



EPOXY-COATED STEEL REINFORCEMENT

GENERAL

Acceptance of epoxy-coated steel reinforcement (Article 4151.03B) will be on the basis of certification from an approved manufacturer of steel reinforcement, an approved coater, and an approved distributor or supplier of steel reinforced products subject to the testing of the acceptance and verification samples secured at destination as outlined herein. Approval to furnish epoxy-coated steel on a certification basis may be withdrawn for deficient test results on verification samples or inadequate documentation or identification of materials. Approved coatiers are listed in Appendix A of this IM and approved suppliers are listed in Appendix B of IM 451. Approved manufacturers of reinforcing steel are listed in Appendix D of IM 451. Approved epoxy powders are listed in Appendix B of this IM.

All reinforcement (deformed and plain) required to be epoxy-coated shall have a protective coating of epoxy applied by the electrostatic spray method in accordance with the requirements of ASTM A775/A775M, except as outlined in this IM. Fabrication, acceptance, and job site handling of epoxy-coated reinforcing steel bars shall be in accordance with the requirements of ASTM D3963/D3963M and IM 451.03B.

All steel reinforcement shall be melted and manufactured in the USA.

SURFACE PREPARATION

Reinforcing steel surfaces to be coated shall receive a thorough blast cleaning to near-white metal in accordance with SSPC SP10. Mill scale, rust and foreign matter shall be completely removed. The blasting media containing sufficient grit shall produce a suitable anchor pattern profile. A profile depth of 2.0 to 4.0 mils (50 μ m to 100 μ m) shall be considered suitable as an anchor pattern. Coating shall be applied to the cleaned surface soon thereafter. In no case shall the coating be delayed more than 0.5 hr. after cleaning.

Additional blast media requirements shall be **required** if a suitable anchor pattern and/or profile depth is not achieved. A **maximum** of 10% steel shot may be added to G-40-R or G-25-R grit.

ACCEPTANCE REQUIREMENTS

- 7.0 to 12.0 mils (175 to 300 μ m) for bar sizes No. 3 to 5 (10 to 16).
- 7.0 to 16.0 mils (175 to 400 μ m) for bar sizes No. 6 to 18 (19 to 57).

Coating thickness measurements shall not be less than the specified minimum thickness or more than the specified maximum thickness.

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- A minimum of fifteen recorded measurements shall be obtained evenly spaced along each side of the test bar (a minimum of thirty (30) recorded measurements per bar). A single measurement is each individual gauge reading. The average of all recorded thickness measurements shall not be less than the specified minimum thickness or more than the specified maximum thickness.
 - Test for coating thickness shall be made on a minimum of two bars every two production hours.

An In-Line Holiday detector shall be required. Handheld (wet sponge type with direct current) detector checks shall be performed each production day to verify the accuracy of the In-Line System. Only 1 Holiday per 1.0 linear foot (3 Holidays per meter) shall be allowed on the coated steel reinforcing bars.

A bend test shall be performed to evaluate the flexibility of the coating. Coated bars shall be tested at a uniform rate, a minimum of one bar of each size every four production hours around a mandrel of a specified size within a maximum specified time period. (See Table 1, ASTM A775/AA775M.) No cracking or disbonding of the coating shall be visible on the outside radius of the bent bar. Evidence of cracking or disbonding of the coating shall be considered a cause for rejection. The test bars shall be between 68°F and 86°F (20°C and 30°C) when tested.

Long-term storage (greater than two months) of bars shall be minimized at the fabricator and at the job site. Coated bars that have been in storage for a period of 6 months or longer from the date of coating shall be inspected, sampled, and tested prior to use on a project. Bars shall be tested for coating thickness and flexibility (bend test). A copy of the test results shall be attached to original coating report. Coated steel reinforcing bars stored outdoors shall be protected from sunlight, salt spray and weather exposure. The coated bars shall be covered with a non-transparent material, or other suitable opaque protective material. Provisions shall be made for adequate ventilation to minimize condensation. Coated steel reinforcing bars shall be stored off the ground on protective cribbing, and/or on padded support with padded timbers placed between bundles when stacking is necessary. Sufficient supports shall be spaced evenly to prevent sags in the bundles. The date on which the coated bars are placed outdoors shall be recorded on the identification tag of the bundled steel. Weathered (discolored) bars shall be rejected.

NOTE: Coated and uncoated steel reinforcing bars shall be stored separately.

COATING REPAIR MATERIAL

- The patching or repair materials shall be compatible with the coating as required per ASTM D3963/D3963M and Appendix B of this IM.
- Sheared ends and / or saw cut ends of coated bars shall have adequate coating, have no signs of surface rust or damage, and shall be coated and / or repaired with approved patch / repair material listed in (Appendix B).

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- Repaired / Patched areas shall be allowed to cure (dry to touch) before concrete placement over the coated bars.
 - Surface preparation, repair, and patching application procedures shall be in accordance with the resin manufacturer's recommendations.

REJECTION

Coated bars that do not meet the requirements of this IM, ASTM A775/A775M, ASTM D3963/D3963M, and the requirements of Specification 4151.03 shall be rejected. Rejected bars shall be marked with contrasting color paint or other suitable identification and stored separately.

COATER APPROVAL

Each coater shall be approved prior to bidding on projects. The coater shall provide the Central Materials Office a written application to become an approved coater of reinforcing steel. This application shall include the following:

1. Sources of steel that would be handled by the company and supplied to Iowa DOT projects.
2. Quality control procedures that the company has established to ensure material identity (as to heat numbers and inventory control) from the time the material arrives from a mill or a source, through the coating and fabricating process, and shipment.
3. Coating quality procedures to ensure the coated steel complies with Iowa DOT Specifications. This shall include the following:
 - a. Names of quality control personnel.
 - b. Quality control testing conducted during the bar cleaning operation.
 - c. Quality control testing conducted on the epoxy coating after coating.
4. Sample three epoxy-coated bars of every size that the coater plans to coat. These samples will be called Process Approval Samples. The bars shall be approximately 6 ft. (2 m) in length. Samples are to be secured by the District Materials Engineer for the source approval.
5. An example of certification documents that the company will furnish for Iowa DOT projects.
6. Plant must be CRSI certified. Copies of the last three CRSI inspection reports must be submitted for review and evaluation.

Upon satisfactory review of this application, satisfactory test results and satisfactory inspection of the facilities for compliance with quality control procedures, the company may be placed on the approved list, Appendix A.

POWDER APPROVAL

Prior to furnishing epoxy powder to coaters for Iowa DOT projects, the powder manufacturer shall submit the following:

1. A written application by the company to become an approved powder manufacturer shall be submitted to the Central Materials Office in Ames, Iowa.
2. Product information, specifications, and recommended application procedures, including minimum gel and cure time
3. A fingerprint sample of the powder, product name and number, and manufacturer name.
4. Prequalification shall be in accordance with ASTM D3963/D3963M and ASTM A775/A775M.
5. A 100 gm (3.5 oz.) sample shall accompany the application.

Upon satisfactory review of this application and a satisfactory trial run in an approved coating plant, the company will be placed on the approved list in Appendix B. Continued approval will be based on satisfactory test results of monitor samples secured at the coating plant.

ACCEPTANCE PROCEDURES

Epoxy-coated steel will be accepted on a certification basis. The coating plant shall furnish an identification list, invoice, or bill of materials for each shipment to a project. It shall show the project and design number, the size, length, grade, heat number and number and weight of pieces in the shipment and contain a certification stating that the attached Mill Certifications and epoxy-coating certifications are applicable to the material.

The Mill Certifications, which are to be attached as directed above, shall state the chemical, physical, and mechanical tests reported and the ASTM designation, type, grade and source.

The epoxy-coating certifications, which are to be attached as directed above, shall provide the powder certifications.

Coating plants that have been approved on a project-by-project basis shall supply all necessary documentation for each shipment as described above. An acceptance sample, 6 ft. (2m) of the most common size in the shipment, shall be secured and tested for coating thickness and flexibility (bend test) prior to incorporation into the project. **NOTE:** The location of the sample within a bar shall be at least 3 ft. (1m) from the ends of the bar.

One copy of the documents prescribed above shall accompany each shipment and be retained in the Project Engineer file. Two copies shall be forwarded, at the time of shipment, one to the Central Materials Office in Ames, Iowa, and one to the District Materials Office responsible for project administration.

VERIFICATION SAMPLING & TESTING

Personnel from the District Materials Office shall secure a random field verification sample 6 ft. (2 m) of the largest size bar in the project. The location of the sample within a bar shall be at least 3 ft. (1 m) from the ends of the bar.

NOTE: Coated bars that have been stored at the project site that have shown any amount of rust (trace, moderate or heavy) shall not be sampled and shall not be accepted; and shall be considered grounds for rejection.

Two additional samples shall be secured if the first sample indicates non-compliance. Non-compliance may be considered a cause for rejection.

Bridge Decks

The verification sample and acceptance sample will be the same sample. The District Materials Office will randomly sample the largest bar size for the deck. If the sample fails, two additional samples shall be secured. Noncompliance on any one of the additional samples shall be cause for rejection of that particular size in the shipment.

If the largest size bar in a shipment is rejected, a similar sampling procedure shall be applied to the remaining bars in the shipment.

The contractor shall not place concrete on the deck until there are passing test results of the epoxy-coated steel.

Samples of epoxy-coated steel reinforcement for all other applications (other than bridge decks) shall be limited to a project quantity of 5 tons (5 Mg) or over.

Pavement Tie Bars

Epoxy-coated pavement tie bars shall be accepted on the same basis as dowel bars in accordance with Appendix C of this IM.

STEEL FROM WAREHOUSE SUPPLY

The District Materials Engineer shall sample epoxy-coated reinforcing steel, which is shipped to a fabricator or contractor for use on several projects, at the above-indicated rates.

Certification

Each coating plant shall furnish at the time of shipment, written certification that samples representing each lot of coated steel reinforcing bars have been either tested or inspected as specified and that the coating requirements have been met. A report of the test results shall be furnished on a regular basis.