOATING APPLICATION INSPECTION

1. Dust, dirt, blast residue, etc., shall be removed from surface to be coated.
2. Surface shall not be recontaminated by oil, grease, flash rusting, sweat marks, etc.
3. Ambient temperature conditions, surface temperature, and dew point shall be monitored as follows:
   a. Dew point and relative humidity shall be determined in accordance with ASTM E 337 using a sling psychrometer or an approved equal.
   b. Dew point and relative humidity monitoring shall be performed at the following times as approved by the purchaser:
      (1) Approximately every 4 hours
      (2) Other time intervals approved by purchaser in writing
      (3) Continuously monitor by using systems approved by purchaser
   c. Surface temperature and humidity readings shall be recorded.
   d. Work shall not proceed if the ambient temperature or relative humidity is outside the requirements of PIP CTSC1000 or the coating manufacturer's requirements.
4. Proper coating shall be used, mixed, and thinned as specified.

F. BETWEEN COATS INSPECTION

1. Wet film thickness shall be monitored by a minimum of three wet film gauge readings per 10 m² (100 ft²).
2. Imperfections, such as overspray, pinholes, insufficient dry film thickness, runs, or sags, shall be corrected.
3. Curing time versus temperature shall be in accordance with coating manufacturer’s requirements.
4. Ambient temperature conditions, surface temperature, and dew points shall be in accordance with PIP CTSC1000.
5. Surface temperature and humidity readings shall be recorded.
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.

G. COMPLETED SYSTEM INSPECTION

1. Cure shall conform to specification.
2. Total dry film thickness shall be verified.
3. 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. The coating or lining shall be visually inspected for defects and shall be in accordance with the manufacturer's requirements.
3. Full compliance with the specification shall be verified.
**APPLICATION OF COATINGS TO CONCRETE**

**DAILY INSPECTION REPORT**

**ASSOC. PIP:**

CTSC1000

**PURCHASER/LOCATION:**

---

**FACILITY NAME/LOCATION:**

---

**ITEM NAME:**

---

**PURCHASER/LOCATION:**

---

**ITEM TAG NO.:**

---

**JOB NO.:**

---

**SERVICE:**

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**PURCHASER ORDER NO.:**

---

**UNIT:**

---

**SUPPLIER/LOCATION:**

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**P&ID NO.:**

---

**SUPPLIER ORDER/ SERIAL NOS.:**

---

**INSTRUCTIONS:**

CONTRACTOR SHALL COMPLETE THIS FORM 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).

---

**REPORT DATE:**

---

**CONDITION**

---

**START OF BLASTING**

---

**START OF WORK**

---

**MIDPOINT OF WORK**

---

**END OF WORK**

---

**TIME**

---

**AMBIENT TEMPERATURE**

---

**RELATIVE HUMIDITY (%)**

---

**DEW TEMPERATURE**

---

**SUBSTRATE TEMPERATURE**

---

**WEATHER CONDITIONS**

---

**SURFACE PREPARATION:**

---

**CONDITION OF SURFACE BEFORE BLASTING:**

---

**METHOD OF REMOVING CONTAMINATION BEFORE BLASTING:**

---

**METHOD OF BLASTING:**

---

**ABRASIVE TYPE:**

---

**GRADE:**

---

**DEGREE OF CLEANLINESS OBTAINED:**

---

**ANCHOR PROFILE:**

---

**METHOD OF MEASURING ANCHOR PROFILE:**

---

**APPLICATION INFORMATION:**

---

**METHOD OF SPRAYING:**

---

**DFT GAGE TYPE AND MODEL:**

---

**DATE CALIBRATED:**

---

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<th>BATCH NO.</th>
<th>LINING COLOR</th>
<th>THINNER NO./TYPE USED</th>
<th>DFT SPECIFIED</th>
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**COMMENTS:**

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CONTRACTOR'S SIGNATURE: __________

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INSPECTOR'S SIGNATURE: __________