Girth Weld Coating With Fusion Bond Epoxy

Processing guidelines

The guidelines below describe surface preparation and application requirements and procedures, inspection and safety recommendations related to the field application of Corro-Coat EP-F to pipeline girth welds.

1. Surface Preparation

1.1. The pipe surface must be free of mill scale and corrosion products, and need to meet the Near White standard as stipulated by SSPC-SP10 or NACE No. 2, or BS Second Quality, and as pictorially represented by the Swedish Standards SA 2 1/2.

1.2. The pipe surface must be free of extraneous matter and contaminants, including:
   a) Welding residues and spatter, dirt, abrasive residues, masking tape leftovers.
   b) Organic contaminants such as grease and oils.
   c) Soluble salts; both unreacted, and those having reacted with iron during the corrosion process.

1.3. The pipe surface must have a suitable anchor pattern. This should be angular and have a surface profile between 50µ and 100µ. The profile should be ‘open’. Avoid folded peaks and undercutting of surface.

2. Cleaning Process and Material Description

Manual open blast system with dry expendable abrasives is one of the most practical methods used to cleaning pipes or related equipment in the field.

2.1. The cleaning equipment may consist of a blast machine, an air compressor, and an abrasive hopper mounted on a moveable trailer. To ensure dry and oil-free air supply, use suitable oil and water eliminators in the compressed air lines.

2.2. To achieve a specified cleanliness standard, the blasting abrasive hardness and size should be adequate. The local supply conditions and the environmental regulations will have a great influence on the choice of the abrasive. It is generally prudent to use proven high quality abrasives rather than locally supplied inexpensive products. The evaluation of the cost must be based on the value received rather than on the cost per kilo of material.
Recommended suitable abrasives include:

a) 16 - 35 Mesh Sand (salt and clay free).
b) Metal Abrasives of proper size and hardness, i.e. GL-25 (metal abrasives are usually used only in enclosed systems such as Vacu-Blast, because of otherwise high cost).

**Note:** in remote construction locations where sand is abundant, it may be advantageous to use local sand for blasting, as long as:

a) Local regulations allow its use.
b) The sand is salt free.
c) The sand is properly screened.
d) The sand will give the proper surface profile.
e) Special care is taken to remove residues from the cleaned surface.

3.  **Cleaning Procedures**

3.1.  Remove extraneous contaminants, including weld spatter, by chiseling if necessary. In the presence of organic contaminants, wipe the surface clean with hydrocarbon solvent such as Xylol. Use lint free rags, and change them frequently. Use a good scrubbing brush with fresh water for salt contamination. If ferrous salts are deeply embedded in the steel, a phosphoric acid solution in water treatment may be necessary.

3.2.  Blast-clean the metal surface and a narrow strip (2 - 3 cm) of the factory applied coating to the specified standard of cleanliness. The factory applied coating must be feathered from the edge of well adhering coating, over a distance of approximately 25 mm (1 inch). This is best done by holding the cleaning nozzle at a distance of approximately 50 cm (20 inches) from the surface, at a very shallow angle blast.

3.3.  During adverse weather conditions (i.e. snow, rain, high winds, fog, etc.) the cleaning operation may only proceed if a satisfactory shelter is provided to protect the work surface, the material and the equipment.

3.4.  **Safety requirements**
Operators should wear suitable protective clothing. All operations must be carried out using sound working practices. Adhere to relevant local safety and health regulations.

5.  **Heating**

To achieve a high quality coated joint, a proper girth weld heating is essential. Electrical induction heating has proven to be the most effective method and is strongly recommended. The use of gas fired infra red heaters have not found successful applications yet, but may be considered if shown to offer some advantages.
Typical equipment and operating directions as used by a successful field joint coating’s contractor are shown below

5.1. Equipment description
Induction heating equipment consists of a mobile generator, a power unit, a control unit, a cooling unit, and a split heating coil. The generator, the power, the control and the cooling units are mounted on a mobile trailer with a boom that supports the induction coil and power cables. The coil is a split type with manual clamps. The mobile trailer is completely shrouded and weather-proofed. The shroud is extendable to cover the pipe for weather protection.

5.2. Equipment operation
Grit particles remaining on the pipe surface are brushed or blown off prior to the heating operation. The induction coil is lowered over the girth weld area and clamped to the pipe, so that it is centrally positioned over the weld. The heating cycle starts then. Once the specified temperature has been reached, the power is switched off, the coil is unclamped, raised off the pipe and moved out of the away.

5.3. Temperature stabilization
The application temperature falls within the limits of the specified FBE powder and is typically up to a maximum of 250°C (480°F) and a minimum of 230°C (445°F). There is allowance for temperature reduction due to delays between switching off the coil and starting the coating. To achieve a constant temperature around the weld area, the heating must be uniform and within the allowed tolerance. It also takes into consideration that the pipe temperatures are already affected by direct sunlight temperatures.

The temperature is measured with a TEMPILSTICK Crayon or a calibrated contact temperature measuring device. To ensure a uniform heating, at least 3 temperature readings, equi-spaced around the circumference, are taken. Under no circumstances should the metal temperature exceed 300°C (575°F).

5.4. Safety requirements
The induction heating coil operates at a maximum of 110 volts. All open ‘live’ contact areas are insulated. Safety notices are displayed during the heating process and ‘Hot Pipe’ notices are displayed after. All relevant sections of the Health and Safety Work Act are adhered to.

6. Coating Application

12-inch (300 mm) diameter pipes, and larger, should be coated with automatic or semi-automatic application equipment. For smaller diameter pipes, flocking by hand spray may be used.

6.1. Coating specification
It is recommended to apply Corro-Coat EP-F powder coatings to a minimum film thickness of 400µ (16 mil). The coating must overlap the factory applied coating by at least 25 mm (1 inch).
6.2. **Typical automatic application equipment description**  
The coating equipment consists of a powder hopper and a feed machine, a control cabinet, a vacuum extraction machine, an air compressor, a rotary traversing machine and spray heads. The powder hopper, the feed machine, the control cabinet, the vacuum extraction machine and the air compressor are mounted on the same trailer as the induction heating equipment. A boom supports the air hoses, cables, and spraying machine. This equipment is located alongside the induction heating equipment and is thoroughly weather-proofed.

6.3. **Typical equipment operation**  
Immediately after the induction heating coil is removed, the rotary traversing machine is lowered onto the pipe and clamped to it so that the spray heads are located centrally over the weld. Use protective pads to prevent the coating machine clamps from damaging the factory applied epoxy coating.

To ensure the temperature is still within the defined limits, the pipe temperature is then rechecked. The coating is then started, obtaining the required thickness with a minimum number of passes, normally two passes will be sufficient. After the coating operation is over, the rotary machine is unclamped and removed. The powder hopper must be periodically checked to ensure that there is always sufficient powder. This will prevent the powder running out during the application process.

After each application, check the spray heads for clogging or contamination, and purge them if necessary.

At the end of each day, completely clean all powder coating equipment and keep empty overnight or until the next coating shift.

The air line, the water and the mobile oil traps and the filters, must be periodically checked to prevent contamination of the powder during spraying.

The stored powder must be kept dry at all times and out of direct sunlight. Powder must be stored at a temperature below 30°C (85°F). Any fluidized bed or material feed or return hopper must also be kept below this temperature and unexposed to sunlight.

7. **Coating inspection**

Use an approved and correctly calibrated film thickness gauge (such as Mikrotest or Elcometer). A minimum of 6 evenly spaced positions around each joint must be measured.

7.1. **Film adhesion and integrity**  
A film formation and adhesion test must be periodically performed. This can be carried out by cutting the film in a V shape with a sharp knife. Use a magnifier to assess the coating adhesion and examine a cross section of the coating as well as the steel/coating interface.
7.2. **Cure**
During the start-up phase of a field joint coating project, a thorough cure testing should be performed while the application parameters are being established. The tests should include impact resistance, adhesion, MEK resistance and DSC measurements.

The best insurance for achieving a good cure, is by maintaining the preheat temperature and the application settings that were found to provide a satisfactory coating performance during the cure tests.

An adhesion test and visible deviation from ‘normal’ coating characteristics may be used as indicators of cure. As a precautionary measure, a weekly DSC check is recommended.

7.3. **Holiday detection**
Jeeping of the coated weld joint is most practically done in conjunction with the completed pipeline jeeping. Experience has shown that under normal field joint coating conditions holidays will rarely occur. Jeeping voltage should never exceed the factory jeeping voltage used on the coating. The field jeeping voltage is recommended to be 200V below the specified factory jeeping voltage.