

# ENGINEERING SPECIFICATION

## FOR

### PIPING AND EQUIPMENT COATING

### IN CATEGORY A AND B AREAS

## PUEBLO CHEMICAL AGENT-DESTRUCTION PILOT PLANT (PCAPP) PROJECT

QUALITY LEVEL:		<input checked="" type="checkbox"/> Q	<input type="checkbox"/> Non-Q	<input type="checkbox"/> N/A			
000	2/21/06	Revised to Incorporate New Quality Level Designation and Issue for Construction		<i>MSH</i>	<i>MSH</i>	<i>MSH</i>	
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## **1 SCOPE**

### **1.1 GENERAL**

This Specification covers the requirements for surface preparation, application, inspection, and documentation of Coatings applied in the shop and in the field to piping and equipment in category A, and B areas in the Pueblo Chemical Agent Destruction Pilot Plant.

The extent of coatings for piping and equipment is specified in the drawings and finish schedule for each room.

This Specification is accompanied by equipment drawings and/or data sheets, which may supersede the requirements of this Specification. If the Seller's interpretation suggests a conflict between this Specification, and the equipment drawings, data sheets, coating manufacturer's standards or supplemental specifications, the Seller shall contact the Buyer and obtain a written clarification before proceeding with any work.

Attachment A contains a description of generic coating materials, coating material codes, coating system codes, and proposed coating products. Surfaces listed in the COATING SCHEDULE, other than those listed in paragraphs 1.2.1 and 1.2.2 below, will receive the surface preparation, coatings, and number of coats prescribed in Attachment B. Attachment C contains color requirements.

### **1.2 ITEMS INCLUDED**

1. Provide all required equipment, labor, materials, and supervision to clean and coat designated structures components, and surfaces as defined in Attachment B.
2. Protect all adjacent surfaces, items, and equipment during all phases of work.
3. Inspection of each phase of the work and documentation of acceptance.
4. Environmental control equipment to provide the application and curing conditions required.
5. Touch-up and repair of defective or damaged coatings.

#### **1.2.1 Surfaces Not Requiring Coating**

The following listed items will not require painting:

Pre-finished Items – unless otherwise indicated, factory-finishing or installer-finishing shall be Manufacturer's Standard finished as is normally specified for such items as (but not limited to) finished mechanical and electrical equipment, including light fixtures, switch-gear, and distribution cabinets.

#### **1.2.2 Surfaces for Which Painting is Prohibited**

1. Surfaces within two inches of field welds, unless otherwise specified.
2. Rubber, elastomers, or similar nonmetallic parts, unless otherwise specified.

3. Machined surfaces, unless otherwise specified.
4. Stainless steel, chromium plate, hastelloy, titanium, plastic, or reinforced plastic surfaces, unless otherwise specified.

### **1.2.3 Operating Parts**

Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, and motor and fan shafts will not require finish painting.

### **1.2.4 Labels**

Do not paint over any code-required labels, such as Underwriters Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates, tracks and track trolleys, sprinkler heads, and fire-detection element, or fiberglass grating, stairs, or handrails.

## **1.3 SAFETY AND ENVIRONMENTAL**

1. All surface preparation, materials, and coatings work shall comply with all applicable environmental and safety provisions, laws, regulations, ordinances, etc., of the city, county, state, province, or nation pertaining to the work being performed and the coating materials being used. Work being performed in the United States shall also be in strict accordance with Federal (OSHA 29CFR 1910.144), State, and local safety and environmental requirements.
2. Seller shall comply fully with OSHA Hazard Communications Standard 29 CFR 1910.1200. Material Safety Data Sheets (MSDS) shall be provided by the materials supplier and available at the place of application for review.
3. The volatile organic compound (VOC) content of all materials shall meet Federal, State, and Local or other Regulatory requirements.

## **2 APPLICABLE DOCUMENTS**

The following documents form part of this specification to the extent specified herein. In the event of a conflict between the referenced document and the contents of this specification, the Buyer shall be notified to resolve the conflict.

### **2.1 CODES AND STANDARDS**

<b>ASTM</b>	<b>American Society of Testing and Materials</b>
D 520	Standard Specification for Zinc Dust Pigment, 2000
D 4417	Field Measurement of Surface Profile of Blast Cleaned Steel, 2003
D 4541	Pull-Off Strength of Coatings Using Portable Adhesion Testers, 2002
E 337	Test for Relative Humidity by Wet-and-Dry-Bulb Psychometric, 2002
D 3359	Standard Test Method for Measuring Adhesion by Tape Test, 2002

<b>FED STD</b>	<b>Federal Standard</b>
595 (rev B)	Colors
<b>OSHA</b>	<b>Occupational Safety and Health Administration</b>
29 CFR 1910.144	Safety Color Code
29 CFR 1910.1200	Hazard Communications Standard
29 CFR 1926.59	Labeling of Hazardous Materials
<b>SSPC</b>	<b>The Society for Protective Coatings</b>
SP-1	Solvent Cleaning, Nov. 1982
SP-3	Power Tool Cleaning, Nov. 1982
SP-5	Abrasive Blast Cleaning to White Metal, Sept. 2000
SP-6	Commercial Blast Cleaning, Sept. 2000
SP-7	Brush-Off Blast Cleaning, Sept. 2000
SP-10	Near White Blast Cleaning, Sept. 2000
SP-11	Power Tool Cleaning to Bare Metal, July 1995
Paint 20	Zinc-rich Primers (Type I, Inorganic and Type II, Organic), Aug. 2001
VIS 1-89	Visual Standards for Abrasive Blast Cleaned Steel
VIS 3	Visual Standard for Power and Hand Tool Cleaned Steel, July 1995
PA 2	Measurement of Dry Paint Thickness with Magnetic Gauges, Aug. 1991
AB 1	Abrasive Specification No. 1 Mineral and Slag Abrasives, June 1991
AB 3	Newly Manufactured or Re-Manufactured Steel Abrasive, May 1997

## **2.2 OTHER DOCUMENTS**

24852-RD-3PS-000-T0001	Engineering Specification for Supplier Quality Assurance
24852-RD-3PS-000-T0001	General Project Requirements

## **3 REQUIREMENTS**

### **3.1 INSTRUCTIONS**

#### **3.1.1 Application Procedure**

The coating material manufacturer's current printed product description, material safety data sheets (MSDS), and technical data sheets for each coating product shall be furnished by the Seller with the bid. MSDS submittals shall meet the requirements of FED-STD 313. Detailed mixing, thinning, and application instructions, minimum and maximum application temperature and drying times between coats, shall be included. Touch-up and damage repair procedure including repair of any destructive testing sites shall be covered in detail. All application and repair procedures shall be submitted and accepted prior to any work being performed.

#### **3.1.2 Equipment Manufacturer's Standard Finish**

A detailed description of the manufacturer's standard finish shall be submitted for all pre-finished equipment and components by the Seller with the bid. The description shall include:

- The method of surface preparation, degree of cleanliness, and profile achieved.

- Generic type, manufacturer, and the product name and number for all coating products in the system and the product data sheet for each coating product.
- The number of coats, application sequence, dry film thickness of each coat, and the total dry film thickness of the completed coating system.

## **3.2 REPORTS**

### **3.2.1 Chemical Resistance**

Test reports showing that products proposed for coating systems that include the chemical resistant epoxy finish (Appendix B system codes AF and GE) meet all the requirements specified in paragraph 4.4 shall be furnished by the coating material manufacturer with the bid. Testing shall be conducted by the coating material manufacturer's own laboratory testing facility or by a certified outside independent testing laboratory. Test reports shall include color photographs of the test samples, test procedures, and test results. The report shall also include the surface preparation of samples, the number of coats used, and the dry film thickness of each coat. Test reports shall also include a statement indicating the coatings are resistant to the chemicals under the conditions (concentration, temperature, humidity) indicated.

### **3.2.2 Certificates**

Furnish a certificate from the manufacturer of each proposed coating product stating the content of lead, mildewcide, insecticide, and zinc chromate or strontium chromate pigments.

Furnish a certificate from the manufacturer of each proposed coating product stating that the coating meet the VOC regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project or work is located.

## **4 MATERIALS**

### **4.1 GENERAL**

Coating materials shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service. Equivalent materials manufactured by other industrial suppliers may be submitted for consideration. The Seller shall furnish satisfactory documentation from the manufacturer of the proposed substitute product that the material meets the requirements and is equivalent or better.

Materials for touch-up of coated surfaces shall be the same as those originally applied.

Tinting shall be done by the manufacturer.

Coatings shall not contain mercurial mildewcides or insecticides. Coatings shall not contain lead in excess of 0.06 percent by weight of the total nonvolatile content (calculated as lead metal). Coatings shall not contain zinc chromate or strontium chromate pigments.

## **4.2 MATERIAL MANUFACTURERS**

Unless otherwise specified, all coating material shall be as specified by the Buyer in Attachment A. Materials from other manufacturers may be used provided the documentation and testing required by section 3.2.1 are provided to support the use of the product as an alternate material. Written acceptance is required from Buyer prior to use.

## **4.3 MACHINED-SURFACE COATINGS**

Machined surfaces not specified to be coated with a specific coating system shall be protected with a solvent cutback asphalt temporary preservative (Tectyl 890, Cosomoline 1058, Rust-Ban 373, or equal) or Buyer accepted equivalent.

## **4.4 TEST REQUIREMENTS**

Testing shall be performed on coating systems AF and GE (Appendix B system codes) that include the chemical resistant epoxy finish coat. All testing shall be performed using the manufacturer's own laboratory testing facilities, or if not available, certified outside independent testing laboratory..

### **4.4.1 Sample Preparation**

Carbon steel test panels shall be 2 x4 x1/8-inches for chemical testing. Test panels shall be at least 2 x 4 x 1/8-inches for adhesion testing. All surfaces shall be coated according to this specification and the manufacturer's recommendations. Steel panels shall be weighed in grams to six significant figures before and after coating to determine the weight of the applied coating.

### **4.4.2 Chemical Resistance Test**

1. Conduct the sodium hydroxide tests at 71° C (160°F) and 45 to 55 percent humidity. Conduct the potassium monopersulfate and sodium hypochlorite tests at 22°C (72°F) and 45 to 55 percent humidity. Immerse at least one steel panel into the specified solutions in a beaker. At the end of 168 hours, remove the samples and let dry. The required test solutions are:
  - a. 5 percent by weight sodium hydroxide in water solution.
  - b. 25 percent by weight sodium hydroxide in water solution.
  - c. 5-1/2 percent by weight sodium hypochlorite in water solution.
  - d. 15 percent by weight potassium monopersulfate in water solution.
2. Take color photographs of the samples 2 hours and 24 hours after removal from the solution. There shall be no blistering, softening, swelling, loss of adhesion, or embrittlement of the surface. Also, there shall be no objectionable discoloration or loss of gloss.
3. Reweigh the steel samples after 24 hours of air drying. Weight gain or loss shall not be more than 1.0 percent for the steel samples.

4. At the end of 168 hours after removal from solution, there shall be no blistering, softening, swelling, loss of adhesion, or embrittlement of the surface. Darkening, fading or loss of gloss will not be considered acceptance criteria. Test results for potassium monopersulfate and sodium hypochlorite solutions will not be used for acceptance of the coating. They are for Government information and aggressive caustic solution testing.
5. The adhesion of the coating shall be tested for steel samples in accordance with ASTM D 4541. Minimum adhesion shall be 200 psi.

#### **4.5 MATERIAL MANUFACTURERS**

Unless otherwise specified, all coating materials used on any one surface or piece of equipment shall be products accepted by the Buyer. Materials from different manufacturers shall not be used over each other without prior written acceptance. The coating materials shall be in pre-measured units. The approved coating materials for each system shall be as shown in this specification. Only the materials approved shall be used.

#### **4.6 ABRASIVES**

Abrasives for blast cleaning shall be clean, free of oil or contaminants, and dry. The particle size shall be capable of producing the specified surface profile. Mineral and slag abrasives shall meet the requirements of SSPC AB 1. Steel abrasives shall meet the requirements of SSPC-AB 3.

#### **4.7 THINNERS, SOLVENTS AND CLEANERS**

Thinners, solvents, and cleaners shall be as recommended by the coating manufacturer and shall be identified by product number or generic formulation. Cleaning solvents shall be of low toxicity with a flash point in excess of 100°F.

#### **4.8 EQUIPMENT**

1. The Seller shall provide equipment capable of regulating and controlling the specified environmental conditions within the work area to perform the work according to the productions schedule accepted by the Buyer.
2. Application equipment shall be equivalent to the equipment recommended by the coating's manufacturer and shall be suitable to apply the coating as specified.
3. Equipment air supply lines shall be equipped with filter/traps to remove moisture and oil as close to the point of use as possible.

#### **4.9 SURFACE PREPARATION – GENERAL**

1. Prior to the start of work, the Seller shall examine all surfaces to be coated to determine their acceptability for the specified work. If the surfaces are found to be unacceptable, the Seller shall either return the surface to an acceptable condition or immediately notify the Buyer in writing if the repairs are outside the scope of work. Work shall not commence until corrective action has been taken. Commencement of work prior to the taking of corrective

action shall preclude any subsequent claim by the Seller. The Buyer may require corrective action at the Seller's expense.

2. All water shall be removed from the surface prior to beginning surface preparation. The substrate surface temperature shall be at least 5°F (3°C) above the dew point.
3. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Items removed prior to painting shall be replaced when painting is completed.
4. The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat and shall be completely removed prior to application of the specified primer.

#### **4.10 SURFACE PREPARATION – STEEL SURFACES**

1. Prior to blast cleaning, oil, grease, and heavy dirt shall be removed by solvent cleaning in accordance with SSPC-SP-1.
2. Bare surfaces to be coated shall be abrasive blast cleaned to the degree shown in attachment B in accordance with the appropriate SSPC surface preparation standard. Where abrasive blasting is impractical, SSPC-SP-11 may be substituted only in limited areas and only with Purchaser's written approval.
3. The surface profile of steel prepared by abrasive blast cleaning shall be as recommended by the coating material manufacturer
4. Blast cleaning shall not be performed in the immediate area where coating or curing of coated surfaces is in progress. All surfaces and equipment which are not to be coated shall be suitably protected from blast cleaning.
5. Burrs, slivers, scabs, laminations, and weld spatter which become visible after blasting shall be removed.
6. Should visible rusting occur or the cleaned surface become wet or otherwise contaminated, the surfaces shall be re-cleaned to the degree specified.
7. After blast cleaning and immediately before coating, dust shall be removed with compressed air, free of oil and moisture. Vacuuming shall be used if the surface cannot be made dust free using compressed air, as determined by the Purchaser's inspector.
8. Machined surfaces shall be wiped with clean solvent before the application of machined-surface coating and shall be protected from damage due to cleaning and coating operations.
9. Machined portions of pipe flanges and other machined mating faces which will not be exposed after final fit-up shall be masked and covered with plywood or otherwise protected from surface preparation and coating activities. The remaining part of the flange face (including bolt holes) or exposed surface shall then be blasted and coated.
10. Equipment shall have all openings plugged, masked, and/or blinded sufficiently to protect internals before abrasive blasting. After the coating operations is complete, all internals shall be blown clean or vacuumed to remove any dust or abrasive blast media that may have entered the coated equipment.

11. Exposed ferrous metals, including nails on or in contact with surfaces to be painted with special coating systems, shall be spot-primed with a suitable corrosion inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

#### **4.11 GALVANIZED AND NONFERROUS SURFACES**

Galvanized, aluminum and aluminum-alloy, lead, copper, and other nonferrous surfaces to be painted shall be solvent-cleaned in accordance with SSPC-SP1. Missed and damaged areas shall be power tool cleaned in accordance with SSPC SP-11 or spot blasted to the degree as originally specified.

#### **4.12 STEEL WHICH HAS BEEN SHOP PRIMED OR COATED**

1. After erection and/or installation but before top coating, items previously primed shall be examined for damage and for unprimed areas. All oil and grease shall first be removed in accordance with SSPC SP1. Following solvent cleaning all loose dirt, chalk, and other contaminants shall be removed by high pressure water wash or other Buyer approved techniques. Unprimed and damaged areas shall be power tool cleaned in accordance with SSPC SP-11 or spot blasted to the degree as originally specified.
2. Equipment Manufacturer's Standard Finish – Oil and grease shall be removed from all coated surfaces by solvent cleaning in accordance with SSPC SP1. Damaged areas shall be power tool cleaned in accordance with SSPC SP-11. The standard finish shall be lightly sanded to roughen the surface removing the gloss and the surface shall then be blown down or vacuumed removing all dust, dirt and other loose debris.

#### **4.13 MIXING AND APPLYING COATINGS**

1. Mixing, applying, and curing of the coating material shall be in accordance with the manufacturer's latest published instruction and the requirements specified herein. When multiple component units are mixed, each component shall be mixed separately prior to the mixing of the combined materials. Only complete kits shall be mixed; no partial kits will be allowed at any time.
2. Coating materials shall be thoroughly mixed until they are smooth and free from lumps. Then strained through a 30 mesh or finer screen. Material shall be agitated to keep the solids in suspension.
3. Coatings shall be applied only within the temperature and humidity ranges recommended by the coating manufacturer.
4. The cleaned surface shall be coated before any visible rust forms on the surface. Coating material shall not be applied when there is moisture on the surface, dust is present which can contaminate the freshly coated surface, or when dirt or other detrimental material has re-contaminated the surface.
5. The application of the coating shall be performed only when the steel surface is at least 5° F (3°C) above the dew point. Except for solvent based ethyl silicate inorganic zinc, the relative humidity shall not exceed 85 percent during coating application and cure. For solvent based inorganic zinc, the humidity shall not exceed 95 percent. If the humidity falls below 50

percent, the cure of the solvent based inorganic zinc primer shall be extended, or the manufacturer's written procedure for cure shall be followed. Both ambient and surface temperature shall be in accordance with the manufacturer's written requirements.

6. Over-coats/topcoats shall be applied within the manufacturer's minimum and maximum recoat times. Each coat within a coating system shall be of contrasting color or shade to facilitate application.
7. Where possible, defects such as runs, sags, drips, and voids shall be corrected as detected during application of the coating.
8. Surfaces which may become inaccessible shall be coated before assembly, tagging, fitting, or welding. Inaccessible surfaces also include lap joint flanges, nozzle necks, lap joint stub ends, lap rings, bolt holes, flanges for exchangers and vessels, and welded joint which become inaccessible after assembly.
9. Paint may be applied by brush, roller, or spray. At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application. Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridged, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. Rollers for applying coatings and paints shall be of a type designed for the coating to be applied and the surface to be coated. Special attention shall be given to ensure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.
10. Coatings applied over an equipment manufacturer's standard shall be mixed, applied, and cured in accordance with the coating material manufacturer's published instructions and this specification.

#### **4.14 VENTILATION**

Adequate ventilation shall be provided during paint application and curing. Respirators shall be worn by all persons engaged in spray painting. Adjacent areas shall be protected by approved precautionary measures.

#### **4.15 CLEAN-UP AND DISPOSAL**

At the end of each working day place all cloths, cotton waste, and other debris that might constitute an environmental or fire hazard in enclosed metal containers and removed at the end of each day. Upon completion of the work, staging, scaffolding, and paint or solvent containers shall be removed from the site or destroyed in an approved and legal manner. Paint and other deposits on adjacent surfaces shall be removed and the entire job left clean and acceptable.

### **5 TESTS AND INSPECTIONS**

#### **5.1 GENERAL REQUIREMENTS**

1. The following steps are subject to inspection by Buyer's representative:
  - a. Following surface preparation and immediately prior to the coating application.

- b. Following the application and curing of each coat.
  - c. Final inspection and sign-off, in accordance with the project requirements.
2. The Seller shall furnish the necessary testing and inspection instruments, properly calibrated and maintained. Such equipment shall be available for use by the Buyer in conducting surveillance of the work.
  3. Compressors used shall be oil-free. Quality of the air shall be tested in accordance with ASTM D 4285. The test shall be made for the first use of the compressor, when the conditions warrant, or at the request of the Buyer. All lines shall be tested individually prior to use. Surfaces which are determined to have been blasted, blown down, or applied using contaminated air shall be re-cleaned to remove oil, grease, and contaminants and new coatings applied using clean air.
  4. Prior to surface preparation and coating application, dew point and relative humidity shall be determined using a sling Psychrometer or an accepted equal following procedures in ASTM E 337. Further tests shall be conducted at Buyer request or when ambient conditions warrant. Alternatively, continuous monitoring may be performed using systems established and/or accepted in writing by the Buyer. The substrate temperature shall be at least 5°F (3°C) above the dew point. The work shall not proceed if the ambient temperature or relative humidity is outside the requirements of this specification.

## **5.2 SURFACE PREPARATION INSPECTION**

The degree of cleanliness of blast cleaned surfaces shall be determined by comparison with SSPC-VIS 1-89, Visual Standards. The anchor pattern profile depth shall be determined in accordance with ASTM D 4417 or using Testex Press-O-Film replica film and a spring micrometer.

Recirculated shot or grit used for abrasive cleaning shall be tested for presence of oil by immersing in water and checking for oil flotation. Tests shall be made at the start of blasting, approximately every four hours thereafter, and at the end of blasting. If oil is evident, contaminated abrasive shall be replaced with clean abrasive and re-tested before proceeding. All steel blasted since the last satisfactory test shall be re-blasted.

## **5.3 COATING INSPECTION**

The dry film thickness shall be verified in accordance with SSPC-PA 2.

The coating shall be visually inspected for defects such as overspray, runs, sags, voids, blistering, peeling, rusting, mud cracking, inadequate cure, and lack of adhesion. Mud cracking must be removed by re-blasting. The Seller shall repair all defects per the approved touch-up and repair procedures. Areas where defective coating have been repaired or replaced shall be reinspected to the original requirements.

## **5.4 DOCUMENTATION**

Surface preparation and coating inspection shall be accepted in writing by the Buyer using the Surface Preparation and Coating Inspection Form (Attachment D), or approved Seller provided form.

## **5.5 REMEDIAL WORK**

1. Coated surfaces that are damaged during assembly, handling, or shipment shall be repaired in accordance with procedures accepted by the Buyer.
2. The surface profile shall be restored to meet the specified surface preparation requirements for cleanliness and profile. The periphery of a damaged area shall be feathered prior to coating application. Power tool cleaning shall be done per the SSPC-SP 11.
3. Precautions shall be taken to protect adjacent coated areas from damage caused by local abrasive blasting.

## **6 PREPARATION FOR SHIPMENT**

### **6.1 SHIPPING, HANDLING, AND STORAGE**

1. Coating materials shall be delivered to the place of application in the manufacturer's unopened, original containers. Containers which are damaged such that the contents are exposed or missing shall not be used.
2. The material shall be handled and stored in accordance with the manufacturer's latest published instructions and shall be protected from damage, moisture, direct sunlight, and temperatures below 40°F and above 100°F.
3. Materials shall be used before the expiration date of the product. If no expiration date is provided, materials shall be used within 6 months of manufacture.
4. Coated items shall be protected on non-abrasive supports during storage and shipment. Coated surfaces shall be protected from damage during lifting, handling, and shipment until accepted by the Buyer at the designated destination.

### **6.2 PACKAGING AND LABELING**

Coatings shall be in sealed containers that legibly show the batch number, color, quantity, date of manufacturer, manufacturer's directions including any warnings and special precautions, and name of manufacturer.

## **7 QUALITY ASSURANCE**

### **7.1 QUALITY ASSURANCE REQUIREMENTS**

The Seller shall control the quality of items and services to meet the requirements of this specification, applicable codes and standards, and other contract documents. Documentation shall be prepared and maintained to provide evidence of compliance with approved procedures and this specification.

For Seller furnished items and services, the Seller shall comply with requirements in 24852-RD-3PS-000-T0001.

## **8 DOCUMENTATION AND SUBMITTALS**

1. Seller shall submit to Buyer a listing of all coating materials, thinners, cleaners and abrasives for surface preparation, to be used in this work which shall identify the specific products by manufacturer and catalog number.
2. Suppliers of equipment with a manufacturer's standard finish shall submit a complete description of that finish as required in section 3.1.2 of this specification.
3. Seller shall submit to Buyer chemical resistance test reports required in section 3.2.1 of the specification.
4. Seller shall submit to Buyer written procedures for storage, handling, surface preparation, environmental control, application sequence, touch-up and repair, curing, and inspection of the coating system for review and permission to proceed prior to use. Conflicts, if any, between the coating manufacturer's recommendations and this specification shall be noted; however, this specification shall prevail.
5. Seller shall submit to Buyer proposed cleaning and coating verification forms for daily inspection records for review and approval.

## **9 ATTACHMENTS**

Attachment A – Coatings Systems

Attachment B – Coating Schedule

Attachment C – Color Schedule

Attachment D – Surface Preparation and Coating Inspection

## Attachment A – Coating Systems

I Coating Number	Generic Products (note 1)	Suggested Coating Manufacturer ( Sherwin-Williams/General Polymers		Suggested Coating Manufacturer (Carboline		Suggested Coating Manufacturer ( Dudick, Inc.		Suggested Coating Manufacturer (International Paint	
		Products	D.F.T. Mils	Products	D.F.T. Mils	Products	D.F.T. Mils	Products	D.F.T. Mils
P01	Inorganic Zinc (notes 2 & 3)	Zinc Clad II or II HS	2.0-4.0 (50-100 $\mu$ m)	Carbozinc 11 VOC	2.0-4.0 (50-100 $\mu$ m)	N/A	N/A	Interzinc 22 or 22 HS	2.0-3.0 (50-75 $\mu$ m)
P02	Organic Zinc Primer	Zinc Clad III HS	2.0-4.0 (50-100 $\mu$ m)	Carbozinc 859	2.0-4.0 (50-100 $\mu$ m)	N/A	N/A	Interzinc 52	2.0-3.0 (50-75 $\mu$ m)
P05	Surface Tolerant Epoxy ( )	Cor-Cote HPV	3.0-4.0 (75-100 $\mu$ m)			Protecto- Coat 330	4.0-5.0 (100-125 $\mu$ m)		
P13	High Performance Epoxy Primer	Cor-Bond MP	2.0-4.0 (50-100 $\mu$ m)	Carboline 888	2.0-4.0 (50-100 $\mu$ m)	Primer 67	3.0-4.0 (75-100 $\mu$ m)	Intergard 251	2.0-3.0 (50-75 $\mu$ m)
P36	Chemical Resistant Epoxy Topcoat ( )	Cor-Cote HPV	5.0-7.0 (125-175 $\mu$ m)			Protecto- Coat 330	6.0-8.0 (150-200 $\mu$ m)		
P33	Galvanized & Nonferrous Primer	DMT Wash Primer	0.7-1.3 (18-34 $\mu$ m)	Rustbond FC	1.0-2.0 (25-50 $\mu$ m)	N/A	N/A	Interprime 539	0.4-0.8 (10-20 $\mu$ m)
P06	Silicone Acrylic	Heat-Flex II 450	1.0-1.5 (25-75 $\mu$ m)	Thermaline 4900 VOC	1.5-2.0 (38-50 $\mu$ m)	N/A	N/A	Intertherm 875	1.0-1.5 (25-75 $\mu$ m)
P35	Silicone Zinc Primer	N/A	N/A	Thermaline 4765	1.5-2.0 (38-50 $\mu$ m)	N/A	N/A	N/A	N/A
P07	Silicone	No. 1200-MSF Series	1.0 (25 $\mu$ m) 2 coats	Thermaline 4700 VOC	1.5-2.0 (38-50 $\mu$ m)	N/A	N/A	Intertherm 50	1.0 (25 $\mu$ m) 2 coats

## Notes:

1. Materials have been selected to meet Federal Guidelines for VOC content for miscellaneous metal parts. Alternate materials, as a minimum, shall meet these State and local requirements.
2. Only Type II zinc per ASTM D 520 shall be used in the formulation. Inorganic zinc primers shall limit the total lead content in zinc powder to 0.01% maximum.
3. Coating applied to faying surfaces of bolted, slip-critical, structural joints shall be qualified in accordance with "Test Method to Determine the Slip Coefficient for Coatings Used in Bolted Joints", as adopted by the Research Council on Structural Connections.
4. For areas where shape and configuration precludes continuous coating creating crevices, skip welds, tight joints, or other situations where the coating film is not continuous and agent or decon solution can accumulate, these type areas shall be caulked after the surface preparation and coatings using a commercial grade polysulfide caulking compound. Caulking shall be applied after the paint has cured and in accordance with manufacturer's recommendations for application. Color shall be gray.

### Attachment B – Coating Schedule

Equipment and piping requiring steam out shall be coated with coatings having a heat resistance capable of withstanding 300°F (150°C) steam out conditions.

	ITEMS	System Code (See Note 9)	Surf. Prep.	Coat 1	Coat 2	Coat 3	REMARKS
1.0	EQUIPMENT/SKID STEEL						
1.1	Interior equipment steel such as skid components, base plates, ladders, platforms, handrails, channels, beams, cages, and other carbon steel members in Category Areas A, and B.	AF	SP-10	P01	P02 Touch up only	P36	This system is not qualified for application on the faying surfaces of a slip critical connection. If required, Special Coating Number P01 may be used as a shop primer with a topcoat being shop applied.
2.0	CARBON STEEL TANKS, VESSELS AND REACTORS (Shop Finished Coated) (Note 1)						
2.1	Uninsulated up to 250°F (120°C) inside in Category A and B.	AF	SP-10	P01	P02 Touch up only	P36	Total system shall be shop applied with field touchup.
2.2	Uninsulated 251°F (121°C) to 400°F (204°C) inside in Category A and B.	D	SP-10	P01	P01 Touch up only	P06	Total system shall be shop applied with field touchup.
2.3	Uninsulated 401°F (205°C) to 1200°F (649°C) inside in Category A and B.	BE	SP-5	P35	P07	None	Total system shall be shop applied with field touchup.
2.4	Insulated inside in Category A, and B.	NONE	No Coatings Required, see Note 2 and 5.			See Note 2.	
3.0	BULK PIPE AND FABRICATED PIPE SPOOLS (to include Pipe Supports, Valves, Flanges, and Fittings)						
3.1	Carbon Steel Pipe – Uninsulated up to 250°F (120°C). Areas inside Category A and B. (Note 1)	AF	SP-10	P01	P02 Touch up only	P36	
3.2	Carbon Steel Pipe – Uninsulated from 251°F (121°C) to 400°F (204°C)A and B. (Note 1)	D	SP-10	P01	P01 Touch up only	P06	
3.3	Uninsulated from 401°F (205°C) to 1200°F (649°C). Areas inside Category A and B. (Note 1)	BE	SP-5	P35	P07	None	
3.4	Insulated (Note 4). Areas inside Category A and B.	NONE	No Coatings Required			See Note 2.	
3.5	Chromium, Hastelloy, Titanium, Plastic pipe – all temperatures and Categories	NONE	No Coatings Required				
3.6	Insulated Stainless steel – up to 250°F (120°C). Areas inside Category A and B.	H	SP-1	P05	None	None	.

**Attachment B – Coating Schedule (cont'd)**

Equipment and piping requiring steam out shall be coated with coatings having a heat resistance capable of withstanding 300°F (150°C) steam out conditions.

	ITEMS	System Code (See Note 9)	Surf. Prep.	Coat 1	Coat 2	Coat 3	REMARKS
4.0	ELECTRIC MOTORS AND EQUIPMENT (Note 5). All Categories	Manufacturer's Standard					
5.0	INSTRUMENT & CONTROL VALVES & PANELS (Note 5). All Categories	Manufacturer's Standard					
6.0	ROTATING EQUIPMENT (Note 3 & 5). All Categories	Manufacturer's Standard					
7.0	HEAT EXCHANGERS						
7.1	Carbon Steel Uninsulated up to 250°F (120°C) inside in Category A and B.	AF	SP-10	P01	P02 Touch up only	P36	Total system shall be shop applied with field touchup.
7.2	Carbon Steel Uninsulated from 251°F (120°C) to 400°F (204°C) inside in Category A and B.	D	SP-10	P01	P01 Touch up only	P06	Total system shall be shop applied with field touchup.
7.3	Carbon Steel Uninsulated from 401°F (205°C) to 1200°F (649°C) inside Category A, and B.	BE	SP-5	P35	P07	None	Total system shall be shop applied with field touchup.
7.4	All Insulated. (Note 4) Areas A and B.	NONE	No Coatings Required			See Note 2.	
7.5	Stainless Steel, Chromium, Hastelloy, Titanium. All temperatures and Categories.	NONE	No Coatings Required				
8.0	GALVANIZED AND NONFERROUS SURFACES						
8.1	Galvanized or nonferrous surfaces in Category A and B.	GE	SP-1, 2 or 3	P33	P13	P36	
9.0	SKID MOUNTED AND MATERIALS HANDLING EQUIPMENT						
9.1	Inside Category Areas A, and B.	Individual components of skid mounted units shall be coated as noted for each individual item listed in this schedule.					
10.0	DUCT, CONDUIT, LOUVERS, CONVECTION ENCLOSURES, GRILLES, AIR OUTLETS, INSTRUMENT STANDS, TUBING, SUPPORTS, ETC. IN CATEGORY AREAS A, and B.						
10.1	Galvanized, Aluminum and Nonferrous.	GE	SP-1, 2 or 3	P33	P13	P36	
10.2	Carbon Steel.	AH	Mfg. Std.	P05	P36	None	

NOTES:

1. This category includes both carbon steel and low alloy steels up to and including 9 percent chrome.
2. Carbon steel pipe designated to be insulated with Personnel Protection (PP) insulation shall be coated the same as uninsulated pipe or surface. Coating System selection shall be based on actual operating conditions to include

**Attachment B – Coating Schedule (cont'd)**

upset, steam out, and startup conditions. For stainless steel pipe or surface designed to be insulated with PP insulation, only the surface area directly under the insulation requires coating application.

3. Rotating equipment shall include all items that make up the assembly or skid. This shall include, but not be limited to, pumps, motors, compressors, blowers, fans, baseplates, instrumentation, piping and electrical.
4. Clips, supports, lugs, and other appurtenances that may protrude from the insulation, shall be blast cleaned and coated with the coating system used on adjacent areas that meets the appropriate operating temperature range, except finish coat color shall be per Attachment C. If the adjacent area is not specified to be coated, the coating system specified for uninsulated items in the appropriate operating temperature range shall be applied.
5. The manufacturer's standard coating system may be upgraded at Seller's option using system AH provided the surface preparation and coating is suitable for upgrading. Coatings that have been misapplied or which are incompatible with the upgrade system shall be removed and reworked. A small test patch of Coating Number P05 shall be applied and visually inspected for wrinkling and lifting and/or subject to an adhesion test to confirm compatibility prior to the coating of the entire unit. One acceptable adhesion test method is ASTM D 3359. An Acceptable test result would be either 4A per Test Method A or 4B per Test Method B. Surface preparation shall be SSPC-SP-1 and SP-2 prior to application of Coating Number SC-3.
6. For some coating systems the galvanized or aluminum surface must be roughened or etched prior to coatings application. The coating manufacturer's written instructions shall be followed.
7. Contact surfaces of steel members to be jointed by high tensile bolting in friction type joints shall be galvanized or primed only with Coating Number P01.
8. All temperatures noted in this schedule shall be actual operating conditions, not design conditions.
9. System Code as shown in Attachment B defines the complete coating system and is the combination of Coating Numbers (P#) from Attachment A, including specified surface preparation (with any applicable notes) and number of coats from Attachment B, to simplify and assign a System Code for each category of equipment, piping and other surfaces requiring painting.

**Attachment C – Color Scheme**

**A. SAFETY COLORS**

PURPOSE: This Table outlines a uniform color coding system for identification of certain hazards.	
ITEM DESCRIPTION	COLORS
A. Fire protection equipment and apparatus. Includes:	Safety Red
1. Fire prevention equipment	Safety Red
2. Fire alarm boxes	Safety Red
3. Fire blanket boxes, buckets and pails	Safety Red
4. Fire extinguishers, pumps, hydrants, and hose locations	Safety Red
B. Danger	Safety Red
C. Emergency stop bars on hazardous machines. Stop buttons or electrical switches used for emergency stopping of machines.	Safety Red
D. Physical hazards. Includes:	
1. Exposed unguarded edges of platforms, pits, and walls.	Safety Yellow w/ Black Stripes
2. Handrails and guardrails.	Safety Yellow
3. Pillars, posts and columns which might be struck by trucks or forklifts.	Safety Yellow
E. Physical hazards such as obstructed clearances and tripping hazards. (Field Coated).	Safety Yellow
F. Emergency safety equipment such as eye-wash stations, safety showers, or first aid equipment.	Safety Green
G. Dangerous parts of machines or energized equipment. Other uses include:	Safety Yellow
1. Inside of movable and transmission guards for gears, pulleys, chains, etc.	Safety Yellow
2. Safety starting buttons.	Safety Red
3. Exposed edges of pulleys, gears, rollers, cutting devices, power jaws, etc.	Safety Yellow
H. Color for designating information signs and bulletin boards.	Safety Green

Attachment C – Color Scheme

**B. PLANT COLOR SCHEME**

COMPONENT	COLORS
Tanks	Light Gray
Furnaces and Thermal Oxidizers	Black
Stacks	Black
Insulated Columns, Vessels, Exchangers, Drums	Same as jacket
Uninsulated Columns, Vessels, Drums	Light Gray
Uninsulated Exchangers	Light Gray
Plat forms, Handrails, and Ladders	Light Gray
Motors and Lighting Panels	Selected by Buyer from Manufacturer's Standard Range
Compressors	Selected by Buyer from Manufacturer's Standard Range
Centrifuges, Turbines, Pumps, Machinery	Selected by Buyer from Manufacturer's Standard Range
Transformers	Selected by Buyer from Manufacturer's Standard Range
Panel Switches/Switch Gear Levers	Selected by Buyer from Manufacturer's Standard Range
Electrical Switchgear	Selected by Buyer from Manufacturer's Standard Range
Control Boards	Selected by Buyer from Manufacturer's Standard Range
Fireproofing	Light Gray
Control Valves and Regulators	Selected by Buyer from Manufacturer's Standard Range
Piping and Fittings	Light Gray*

For piping and fittings other than Special Coatings, see Piping and Equipment Coating in C and D areas 24852-3PS-A0200

Fed Std – COLORS	Fed Std – COLORS	Fed Std – COLORS
Light Gray #26440	Black #27038	Green #24260
Yellow #23655	White #27925	Orange #22190

**Attachment D – Surface Preparation and Coating Inspection Form**

Report No:		Page ____ of ____
Project:		Date:
Subcontractor:		Shift:
Equipment/Area:		Inspector:
Substrate:		Coating Spec. No.

**ENVIRONMENTAL CONDITIONS:**

Coating Work Activity							
Time							
Dry Bulb Temp. °F (°C)							
Wet Bulb Temp. °F (°C)							
Relative Humidity, %							
Dew Point °F (°C)							
Surface Temp. °F (°C)							
Blotter Test							

Pre-Surface Preparation      SP- \_\_\_\_\_      Masking/Protection: \_\_\_\_\_      Surf. Defect \_\_\_\_\_

**SURFACE PREPARATION**

Method: \_\_\_\_\_

Abrasive Type/Size/Storage: \_\_\_\_\_

Cleanliness Spec: \_\_\_\_\_      Actual: \_\_\_\_\_

Profile Spec: \_\_\_\_\_      Actual: \_\_\_\_\_

Equipment: \_\_\_\_\_

**COATING/LINING MATERIALS & MIXING**

Products: \_\_\_\_\_

Batch No./Quantities/Expiration Date: \_\_\_\_\_

Thinners/Batch No./Thinning Ratio: \_\_\_\_\_

Storage: \_\_\_\_\_

Mixing: \_\_\_\_\_      Induction Time: \_\_\_\_\_

Material Temperature: \_\_\_\_\_      Pot Life Expiration Time: \_\_\_\_\_

**Attachment D – Surface Preparation and Coating Inspection Form**

**COATING/LINING APPLICATION**

Start Time: \_\_\_\_\_ Finish Time: \_\_\_\_\_

Coat(s): \_\_\_\_\_

Method: \_\_\_\_\_ Wet Film Thickness: \_\_\_\_\_

Recoat Time/Temp: \_\_\_\_\_ Cure Time/Temp: \_\_\_\_\_

Equipment: \_\_\_\_\_

**APPLIED COATING**

Visual Inspection (film imperfections): \_\_\_\_\_

Dry Film Thickness: Spec: \_\_\_\_\_ Actual: \_\_\_\_\_ Method: \_\_\_\_\_

Holiday Test: \_\_\_\_\_ Method: \_\_\_\_\_

Other Testing: \_\_\_\_\_ Method: \_\_\_\_\_

Touch-Up and Repair: \_\_\_\_\_ Final Cure: \_\_\_\_\_

Comments (use reverse side if necessary): \_\_\_\_\_

Inspector's Signature: \_\_\_\_\_