SECTION 1021 -- EPOXY COATED REINFORCING STEEL

1021.01 -- Description

1. Steel bars for concrete reinforcement required to be epoxy coated shall conform to the requirements of Section 1020 and as shown in the plans. The bars shall be free of contaminants such as oil, grease, paint, slivers, or any other imperfections which may be detrimental to the coating process.

2. All reinforcing bars furnished under this item shall be given a protective coating of a fusion bonded epoxy resin.

1021.02 -- Material Characteristics

1. The coating shall be applied as an electrostatically charged dry powder sprayed onto a grounded steel bar using an electrostatic spray gun. The powder may be applied to either a hot or cold bar. The coated bar shall be given a thermal treatment specified by the manufacturer of the epoxy resin which will provide a fully cured finished coating.

2. The coating material shall be a powdered epoxy resin prequalified by evaluation as prescribed in AASHTO M 284/M 284M and tests performed by the National Bureau of Standards (NBS), a qualified independent testing laboratory, or a state laboratory approved by the NDR Materials and Tests Division. Approval of material by an independent or state laboratory is subject to the Engineer's review of the test data.

3. The manufacturer of the epoxy resin shall also supply the coating applicator with all other information and recommendations essential to the proper use and performance of the powdered resin as a coating. An authorized representative of the manufacturer shall provide written certification to the applicator that the powdered resin furnished for coatings is the exact formulation that was prequalified by the NBS or other testing agency.

4. At the request of the Engineer, the coating applicator shall provide a representative 200 g sample of the resin powder used to coat each lot of bars. The sample shall be packaged in an air-tight container with identification by lot number.

5. The approved powdered epoxy resins are on the NDR Approved Products List.

6. A suitable patching material compatible with the coating and inert in concrete shall be made available to the Contractor by the manufacturer of the epoxy resin for repair of damaged coating areas at the applicator's plant or in the field. The patching or repair shall be performed in accordance with the recommendations of the material manufacturer.

7. A film thickness after curing of 125 - 250 µm shall be applied in a uniform, smooth coat with no discontinuities, except as provided herein. Thickness of the film shall be measured on a representative number of bars from each production lot by the same method outlined in ASTM G 12 for measurement of film thickness of pipeline coatings on steel.

8. The coating shall be checked after curing for continuity of coating and shall be free from holes, voids, contamination, cracks, or other damaged areas. In addition, there shall

not be more than 2 holidays (pinholes not visually discernible) in any 300 mm of the coated bar. An in-line 67.5 volt DC powered detection system with an audible or visual signal shall be used in accordance with the manufacturer's instructions to check the coating for holidays and other defects.

9. a. The flexibility and adhesion of the coating shall be evaluated on samples of all the bar sizes for each day's production lot.

b. The coated bars shall be capable of being bent 120 degrees around a mandrel of the size specified in Table 1021.01.

c. The bend test shall be made at a uniform rate.

d. The coating on the bars shall show no evidence of cracking or separation from the bar. If a sample's coating shows evidence of cracking or separation, 2 retests shall be conducted on random samples from the same day's production lot.

e. If the results of both retests meet specified requirements, the coated bars represented by the sample shall be accepted.

Table 1021.01

Bend Test Requirements			
English		**Metric**	
Bar No.	**Mandrel Diameter (millimeters)**	**Bar**	**Mandrel Diameter (millimeters)**
3	76		
4	100	10	100
5	125	15	125
6	150	20	150
7	178		
8	200	25	200
9	230	30	230
10	254		
11	280	35	280
14	430	45	430
18	580	55	580

10. The bending test shall be conducted at room temperature after the specimen has been exposed to room temperature for a sufficient time to insure that it has reached thermal equilibrium. A temperature in the range of 20° to 30°C shall be considered room temperature.

11. The coating applicator shall ensure that samples for the bend test will not short the bar lengths specified in the plans.

1021.03 -- Procedures

1. The surface of the bars to be coated shall be clean and free from rust, scale, oil, grease, and similar contaminants.

2. The surface shall be blast cleaned to a near-white metal in accordance with the Steel Structure Painting Council Surface Preparation Specifications, SSPC-SP10.

3. All traces of dust and grit from the blasting shall be removed.

4. The coating shall be applied to the cleaned surface as soon as possible after blasting and before visible oxidation of the surface occurs. However, in no case shall the application of the coating be delayed more than 8 hours after blasting without specific approval of the Engineer.

5. In order to protect the coated reinforcement from damage, the Contractor shall use padded or nonmetallic slings and padded strips. Bundled bars shall be handled in a manner which will prevent excessive sagging of bars which will damage the coating. The bundled bars shall not be dropped or dragged and must be stored on wooden cribbing. If, in the opinion of the Engineer, the coated bars have been extensively damaged, the material will be rejected. The Contractor may propose, for the approval of the Engineer, alternate precautionary measures.

6. The Engineer may defer final inspection and approval of the bar coating integrity and repairs until the bar mat is in place and all handling is completed. A reasonable amount of coating damage due to fabrication and handling may be allowed depending on the number, extent, size, and location of such damaged areas. The Engineer shall be the sole judge of which imperfections in the coating need not be repaired.

7. The bars shall be fabricated and placed as shown in the plans and as specified in Section 707.

8. a. Patching materials supplied or recommended by the manufacturer of the powdered resin shall be used to repair the coating and shall be applied to provide a minimum film thickness of 125 µm over the bare area. Areas to be patched shall be clean and free of surface contaminants. They shall be properly treated in accordance with the resin manufacturer's recommendations before detrimental oxidation occurs.

b. Care should be taken during the patching procedure to assure that the coating thickness on the area adjacent to the patched area does not exceed 375 µm. Extensive areas of damaged coating, exceeding that which is unavoidable in careful handling and shipping, may be cause for rejection of the damaged bars.

c. In no case, however, shall the total bar surface area covered by patching material exceed 5 percent. (The 5 percent total bar surface area is the combined area for repairs done in the fabricator's shop and those done in the field.)

d. Proper repairs shall be the Contractor's responsibility even when the work is done by an applicator, fabricator, or other subcontractors.

9. The identification of all reinforcing bars (manufacturer, heat number, and size) shall be maintained by the fabricator throughout the fabrication and coating process to assure that the coated, fabricated bars are identified with proper tags for final shipment to the job site (tags should show size, heat number, and mark).

10. a. The coating applicator shall furnish with each shipment a written certificate stating that all bars have been coated in accordance with the resin manufacturer's recommendations and these *Specifications*.

b. The certification shall include for each bar size the preheat temperatures, cure times, thickness charts, holidays detected, and bend test results.

1021.04 -- Acceptance Requirements

1. a. A plant intending to supply epoxy coated reinforcing steel under these *Specifications* shall be inspected and approved by NDR representatives before making shipments to job sites. The plant shall notify the NDR Materials and Tests Division 30 days before processing any material. A date and time of inspection will be arranged by the NDR Materials and Tests Division and the plant.

b. Once a plant is inspected and approved, the applicator may ship the coated bars on the basis of a certificate of compliance which lists the material shipped and states that the material complies with these *Specifications*.

c. The inspection and approval of a plant does not constitute a blanket-type approval. The coating applicator's plant will be subject to additional in-plant inspections if, at any time, in the opinion of the Engineer, the quality of the coated bars appears to be below specification requirements.

2. Coated bars will be inspected at the destination before any bars are incorporated in the work.

3. The coated bars will be inspected on the job site for handling defects, coating thickness, and continuity of coating. A 67.5 volt DC holiday detector will be used for determination of continuity of coating.

4. In addition to the testing done at the coating applicator's plant (continuity, flexibility, adhesion, and film thickness), two 1.8 m samples of the coated bar (for tension testing and bend testing) of each size bar and each heat number shall be sent to the NDR Materials and Tests Laboratory, Lincoln, Nebraska. These bars will be properly identified with tags showing the size and heat number.