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In-Situ Coating of Steel Pipelines via Pigging

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AMPP values your input. To provide feedback on this standard, please contact: standards@ampp.org

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Foreword

In-situ pipeline coating was originally pioneered in the 1970s and has been used effectively to protect the internal surface of existing pipelines and extend the life of steel pipelines for many years.

Scope

This report provides the most current technology and industry practices for the internal in-situ cleaning and coating application in an existing steel pipeline. This report presents general practices and preferences in regard to the cleaning, surface preparation, drying, and the application of a coating in a steel pipeline by the pig (scraper) batching method. It is applicable to onshore or offshore steel pipelines in all industries including the oil and gas gathering, distribution, and transmission industries. It is also applicable to welded steel water and brine handling pipelines.

Rationale

In-situ coating is a non-traditional corrosion coating technology for the following reasons: (1) the cleaning process does not involve traditional abrasive blasting, and (2) the process lacks the ability to 100% inspect either the surface preparation or the coating application. Acceptance criteria rely on analytical data, test area inspection, and limited visual inspection. There is a recognized need for this report in order to make the broader industry aware of what is a seldom used but very established technology and to ensure long-term effectiveness of the coating in such applications by including the necessary details. This report is intended for use by pipeline operators, pipeline service providers, government agencies, and any other persons or companies involved in planning, designing, maintaining, or managing pipeline integrity.

Referenced Standards and Other Consensus Documents

Unless specifically dated, the latest edition, revision, or amendment of the documents listed in the table below shall apply.

AMPP/NACE/SSPC, www.ampp.org:	
SSPC-PA 2	Procedure for Determining Conformance to Dry Coating Thickness Requirements
NACE No. 2/SSPC-SP 10	Near-White Metal Blast Cleaning
ASTM International, www.astm.org:	
ASTM D3359	Standard Practice for Adhesion Measurement by Tape Test
ASTM D6677	Standard Practice for Scribe Adhesion
ASTM D5402	Standard Practice for Assessing the Solvent Resistance of Organic Coatings Using Solvent Rubs

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Section 1: General

Pipelines have been internally coated for many years for many reasons including flow enhancement/hydraulic efficiency, product purity, corrosion protection, etc. The internal coatings applied to pipelines for corrosion protection provide a physical (protective) barrier between the steel and the corrosive commodity being transported and are considered an effective corrosion control measure. Plant-applied internal coatings are commonly applied to individual pipe joints, with welded field joints coated/protected separately by different processes, including sleeves, couplings, mechanical interference connections, and robotically controlled blasting/coating equipment. In-situ pipeline coating, also known as the “pig batch method,” is a procedure used for coating existing pipelines or for new pipelines, post-construction that require a continuous and consistent coating.

This report presents general practices and preferences regarding the cleaning, surface preparation, drying, and the application of a protective coating in a steel pipeline by the pig (scraper) batching method. It is applicable to onshore or offshore steel pipelines in all industries including the oil and gas gathering, distribution, and transmission industries, as well as water handling systems.

Included are methods for mechanical and chemical cleaning, surface preparation, solvent drying, coating selection and application, quality control, applicator qualification, final acceptance criteria, and recommended coated pipeline operation.

The in-situ process for internal cleaning and coating of steel pipelines is a complex procedure that requires a specialized and experienced applicator.¹⁻² Only coating materials formulated for or having physical properties suitable for in-situ application are utilized. The applicator and coating material are selected by the owner based on fitness for purpose.

In-situ pipeline coating selection and procedures are determined by specific criteria relating to the project to be executed. Since no two pipelines are identical (size, length, location, terrain, service), this report provides guidelines to help the applicator develop specific hydraulic and pneumatic procedures and controls based on individual pipeline parameters. To ensure proper cleaning and coating application, all pig batches are run at predetermined, stable velocities. In special cases, abrasive cleaning may be considered, but this is quite limited.

The coating inspector or company representative has access at all times to the work performed, in accordance with the company specifications, and will have the right to inspect such work and all materials furnished by the applicator.

For pipeline cleaning, surface preparation, and coating applications the applicator has to use personnel, equipment, and procedures that have been pre-qualified for the specific coating being used. Pipeline owners/operators are responsible for specifying applicable safety, health, and environmental practices to ensure compliance with all applicable regulations.

Section 2: Summary of the In-situ Coating Methodology

The in-situ process for internally coating pipelines involves cleaning the line with a combination of chemical and mechanical means to remove all residual product, solids, by-products, corrosion products, moisture, and any other species to produce a clean, dry internal steel surface. Once this clean surface has been attained, liquid coatings are applied using a pig train which consists of a slug of coating between two polyurethane pigs. The pig train moves from the pig launcher to the receiver and deposits a coating film, which is dried by flowing dry air. Multiple pig trains are used in consecutive pig runs to build the coating to the specified final dry film thickness (DFT), and dry air is run until the coating has reached its final cure.

An example decision tree-type cleaning process is shown in Figure 1, while the coating process is shown in Figure 2. These figures are for illustrative purposes only and represent a typical operation - they are not intended to be the industry standard since each pipeline will likely require its own specific procedure tailored to the properties and condition of the existing pipeline.