

# Internal FBE Coating Procedure

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## 1. General

Line Pipes of Carbon steel have since long being used in transportation of water, Oil, Gas chemicals etc in onshore and offshore. The Carbon steel pipes after due course of time tend to corrode and hence require protective coating eternally and internally depending on the usage and type of fluid being transported. Fusion bonded epoxy coating process is being used since long for corrosion protection of CS line pipes which is electrostatic spray process. However for sour services (transportation of petroleum products acids and chemicals) internal Fusion bonded epoxy coating is nowadays being considered more throughout the world. It is also and electrostatic spray application of epoxy resin (with properties different then the external FBE powder) but with a process which is different from the FBE coating applied external. Following is a procedure for application of Internal Fusion bonded Epoxy (FBE) in the inside of Line pipes. Mostly this process is carried out inside a plant with all the facilities for coating.

- 1) This procedure is the application guide of FBE Internal coating system with phenolic primer application and FBE coating
- 2) The Coating material shall be handled, stored and applied in accordance with the specification of paint manufacturer or the authorized coating applicator.

## 2. Pretreatment

2.1 Prior to blast cleaning, all oil, grease, mill lacquer and other deleterious material on the surface of the metal shall be removed and inspected in accordance with SSPC-SP1.

2.2 Visible oil and grease marks shall be cleaned by safe solvent without any residue.

2.3 The pipe shall be blast cleaned according to NACE No.1, SSPC-SP5, Sa 2 1/2, and ISO 8501-1 white metal by steel grit. Near white metal finish means that all rusts, contaminants, oxide compound and other foreign substance shall be removed. Slightly shadows and discoloration are acceptable. However should not exceed 5% of total surface area.

2.4 For consistent abrasive working shall be maintained by adding new abrasive commensurate with consumption. The anchor pattern profile shall have height of 50~100µm as measured with X Course Press-O-Film Replication tape or suitable profilometer.

2.5 Any slivers or bristles of steel remaining on a newly blasted surface shall be removed by the use of high speed wire brushes, sanders, files or other approved means. This

shall be done after the grit blasting operation and prior to the coating application.

2.6 Following cleaning and prior to coating, boss, steel leftover, bristle remaining on the surface shall be cleaned by abrasion machine or manual rasp without any damage to the uneven shape on the surface.

2.7 Prior to coating, the cleaned pipe shall be inspected to ensure all cleaning procedures have been appropriately performed. The abrasives or other contaminants inside of pipe shall be removed by compressed air etc. Blast cleaned pipe shall be protected from conditions that would allow them to be rusted or damaged before coating.

2.8 Maximum time between blasting and primer coating shall be 4 hours and any metal surface showing evidence of flash rusting shall be re-blasted prior to coating.

## 3. Coating Application

3.1 Cleaned pipe shall be entered the spraying booth having no residue or contaminant on the surface.

3.2 Pre-heat temperatures shall be monitored, controlled and recorded.

3.3 Roller contact pyrometer is recommended to measure the preheating temperature. Infrared sensing equipment also may be used to measure temperature of the applied Coating.

**3.4 Liquid primer coating shall be applied to the pipe as follows;**

3.4.1 The surface must be completely cleaned and dried. Do not apply when relative humidity is above 85%.

3.4.2 The surface temperature must be at least 3°C(5°F) above dew point to prevent condensation. In confined areas, ventilate with clean air during application to assist solvent evaporation.

3.4.3 Methyl-ethyl ketone, or Acetone can be used as thinner when dilution is required. Thinning rate can be varied according to the spray conditions.

3.4.4 Airless spray primer with 12~35µm thickness.

3.4.5 Minimum Hold time after primer application and before primer curing is 5 to 10 minutes and Maximum 4 hours.

3.4.6 Heat primed pipe to 177~210°C (351~410°F).

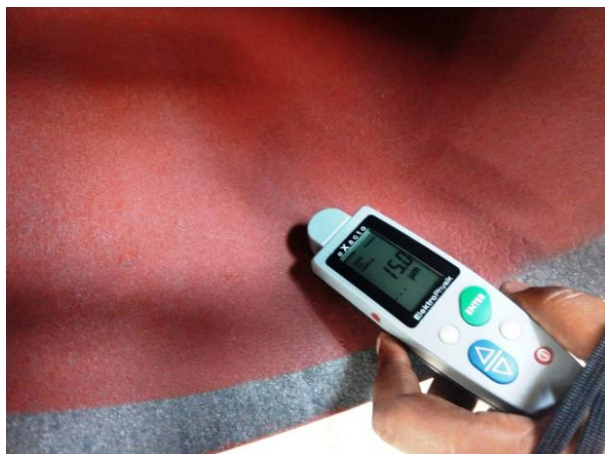
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Holding 30~50 minutes in the oven (time is depending on the wall thickness and diameter of the pipe being coated) and shall not exceed 4 hours at a maximum pre-heat temperature of 230°C (450°F)

3.4.7 Pipe or fittings which have been primed and waiting for FBE coating application must be covered to be protected against any dirt or other deleterious materials and not to be hold more than 4 hours for FBE coating application.



Primed Pipe



Primed Pipe

**3.5 FBE Internal coating shall be applied to the pipe as follows;**

3.5.1 The preheating temperature is generally recommended between 177 ~ 230°C(350~450°F) to achieve the best properties of the coating. Pipe Shall be externally heated & Preheating time shall be to achieve temperature of 177 ~ 230°C(350~450°F).

(The final curing process must begin within 2 hours of the FBE application.)

3.5.2 The cure condition is recommended that temperature is between 204~220°C(399~428°F) and holding time is 30~50 minutes by keeping in oven. (Cure condition depends on steel wall thickness and diameter.)

3.5.3 Apply base coat with 375 ~ 625µm thickness by

electrostatic powder spray gun or pneumatic spray Nozzle. (The film thickness can vary depending on the customer specification.)

3.5.4 To insure proper cure, the powder shall be applied according to the time-temperature data provided by the manufacturer.

3.5.5 After curing, the coated pipe shall be cooled with natural air or water spray.



IFBE Coated Pipes

#### 4. Inspection

4.1 After completion of the coating and cooling, the coated pipe shall be inspected by using the voltage calculation methodology. The direct current potential of the detector shall be set to exceed 5 V for each micrometer of nominal coating thickness. The search electrode shall be steel spring or conductive rubber.

4.2 The thickness of the coating shall be checked with properly calibrated gauges.



Pipe Sampling

#### 5. Coating Repair

5.1 The defects due to incident factors like scars, silvers, coating imperfection shall be repaired as the following process. Pipe requiring small spot repairs shall be cleaned

to remove dust or contaminant which deteriorates the adhesion of the repair material by using sandpaper or other proper methods.

5.2 For pinholes only, the repair coating shall be applied according to the general liquid epoxycoating application.

5.3 Pipe with major coating defects such as partially coated area, unbounded coating and inadequate film thickness shall be set aside for a decision to be repaired or recoated.

## **6. Storage, Handling and Shipping**

6.1 Coated pipe shall be treated and stored carefully to avoid damage to the pipe wall, beveled ends and etc. Coating damage while handling shall be efficiently repaired.

6.2 Loading shall be made in accordance with the specification required. Sufficient space and safety padding shall be used to prevent damage to pipe and coating.

6.3 Pipe shall be transported from the coating yard to the job site by truck, rail or vessel as per requirement. In loading and transportation, sufficient tonnage shall be used to Protect the pipe and its coating.

6.4 The use of Chain or wire rope for binding without safety paddling is not recommendable.

6.5 Pipe shall be transported in accordance with the shipping standard regulations.

## **References**

- [1] CAIRN Specification no. : CAIRN-TSG-Y-SP-0027, Rev.A2, Fusion Bend Epoxy Powder coating for internal surface of carbon steel water pipeline.
- [2] Internal FBE -Application guide KCC Korea
- [3] Surface preparation of line pipes as per SSPC ( The Society for Protective Coatings )  
ISO 8501-1