



**MATERIAL SPECIFICATION FOR
EPOXY COATED REINFORCING STEEL BARS FOR CONCRETE**

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1442.01 SCOPE

This specification covers the requirements for the production of reinforcing steel bars for concrete with protective epoxy coating applied by the electrostatic spray fusion bond method.

1442.01.01 Specification Significance and Use

This specification has been developed for use in provincial- and municipal-oriented Contracts. The administration, testing, and payment policies, procedures, and practices reflected in this specification correspond to those used by many municipalities and the Ontario Ministry of Transportation.

Use of this specification or any other specification shall be according to the Contract Documents.

1442.01.02 Appendices Significance and Use

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

1442.02 REFERENCES

When the Contract Documents indicate that provincial-oriented specifications are to be used and there is a provincial-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.PROV, unless use of a municipal-oriented specification is specified in the Contract Documents. When there is not a corresponding provincial-oriented specification, the references below shall be considered to be to the OPSS listed, unless use of a municipal-oriented specification is specified in the Contract Documents.

When the Contract Documents indicate that municipal-oriented specifications are to be used and there is a municipal-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.MUNI, unless use of a provincial-oriented specification is specified in the Contract Documents. When there is not a corresponding municipal-oriented specification, the references below shall be considered to be the OPSS listed, unless use of a provincial-oriented specification is specified in the Contract Documents.

This specification refers to the following standards, specifications, or publications:

Ontario Provincial Standard Specifications, Material

OPSS 1440 Steel Reinforcement for Concrete
OPSS 1443 Organic Coatings for Reinforcing Steel Bars for Concrete

Ministry of Transportation Publications

MTO Laboratory Testing Manual:
LS-420 Cathodic Disbondment Test for Epoxy-Coated Reinforcing Bars
LS-421 Salt Spray Test for Epoxy-Coated Reinforcing Bars

ASTM International

A 775/A 775M-06 Epoxy Coated Steel Reinforcing Bars
D 3963/D 3963M-93 Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars

Concrete Reinforcing Steel Institute (CRSI)

Voluntary Certification Program for Fusion - Bonded Epoxy Coating Applicator Plants

1442.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Holidays means pinholes and voids in non-conductive coatings that allow an electrical current to pass through the protective coating to the metal base material. These discontinuities are such that they may not be visible to a person with normal vision.

Manufacturer means coating applicator or coater.

1442.05 MATERIALS

1442.05.01 Reinforcing Steel Bars

Reinforcing steel bars shall be according to OPSS 1440.

1442.05.02 Coating

Epoxy coating and patching material shall be according to OPSS 1443.

1442.07 PRODUCTION

1442.07.01 Surface Preparation and Application of Coating

All surfaces of the reinforcing steel bars shall be prepared and coated according to ASTM A 775M.

1442.07.02 Requirements

The requirements and the test methods for film thickness, continuity, flexibility, and adhesion shall be according to ASTM A 775M, ASTM D 3963M, and MTO test methods LS-420 and LS-421 except as modified as follows:

- a) The continuity of the coating shall be visually inspected after curing. The coating shall be free of holes, voids, blemishes, cracks, contaminations, and any damaged areas discernible to a person with normal vision. There shall be an average of no more than four holidays per linear metre of the bar when tested with a holiday detector.
- b) The flexibility of the coating shall be evaluated by bending test specimens around a mandrel with the appropriate bending pin diameter shown in Table 1. The bars shall be bent to 180 degrees, after rebound. The bend shall be made at a uniform rate and may take up to 5 seconds maximum to complete. The test shall be performed on test pieces having a uniform temperature of not less than 15 °C.

1442.07.03 Handling and Identification

Handling and identification of the coated reinforcing steel bars shall be according to ASTM A 775M and ASTM D 3963M except as follows:

- a) Coated reinforcing steel bars in the plant and at the Working Area shall be clearly labelled with the following information:
 - i. Name of manufacturer
 - ii. Coating system used
 - iii. Production date consisting of the month and year

- b) Unprotected storage of the coated reinforcing steel bars shall not exceed 30 Days. The total storage time shall not exceed 120 Days unless stored in such a manner as to protect them from the sun and moisture condensation.

1442.07.04 Fabrication

Fabrication of the reinforcing steel bars after application of the coating shall be according ASTM D 3963M.

1442.07.05 Repairs To Damaged Coating

Damage to the coating of the coated reinforcing steel bars caused during the fabrication and handling at the manufacturer's premises, including hairline cracks without bond loss and sheared bar ends, shall be repaired according to ASTM D 3963M. Repairs shall be completed before rusting and shipment occurs, with the following exceptions:

- a) Damage shall not exceed a surface area of 10 mm² in any linear metre of coated bar, not including sheared ends.
- b) There shall be no more than four defects per coated bar length.
- c) Bars containing hairline cracks that are associated with bond loss shall be rejected.

Coated reinforcing steel bars with damage exceeding the above shall be rejected.

1442.07.06 Quality Control

The manufacturer shall exercise quality control procedures to ensure the requirements of this specification are met.

Tested samples shall be retained by the manufacturer for 90 Days after testing and be identified with labels containing the following information:

- a) Date of manufacture
- b) Time of sampling
- c) Coating type
- d) Bar line

Tested samples shall be available at the manufacturer's premises for examination by the Contract Administrator.

Test results shall be submitted to the Contract Administrator. The submission shall include the Average Radial Disbondment for the Cathodic Disbondment Test and for the Salt Spray Test, calculated on the basis of three consecutive months' test results. The submission shall be signed by a qualified representative of the manufacturer verifying that results are included for all adhesion tests performed and that testing was according to LS-420 and LS-421. The submission shall include the name of the individuals who performed the testing.

Suppliers shall provide the purchaser with all testing records for each lot or part of lot to verify that the coated steel reinforcing bars supplied were produced and tested according to the appropriate specification requirements.

1442.07.06.01 Sampling and Frequency of Testing

Film thickness shall be determined according to ASTM D 3963M at the rate of one bar for every 25 coated bars or part thereof for each bar size produced on any one Day.

One bar sample, one metre in length, for every 1,500 m or part thereof for each coated bar size produced on any one day shall be taken and tested for flexibility.

One bar sample, 200 mm in length, for each bar size produced for every eight hours of production shall be taken for adhesion testing according to LS-420. The test samples shall be taken from each production line in rotation.

One bar sample, 200 mm in length, for every 24 hours of production shall be taken for adhesion testing according to LS-421. The test samples shall be taken from each production line in rotation and at least one sample representative of each bar size produced shall be tested for every seven Days of production.

1442.07.07 Certification of Manufacturer

The manufacturer shall meet the minimum quality criteria set forth by the CRSI Voluntary Certification Programme for Fusion-Bonded Epoxy Coating Applicator Plants and have a valid copy of this certificate available at their plant for review by the Contract Administrator.

1442.08 QUALITY ASSURANCE

1442.08.01 Inspection and Testing

The Owner reserves the right to inspect and test at such times as the Owner may consider necessary to ensure that the materials supplied are according to this specification.

The inspection and sampling of the coated reinforcing steel bars may be carried out at the coating plant, fabricating plant, or point of delivery to the Working Area.

Materials not meeting the requirements of this specification shall be rejected.

1442.08.02 Acceptance

Acceptance will be based on satisfactory test results that the coated reinforcing steel bar sample is according to this specification. Culling of rejected coated reinforcing steel bars is permitted. Rejected coated reinforcing steel bars are not to be used as uncoated reinforcing steel.

The average disbondment radius of the test site of coated reinforcing steel bar for cathodic disbondment according to LS-420 shall not exceed 2 mm, when measured from the edge of an intentional coating defect.

The average disbondment radius of six test sites of coated reinforcing steel bar for the Salt Spray, according to LS-421 shall not exceed 3 mm, and any individual test site shall not have greater than 5 mm disbondment radius average when measured from the edge of an intentional coating defect.

For film thickness acceptance purposes, at least 90% of the recorded thickness measurements shall be between 175 and 300 µm, excluding steel profile.

For adhesion of coating acceptance purposes, any coated reinforcing steel bars with cracking or cracking and disbonding of coating shall be rejected.

When inspected as delivered to the Working Area, the following criteria shall apply:

- a) Bars with coating damage greater than 1% of their surface area in any one metre length shall be rejected.
- b) Bars with coating damage of 1% or less of their surface area shall have all damaged areas of the bar coating repaired.
- c) If the additional required repairs result in a total bar surface area covered by patching material exceeding 5% of the bar surface area, the bar shall be rejected.

When the manufacturer is notified by the Owner of the uncertainty of the quality of the coated reinforcing steel bars, such bars shall be rejected and no additional coated reinforcing steel bars shall be shipped until the manufacturer has performed additional testing and notice of acceptance has been received from the Owner.

TABLE 1
Bending Pin Diameters

Bar Size, M	10	15	20	25	30	35	45	55
Bending Pin Diameter, mm	80	120	160	200	240	350	450	550

**Appendix 1442-A, November 2007
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS**

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

Designer Action/Considerations

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

Related Ontario Provincial Standard Drawings

None