

CHAPTER SEVEN

STRUCTURAL STEEL PAINTING

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GENERAL

There are two types of structural steel painting operations: first time or new construction paint jobs and repaint or maintenance paint jobs. New members usually receive a first coat or prime coat of paint after they are fabricated and are still in the fabrication plant or shop. This coat is sometimes referred to as the shop coat. The member is painted again in the field - one or two more coats - and these are referred to as field coats. Maintenance paint jobs can be as simple as painting over (over-coating) a deteriorated but intact topcoat or as complex as complete removal and repainting of all coats.

Concerns associated with painting operations include worker safety, air and water pollution, control of overspray and disposal of contaminated waste. These concerns can have a major impact on public safety and so you must be familiar with all the specifications and regulations that govern these issues. You must bring violations to the attention of the Project Administrator immediately since they can result in serious injury or death of project personnel or the public.



Spent Abrasive Media and Removed Paint Storage

COMPLIANCE OF PAINT MATERIALS WITH SPECIFICATIONS [SS 560 and 975]

Prior to the start of any paint application you must verify that paint materials are in compliance with the specification and this includes checking packaging and labeling; verifying the condition of paint in the container; and taking samples for testing.

Paint material cannot be used by the Contractor unless it is on the Department's Qualified Products List (QPL). Products on the QPL have been thoroughly tested at the Department's State Materials Office and are the only products approved for use. Once you confirm that the product is on the QPL, you will need to make sure packaging and labeling are per the specifications. The container must be marked with the following information: weight in pounds per gallon, total amount contained in gallons, color, user information, date of manufacture, LOT, batch and DOT code number and other information required by SS 975. If any of the information is missing the product should not be accepted but the Project Administrator should be notified for a final decision on acceptance.

You should inspect the contents of all containers when opened for the first time or if reopened after an extended period of time, to make sure the paint has not hardened, gelled or formed a solid film referred to as livering. When the paint is mixed it must have a smooth, uniform consistency or it should be rejected. The paint should be mixed and remixed per the manufacturer's recommendations. If pigment, thinner or paste is mixed into the paint, it must be done according to the specification. Also, verify that the material storage life date, shown on the label, has not been exceeded.

The paint will need to be sampled, so consult the Job Guide Schedule to find out what sampling frequency and procedure you will need to follow. Samples will need to be sent to the designated Department Lab for testing.

Q U I Z

- 1) True or false: only the topcoat of paint needs to be on the QPL.
- 2) If labeling information is missing, who should make the final decision about acceptance of the material?

PREPARATION OF THE SURFACE TO BE PAINTED

[SS 560]

NEW CONSTRUCTION JOBS

If the project is a first time paint job, the steel members will be delivered to the construction site with the prime coat applied. When steel members arrive at the site, they need to be inspected to see if there was damage of the prime coat during shipment. Damaged places must be touched up prior to the application of any other coats. You must verify that touch-up paint is the same paint that was used in the shop.



Steel Shot Media Used for Surface Preparation at a Fabrication Facility



Abrasive Media Used for Surface at a Bridge Repainting Project



A Primed Plate Girder Arriving from the Fabrication Facility



A Freshly Painted Bridge Superstructure – note the absence of overspray on the deck overhang and SIP forms

Before the application of other coats, make sure any dust, dirt, oil, grease or other foreign materials are removed from the surface of the prime coat to insure the next coat will adhere properly. Pay particular attention to horizontal surfaces or surfaces that can collect debris including airborne material generated by dusty construction operations. These surfaces are usually not visible from the ground and are easily missed during the cleaning process.

MAINTENANCE JOBS

For maintenance paint jobs, preparation procedures are usually complex and difficult since existing coats of paint usually have to be removed. Removal can employ a variety of methods as simple as hand held power tools and as complex as large-scale sand or shot blasting machines. The removed paint material must be contained as completely as possible and be disposed of in an appropriate manner. Methods of containment and disposal are specified in Society for Protective Coatings (SSPC) Guide 6, "Containment of Debris During Paint

Removal Operations" and Guide 7, "Disposal of Lead-Contaminated Surface Preparation Debris". In order to contain all material generated during removal, the site of the work must be completely enclosed in a temporary tent. If the removed material is hazardous or toxic then the enclosure must also be airtight and workers must use a purified and sealed air supply much like that of underwater divers.

The handling of the waste material must be done in the strictest manner and according to very detailed procedures. Your job will be to become knowledgeable about the proper procedures for containment, waste disposal and worker safety. The Department does not enforce these requirements but you must be knowledgeable enough to recognize violations when they occur so you can report them to the Project Administrator for appropriate action. Your Project Administrator will know what procedures and laws govern any particular removal operation and you will be able to obtain copies from him in order to familiarize yourself with the requirements.

These procedures and laws deal with worker safety which also applies to you since you may have to inspect areas that have hazardous or toxic waste or dangerous air quality. In addition, special procedures that deal with the handling of worker clothing and washing may apply and these must be followed very carefully to ensure that the health of workers is safeguarded.

The actual surface preparation and cleaning procedure must be done in accordance with SSPC Surface Preparation Specifications. You must be thoroughly familiar with these procedures. These specifications define the condition and texture of surfaces after cleaning. Use , "[SSPC-VIS 1: Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning](#) and [SSPC-VIS 3: Guide and Reference Photographs for Steel Surfaces Prepared by Hand and Power Tool Cleaning](#), to verify the Contractor has achieved the specified surface preparation. These standards provide photographs of what surfaces should look like so that you will have a guide to judge the quality of the actual work.

Q U I Z

- 1) Members must arrive at the site with the _____ coat already applied.
- 2) True or false: damaged prime coat must be touched up with intermediate coat paint.
- 3) What type of surface debris is the most easily overlooked?
- 4) Must all removed material be contained and disposed of properly?
- 5) Even though the Department is not responsible for enforcement, why must you be familiar with proper procedures for containment, waste disposal and safety?
- 6) Actual surface preparation and cleaning procedures must be in accordance with what organization's specifications?

PAINT APPLICATION

[SS 560]

PROTECTION OF ADJACENT PROPERTY AND WORKER SAFETY

Before any painting begins, the Contractor must provide a method for protecting buildings, houses, vehicles, boats, bodies of water and any other property in the immediate vicinity of the painting operation from being sprayed by paint. Very often, paint is applied at high elevations where the wind is always blowing so that any excess paint spray, referred to as "Overspray", can be picked up by the wind and be deposited on property adjacent to the job site.

The Contractor must provide screens, enclosures or any other means available to contain overspray. If the Contractor uses non-spray application methods like brushes or rollers, drips and excess paint can still fall on vehicles, boats or in the water or objects below and; therefore, protection must still be provided.

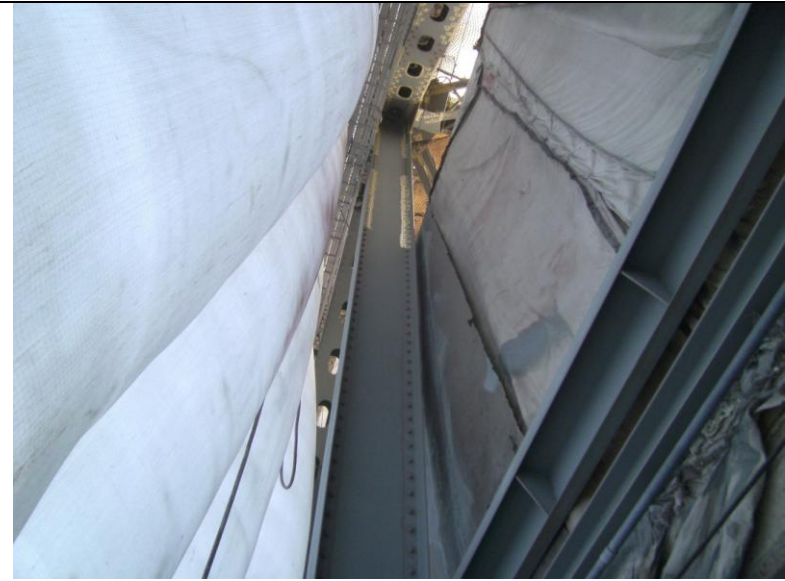
You must monitor the protection requirement carefully because inadequate protection of adjacent property can result in damage to public and private property which can generate very negative public relations for the Department and Contractor as well as costly lawsuits.

As discussed in the Maintenance Paint Job section, procedures and laws related to worker safety are very important and apply to the application of paint just as they do to the removal of paint. You must monitor violations of the procedures and laws that cover worker safety for the paint application operation.

Inadequate protection systems and violations of worker safety procedures must be reported to the Project Administrator immediately.



A Contained Environment for a Small Bridge



A Contained Environment for a Large Bridge

FIELD PAINTING

The type paint to be used and the number of coats required are usually determined on a project by project basis; therefore, with regard to type paint and number of coats, the Standard Specifications will usually not govern. Instead, the contract documents package or the plans will usually contain Special Provisions or notes that identify the type of paint to be used and the number of coats along with other paint application requirements that are unique to your paint project. You must be thoroughly familiar with these special provisions in order to ensure the Contractor uses the correct paint and applies the correct number of coats as well as other considerations such as required minimum time between coats and thickness of coats. Plural component paints have a limited time period to be used once mixed, this is called "pot life". Ensure the Contractor does not exceed the manufacturer's recommended pot life.

One of the most important inspection tasks you must perform during a painting project is measuring the thickness of the paint coat. The measuring is done with "Dry Film Thickness Magnetic Gage" and there are two types. You will be able to obtain one of these gages from you Project Administrator who will instruct you in their proper use. Some points to keep in mind when checking paint coat thickness are as follows:

- Required paint coat thickness always refers to the thickness after the paint has dried in accordance with SSPC PA-2, "Measurement of Dry Coating Thickness with Magnetic Gages".
- Coat thickness measurements should be taken at the average rate of one every 25 square feet of painted area. If thickness is deficient, increase the measurement rate as needed.
- The total thickness of the complete paint system must not be less than the minimum required thickness of each individual coat added together.

BRUSH PAINTING

When using a brush, paint should be worked into all crevices and corners whenever possible. Any runs or sags should be immediately brushed out. Hard-to-reach places may be painted by using sheepskins or daubers.

Thorough mixing of the paint before it is applied is essential. A mechanical mixer should be used for stirring the paint when required.



Hand Painted Stripe Coating On Existing Bridge Rivets



Note the Visibility of the Stripe Coating, Even After Application of the Final Top Coat

SPRAY PAINTING

Sprayers must be clean and in good working order. Clean sprayers will prevent dirt and dried paint from contaminating the paint finish. Paint should be sprayed in even layers to prevent uneven build-up. Any hard-to-reach places may be painted by using sheepskins or daubers. Runs or sags should be brushed out immediately.

The pattern to be followed in applying the paint should make it possible to get a uniform thickness not less than the thickness specified. There must be some overlapping at the edges of strips covered on successive strokes of the spray gun. The spray gun should be held at right angles to the surface being painted and at the correct distance away from it. All small cracks and cavities, such as those in back of crimped stiffeners and ground splice plates, which were not sealed watertight by the first coats of paint, must be caulked with an approved caulking compound. This caulking compound must be dry before the next coat of paint is applied.



A Caulked Field Connection

Q U I Z

- 1) What is the excess spray paint called that gets picked up by the wind and can be deposited on adjacent property?
- 2) True or false: the Contractor has to contain overspray but not drips if a brush application is used.
- 3) Should you report violations of safety procedures related to paint application to the Project Administrator?
- 4) The type of paint to be used and the number of coats will be covered in the _____ of the contract documents or in the _____.
- 5) Should you measure the paint coat thickness before the coat is dry?
- 6) A spray gun should be held at _____ to the surface being painted.

WEATHER AND TEMPERATURE LIMITATIONS

[SS 560]

Painting should not take place if the paint or steel temperature is below 40 degrees F. The Contractor must adhere to the manufacturer's temperature restrictions if they are warmer than the conditions specified in the Contract Documents.

Paint must not be applied if it is raining, excessively windy, foggy, or misty. In addition, paint must not be applied if moisture will condense - referred to as dew - on steel surfaces. At a given combination of temperature and humidity, dew will form on steel surfaces when the temperature of the steel is a predictable value and this is referred to as the "Dew Point" temperature. The Contractor must not apply paint unless the steel surface temperature is at least 5 degrees the dew point temperature. The tables that follow will assist you in determining the dew point temperature. In the first table, for example, if you follow the 70 degrees F ambient air temperature column down and follow the 65% relative humidity row across, where they intersect gives the dew point temperature of 57 degrees F. This means that as long as the temperature and humidity do not change, the Contractor must not apply paint if the steel surface temperature is below 62 degrees F. If the temperature or humidity changes then a new dew point must be determined.

If paint is applied under cover in damp or cold weather, it must remain covered until it is dry or until weather conditions permit exposure to the open air. Be sure the Contractor observes these requirements.

Q U I Z

- 1) If the manufacturer's temperature restrictions are warmer than the contract documents, should they govern?
- 2) True or false: paint may be applied if the steel surface temperature is below the dew point temperature.
- 3) What is the dew point temperature if the relative humidity is 35% and the air temperature is 50° F?

DEW POINT CALCULATION TABLES

DEGREES FAHRENHEIT

RELATIVE HUMIDITY %	AMBIENT AIR TEMPERATURE IN DEGREES FAHRENHEIT										
	20	30	40	50	60	70	80	90	100	110	120
	DEW POINT --- SURFACE TEMPERATURE OF STEEL AT WHICH CONDENSATION OCCURS										
90	18	28	37	47	57	67	77	87	97	107	117
85	17	26	36	45	55	65	75	84	95	104	113
80	16	25	34	44	54	63	73	82	93	102	110
75	15	24	33	42	52	62	71	80	91	100	108
70	13	22	31	40	50	60	68	78	89	96	105
65	12	20	29	38	47	57	65	76	85	93	103
60	11	19	27	36	45	55	64	73	83	92	101
55	9	17	25	34	43	53	61	70	80	89	98
50	6	15	23	31	40	50	59	67	77	86	94
45	4	13	21	29	37	47	55	64	73	82	91
40	1	11	18	26	35	43	52	61	69	78	87
35	2	8	16	23	31	40	48	57	65	74	83
30	6	4	13	20	28	36	44	52	61	69	77

ANSWERS TO QUESTIONS

Page 7-4, Compliance of Paint Materials with Specifications

- 1) False, all coats must be on the QPL
- 2) Project Administrator
- 3) 5 gallons

Page 7-8, Preparation of the Surface to Be Painted

- 1) prime
- 2) False, the same as used in the shop
- 3) horizontal or those that collect debris
- 4) yes
- 5) to report violations to the Project Administrator
- 6) SSPC

Page 7-13, Paint Application

- 1) overspray
- 2) False
- 3) yes
- 4) special provisions, plans
- 5) no
- 6) right angles

Page 7-14, Weather and Temperature Limitations

- 1) yes
- 2) False
- 3) 23 degrees F