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(August 1, 2011)

Metallic Coatings

General Requirements

This specification covers the requirements for thermal spray metallic coatings, with and without additional paint coats, as a means to prevent corrosion.

The coating system consists of surface preparation by wash cleaning and abrasive blast cleaning, thermal spray application of a metallic coating using a material made specifically for that purpose, and, when specified, shop primer coat or shop primer coat plus top coat in accordance with Section 6-07.3(11)A. The system also includes inspection and acceptance requirements.

Reference Standards

SSPC-SP 10	Near-White Blast Cleaning
SSPC CS 23.00	Guide for Thermal Spray Metallic Coating Systems
AWS Committee on Thermal Spraying	Thermal Spraying – Practice, Theory, and Application
ASTM-C-633	Test Method for Adhesive or Cohesive Strengths of Flame-Sprayed Coatings
ASTM D 4417	Standard Test Methods for Field Measurement of Surface Profile of Blast-Cleaned Steel
ASTM D 6386	Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
ASTM D 4541	Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ANSI/AWS C2.18	Guide for the Protection of Steel with Thermal Sprayed Coatings of Aluminum, Zinc and their Alloys and Composites

Quality Assurance

A representative sample of each lot of the coating material used shall be submitted to the Engineer for analysis prior to use. Zinc shall have a minimum purity of 99.9 percent. Zinc Aluminum 85/15 wire shall be 14 to 16 percent maximum aluminum.

The thermal sprayed coating shall have a uniform appearance. The coating shall not contain any blisters, cracks, chips or loosely adhering particles, oil or other surface contaminants, nodules, or pits exposing the substrate.

The thermal spray coating shall adhere to the substrate with a minimum bond of 700 psi. The Contractor's QA program shall include thermal spray coating bond testing.

The Engineer may cut through the coating with a knife or chisel. If upon doing so, any part of the coating lifts away from the base metal 1/4 in. or more ahead of the cutting blade without cutting the metal, then the bond is considered not effective and is rejected.

Coated areas which have been rejected or damaged in the inspection procedure described shall have the defective sections blast cleaned to remove all of the thermal sprayed coating and shall then be recoated. Before resubmittal and

1 inspection, those sections where coating has not reached the required thickness
2 shall be sprayed with additional metal until that thickness is achieved.
3

4 **Submittals**

5 The Contractor shall submit to the Engineer, prior to abrasive blast cleaning, a 12
6 inch square steel plate, of the same material and approximate thickness of the steel
7 to be coated, blasted clean in accordance with the **Surface Preparation**
8 subsection of this Special Provision. The sample plate will be checked for specified
9 angular surface pattern, the abrasive grit size and type used, and the procedure
10 used. This plate shall be used as the visual standard to determine the acceptability
11 of the cleaned surface. In the event the Contractor's cleaning operation is inferior
12 to the sample plate, the Contractor shall be required to correct the cleaning
13 operation to do a job comparable to the specimen submitted.
14

15 At the same time as submitting the abrasive blast cleaned steel plate sample, the
16 Contractor shall submit to the Engineer, a second 12 inch square steel plate of the
17 same material and thickness, cleaned and thermal spray coated in accordance with
18 the same processes and with the same equipment as intended for use in applying
19 the thermal spray coatings for this project. The Engineer may request additional
20 cleaned and thermal spray coated samples to be produced and submitted
21 coincident with thermal spray coating of the items specified in the Plans to receive
22 thermal spray coatings.
23

24 **Surface Preparation**

25 Surface irregularities (e.g., sharp edges and/or carburized edges, cracks,
26 delaminations, pits, etc.) interfering with the application of the coating shall be
27 removed or repaired, prior to wash cleaning. Thermal cut edges shall be ground to
28 reduce hardness to attain the surface profile required from abrasive blast cleaning.
29

30 All dirt, oil, scaling, etc. shall be removed prior to blast cleaning. All surfaces shall
31 be wash cleaned with either clean water at 8000 psi or water and detergent at 2000
32 psi with two rinses with clean water.
33

34 The surface shall be abrasive blast cleaned to near white metal (SSPC-SP 10).
35 The surface profile shall be measured using a surface profile comparator, replica
36 tape, or other method suitable for the abrasive being used in accordance with
37 ASTM D 4417.
38

39 Where zinc coatings up to and including 0.009 inch thick are to be applied, one of
40 the following abrasive grits shall be used with pressure blast equipment to produce
41 a 3.0 mils AA anchor tooth pattern:
42

- 43 1. Aluminum oxide or silicon carbide
44 mesh size: SAE G-25 to SAE G-40
45
- 46 2. Hardened steel grit
47 mesh size: SAE G-25 to SAE G-40
48
- 49 3. Garnet, flint, or crushed nickel or black beauty coal slag
50 mesh size: SAE G-25 to SAE G-50
51

1 Where zinc coatings greater than 0.010 inch thick are to be applied, one of the
2 following abrasive grits shall be used with pressure blast equipment to produce a
3 5.0 mils AA anchor tooth pattern:
4

- 5 1. Aluminum oxide or silicon carbide
6 mesh size: SAE G-18 to SAE G-25
7
- 8 2. Hardened steel grit
9 mesh size: SAE G-18 to SAE G-25
10
- 11 3. Garnet, flint, or crushed nickel or black beauty coal slag
12 mesh size: SAE G-18 to SAE G-25
13

14 The pressure of the blast nozzle, as measured with a needle probe gauge, with
15 pressure type blasting equipment shall be as follows:
16

- 17 1. With aluminum oxide, silicon carbide, flint, or slag - 50 psi minimum and
18 60 psi maximum.
19
- 20 2. With garnet or steel grit - 75 psi minimum.
21

22 The pressure at the blast nozzle, with siphon blasting (suction blasting), shall be as
23 follows:
24

- 25 1. With aluminum oxide, silicon carbide, flint, or slag - 75 psi maximum.
26
- 27 2. With garnet or steel grit - 90 psi maximum.
28

29 The abrasive blast stream shall be directed onto the substrate surface at a spray
30 angle of 75 to 90 degrees, and moved side to side. The nozzle to substrate
31 distance shall be 4 to 12 inches.
32

33 **Application of Metallic Coating**

34 No surface shall be sprayed which shows any sign of condensed moisture or which
35 does not comply with the **Surface Preparation** subsection of this Special
36 Provision. If rust bloom occurs within the holding time between abrasive blast
37 cleaning and thermal spraying, the surface shall be reblasted at a blast angle as
38 close to perpendicular to the surface as possible to achieve a 2.0 to 4.0 mil anchor
39 tooth pattern. Thermal spraying shall not take place when the relative humidity is
40 90% or greater, when the steel temperature is less than 5F above the dew point, or
41 when the air or steel temperature is less than 40F.
42

43 Clean, dry air shall be used with not less than 50 psi air pressure at the air
44 regulator. Not more than 50 feet of 3/8 in. ID hose shall be used between the air
45 regulator and the metallizing gun. The metallizing gun shall be started and
46 adjusted with the spray directed away from the work. During the spraying operation
47 and depending upon the equipment being used, the gun shall be held as close to
48 perpendicular as possible to the surface from 5 to 8 inches from the surface of the
49 work.
50

51 Manual spraying shall be done in a block pattern, typically 2 feet by 2 feet square.
52 The sprayed metal shall overlap on each pass to ensure uniform coverage. The

1 specified thickness of the coating shall be applied in multiple layers. In no case are
2 fewer than two passes of thermal spraying, overlapping at right angles, acceptable.
3
4 At least one single layer of coating shall be applied within 4 hours of blasting and
5 the surface shall be completely coated to the specified thickness within 8 hours of
6 blasting.

7
8 The minimum coating thickness shall be 6 mils unless otherwise shown in the
9 Plans.

10
11 **Applications of Shop Coats and Field Coats**

12 The surface shall be wiped clean with solvent immediately before applying the
13 wash primer. The wash primer shall have a low viscosity appropriate for absorption
14 into the thermal spray coating, and shall be applied within 8 hours after completion
15 of thermal spraying or before oxidation occurs. The dry film thickness of the wash
16 primer shall not exceed 0.5 mils or be less than 0.3 mils. It shall be applied using
17 an appropriate spray gun except in those areas where brush or roller application is
18 necessary. The subsequent shop primer or field coats shall be applied no less than
19 one-half hour after a wash primer.

20
21 The shop primer coat, when specified, shall be applied in accordance with Section
22 6-07.3(11)A and the paint manufacturer's recommendations.

23
24 All field coats, when specified, shall be applied in accordance with Section 6-
25 07.3(11)A and the paint manufacturer's recommendations. The color of the top
26 coat shall conform to Section 6-03.3(30) as supplemented in these Special
27 Provisions.