

GENERAL SPECIFICATION

CORROSION

GS EP COR 222

Fusion Bonded Epoxy (FBE) external coating for pipelines

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1. Scope

This specification covers the minimum requirements to ensure proper application and performance of plant-applied fusion bonded epoxy powder coatings to the external surfaces of pipelines.

The purpose of such coatings is to prevent corrosion when used in conjunction with cathodic protection.

The coating shall be suitable for service temperature from -20°C up to +80°C (depending on the type of epoxy primer).

For higher temperature, high glass transition temperature epoxy powders are necessary. Specific requirements and qualification tests might be requested by Company on a case by case basis. Qualification dossiers specific to such product shall be submitted to Company before the epoxy powder is ordered, and in any case, two (2) months prior to the commencement of coating works, for formal approval based on the present specification to which high service temperature related performance characteristics shall be added.

2. Reference documents

The reference documents listed below form an integral part of this General Specification.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

Reference	Title
ASTM D 570	Standard Test Method for Water Absorption of Plastics
ASTM D 4940	Standard test method for conductimetric analysis of water soluble ionic contamination of blasting abrasives
ASTM G 8	Standard test methods for cathodic disbonding of pipeline coatings
ASTM G 95	Standard test methods for cathodic disbonding of pipeline coatings (Attached Cell Method)
CSA Z245-20	External fusion bond epoxy coating for steel pipes
ISO 2811-1	Paints and varnishes - Determination of density - Part 1: Pyknometer method
ISO 4287	Geometrical Product Specifications (GPS) - Surface texture: Profile method - Terms, definitions and surface texture parameters
ISO 8130-6	Coating powders - Part 6: Determination of gel time of thermosetting coating powders at a given temperature

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Reference	Title
ISO 8501-1	Preparation of steel substrates before application of paints and related products - Visual assessment of surface cleanliness - Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings
ISO 8502-3	Preparation of steel substrates before application of paints and related products - Tests for the assessment of surface cleanliness - Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)
ISO 8502-6	Preparation of steel substrates before application of paints and related products - Tests for the assessment of surface cleanliness - Part 6: Extraction of soluble contaminants for analysis - The Bresle method
ISO 8502-9	Preparation of steel substrates before application of paints and related products. Tests for the assessment of surface cleanliness - Part 9: Field method for conductometric determination of water-soluble salts.
ISO 8503-4	Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast-cleaned steel substrates - Part 4: Method for the calibration of ISO surface profile comparators and for the determination of surface profile - Stylus instrument procedure
NACE SP0490	Holiday Detection of Fusion-Bonded Epoxy External Pipeline Coatings of 250 to 760 µm (10 to 30 mils)

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

Reference	Title
Not applicable	

3. Obligations of Applicators and Manufacturers

3.1 Company requirements regarding coating products

Applicator shall, in his tender, submit the data sheets of the selected products both for Fusion Bonded Epoxy (FBE) and repair products for Company approval. He will also provide a written notice attesting that the FBE material and the repair products delivered shall meet the required characteristics as set forth in § 4 according to the specified methods.

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The Applicator shall inform by writing the Manufacturer, with a copy to Company, of Company requirements related to:

- Test certificates, properties and conformity certificates of FBE and repair products as detailed in the present document
- The packaging: Manufacturer shall deliver the products in waterproof plastic bags to prevent water contamination and absorption of humidity during storage and transportation.

Once approved by Company, the epoxy powder and the repair products shall not be changed by the Applicator.

Approval of the products by Company shall not, under any circumstances, be considered as a guarantee from Company with respect to coating materials and repair products but simply as an authorisation for use.

3.2 Qualification of Applicator plant and coating system

Qualification of the proposed application plant, personnel, coating process, and products shall be carried out in due time through a Procedure Qualification Trial (PQT). Qualification shall be organised jointly by Contractor and Applicator, and witnessed by a Company representative. Qualification testing shall be organised at least 2 months before the works start in order to ensure that a suitable solution can be implemented in case of test results failing to meet the requirements of this specification.

Qualification shall consist of the following steps:

- Submission of information for Company approval for raw materials (epoxy, repair products) prior to the start of PQT:
 - Conformity certificates (see § 4.3.3) and tests results for materials requirements (see § 4.3.2)
 - Certificate of analysis (see § 4.3.4) for each batch of product used for PQT
 - For FBE, tests results (see § 4.3.5) on laboratory coated sample plates.
- Coating process: The PQT will be witnessed by Company representative and shall be in accordance with § 5. Coating process parameters shall be fully recorded during PQT and the same parameters shall be used for production, with a maximum discrepancy of 5% for each parameter, including the pipe travel speed for blasting and coating operations, which shall be strictly monitored during PQT and production (within the 5% margin).
- Coating properties: Tests shall be witnessed by Company representative and in accordance with § 6.
- An Inspection Test Plan for the PQT is given in Appendix 1. Contractor and Applicator shall submit a complete joint report of the PQT results to Company for approval.
- Once approved, the FBE coating will be considered as qualified on the corresponding coating line. Any change in the components of the coating or the application process of a qualified coating on a new coating line shall lead to a new qualification process. The qualification of the coating on the coating line is valid for three years duration. Renewal of the qualification is normally based on a technical visit and/or Company track record. A

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new PQT can be requested in case of quality issues noted on the line during the three years duration.

- At start of production a Pre Production Test (PPT) shall be carried out, as described in Appendix 1.

3.3 Notification prior starting coating work

Contractor shall notify Company, at least eight working days before production start up, to allow for the mobilisation of Company designated Inspector.

Company inspector shall have free access to workshops, storage yards, and laboratory of Applicator who shall also provide him with all the facilities necessary for the proper execution of his work (i.e. office, telephone and fax, handling equipment, measuring instruments with calibration certificates, etc.).

Upon arrival at the coating plant, Company Inspector shall receive from Contractor the documents supplied by Applicator.

3.4 Acceptance certificate

Contractor and Applicator shall sign jointly with Company Inspector the coated pipes acceptance certificate including the results of all tests and inspection as set forth in this specification.

The acceptance certificate of coated pipes shall certify that all tests and inspections have been performed by Applicator under the responsibility of Contractor for all Company ordered pipes and have been witnessed by Company Inspector.

One copy of the acceptance certificates shall be transmitted to Company and one copy to Company Inspector.

4. Coating system and characteristics of raw materials and repair products

For each raw material (epoxy powder and repair product) the documentation requirements prior to the start of the work are as follows:

- Nature and type of raw material
- List of technical design and performance requirements of Company
- Certificate of conformity from Manufacturer
- Certificate of analysis from Manufacturer.

4.1 Coating system

The Fusion Bonded Epoxy external coating shall consist of one coat of powder epoxy of 400 to 500 microns DFT, with neither primer nor conversion chemical surface treatment such as chromatation.

Coating shall be plant applied in one coat.

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4.2 Marking and identification

Raw materials shall be clearly identified with the following markings (whatever the packaging of the product):

- Name of Manufacturer
- Production plant
- Name of product
- Batch number
- Date of manufacture
- Shelf life or expiry date.

4.3 Characteristics of epoxy powder product

4.3.1 Nature and type

The epoxy shall be 100% solid powder. The use of liquid epoxy is not allowed.

4.3.2 Technical requirement for epoxy powder

The epoxy powder shall meet the requirements of Table 1.

Table 1 - Technical requirements for FBE powder

Characteristic	Test	Units	Acceptable Values
Moisture content	Powder: 20 g Temperature: 105°C Time: 30 min	%	0.5 (max.)
Glass transition temperature *	Differential Scanning Calorimeter (DSC)	°C	Not less than 100°C for fully cured material
Water absorption (demineralised water)	ASTM D 570 on a free film of 500 microns ± 50 microns	%wt	Less than 15% of weight uptake after 28 days at 80°C

* For service temperature up to 80°C. For higher service temperature, high glass transition temperature materials are requested. They shall be submitted to Company for approval on a case by case basis. In all cases, Tg shall be understood as the inflection point on a DSC spectra.

4.3.3 Content of conformity certificate

The conformity certificate is issued by the raw material Manufacturer (specific to each raw material). It lists physical and chemical characteristics to be controlled for each production batch with conformity acceptance values set by Manufacturer.