



Engineering Standard

SAES-H-200

7 February 2017

Storage, Handling, and Installation of Externally Coated Pipe

Document Responsibility: Paints and Coatings Standards Committee

Contents

1	Scope	2
2	Conflicts and Deviations	2
3	References	2
4	Definitions	3
5	Storage, Handling, and Transportation	3
6	Installation	6
7	Inspection and Quality Assurance	8
	Revision Summary	9

1 Scope

This standard covers the minimum mandatory requirements governing the storage, handling, and installation of line pipe and piping that have been externally coated with Fusion Bonded Epoxy (FBE) or liquid epoxy coatings.

2 Conflicts and Deviations

- 2.1 Any conflicts between this standard and other applicable Saudi Aramco Engineering Standards (SAESs), Materials System Specifications (SAMSSs), Standard Drawings (SASDs), or industry standards, codes, and forms shall be resolved in writing by the Company or Buyer Representative through the Manager, Consulting Services Department of Saudi Aramco, Dhahran.
- 2.2 Direct all requests to deviate from this standard in writing to the Company or Buyer Representative, who shall follow internal company procedure [SAEP-302](#) and forward such requests to the Manager, Consulting Services Department of Saudi Aramco, Dhahran.

3 References

All referenced Specifications, Standards, Codes, Forms, Drawings, and similar material shall be of the latest issue (including all revisions, addenda, and supplements) unless stated otherwise.

3.1 Saudi Aramco References

Saudi Aramco Engineering Procedure

[SAEP-302](#)

Instructions for Obtaining a Waiver of a Mandatory Saudi Aramco Engineering Requirement

Saudi Aramco Engineering Standards

[SAES-H-002](#)

Internal and External Coatings for Steel Pipelines and Piping

[SAES-H-201](#)

Over the Ditch External and Internal FBE Coating for Field Girth Welds

[SAES-L-350](#)

Construction Requirements for Plant Piping

[SAES-L-450](#)

Construction Requirements for On-land and Nearshore Pipelines

Saudi Aramco Materials System Specifications

[09-SAMSS-089](#)*Shop-Applied External Fusion Bonded Epoxy Coating for Steel Line Pipes*[09-SAMSS-113](#)*The Requirements of External Liquid Coatings for Buried Pipelines and Piping (APCS-113A)*

3.2 Industry Codes and Standards

American Society for Testing and Materials

*ASTM D6677**Standard Test Method for Evaluating Adhesion by Knife*

ISO Standard

*ISO 8501-1**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***4 Definitions****APCS:** Approved Protective Coating System**Coating Defect:** Any defect such as film discontinuity, pinholes, cracks, and any other forms of defects that may cause permanent damage, premature failure and affect the service life of the coated pipe.**Cut-back:** The length of pipe left uncoated at each end for joining purposes.**Responsible Unit Supervisor (RUS):** The Engineering Consultant of Nonmetallic, CP & Coatings Group who is designated by the Manager, Consulting Services Department.**Visco-Elastic Coating:** Non-cured coating with Visco-elastic properties that can be applied in form of wrapping on the pipe body in accordance with APCS-113C.**5 Storage, Handling, and Transportation**

5.1 General Handling Requirements

5.1.1 The coated pipe shall be handled at all times in a manner that prevents damage to the pipe walls, beveled ends, and to the applied coatings (including internal coatings, if applied). End caps or any suitable end covers shall be used to prevent sand, water, and other contaminants in getting in contact with the internal coating of the pipes that can lead to corrosion during field storage. End seal tapes shall be used to keep the

end caps or end covers in place and to protect the cut-back from corrosion and surrounding contaminants.

5.1.2 All equipment, including field bending machines and pipe cradles, that contact the coated surface of the pipe shall be padded. Slings shall be nylon or equivalent; steel cables shall not be used.

5.1.3 Coated pipes shall not be rolled or dragged on the ground. Coated pipes shall be protected by wrapping polyethylene strings near the pipe ends.

5.1.4 Bevel protectors, when used, shall be firmly attached to the pipe.

5.1.5 For lifting operations, when a hook is used for handling large diameter pipes, the hook shall be of sufficient width and depth to fit inside the pipe and shall be padded or covered with rubber.

5.2 Stacking Requirements during Storage and Transportation

5.2.1 During storage the coated pipes shall be placed at least 150 mm off the ground on either rock-free sand berms covered with polyethylene sheeting or on padded skids spaced and leveled so that the pipes are supported without damaging the coating. All possible efforts shall be exerted to prevent direct contact of the coated pipes with the ground or ground moisture.

5.2.2 FBE and Liquid Epoxy-Coated Pipes

FBE and liquid epoxy-coated pipes shall not be stacked directly against each other at any time during storage or transportation. They shall be separated by full encirclement, non-compressible rubber padding or equivalent at least 10 mm thick.

5.2.2.1 Twelve meter (12 m) joints of pipe shall have at least 3 full encirclement separation pads. Two (2) shall be located 1 to 3 m from each end of the pipe and 1 in the middle.

5.2.2.2 Twenty four meter (24 m) double-jointed pipe lengths shall have at least 5 full encirclement separation pads placed so that 2 of them are 1 to 3 m from the outer ends of the pipe and 3 of them support the center section of the pipe. Placement of the pads should be approximately equidistant from each other.

5.2.2.3 Additional separation pads shall be used if required to keep the coated pipes from touching each other.

- 5.2.2.4 The separation pads shall be attached by some mechanical means that ensures these will stay in place.
- 5.2.2.5 The FBE and liquid epoxy coated pipes shall be protected from direct sunlight if to be stored in vendor's yard, in the field or project site for more than six (6) months in order to prevent UV degradation. This shall be done by covering the stacked coated pipes with tarpaulins or similar protection. The tarpaulins shall be maintained in good condition for as long as the pipes are exposed to direct sunlight. If coated pipes are stored outdoors without appropriate cover or protection for a year or more, the coated pipes shall be requalified. For FBE coated pipes, requalification shall be according to Table 3 of [09-SAMSS-089](#). Liquid epoxy-coated pipes shall be retested as per requirements of APCS-113A and [09-SAMSS-113](#).

5.2.3 General Transportation Requirements

- 5.2.3.1 When coated pipes are transported, the bottom tier of pipe shall be supported by padded cradles. The cradles shall either be sized (scalloped) for the specific diameter of pipe being transported or otherwise designed to ensure that the pipes do not move during transport. Side supports, if any, shall also be padded. The padding shall be replaced when it becomes worn to the point that shipping damage may result to the coating. New padding shall be at least 10 mm thick. Padding shall be made of rubber or any suitable materials for same purpose.
- 5.2.3.2 Non rigid systems for supporting the bottom tier of pipe, such as mattresses and chock blocks, shall not be used.
- 5.2.3.3 The minimum allowable distance between the bottom of the pipes in the bottom tier and the bed of the transporting vehicle shall be 100 mm.
- 5.2.3.4 If pipe saddles are used for square stacking, they shall be padded. The padding shall be at least 10 mm thick.
- 5.2.3.5 The stack of pipe shall be secured by a minimum of 3 straps made of a resilient material. No chains, trailer stakes, or other metal objects including the devices used to tighten the straps shall be permitted to come in contact with the pipe coating.
- 5.2.3.6 During transport, the coated pipes shall be protected from loose or flying objects that would damage the coating. Flat beds

shall have solid beds. Bogie trailers shall have mud flaps on the wheels and canvas or other effective protective cover between the bottom tier of pipe and the road.

- 5.2.3.7 The transporting vehicle, pipe support, and restraint systems shall be approved by Saudi Aramco Inspector. Loading, unloading, and/or transporting shall not be permitted if, in the Inspector's opinion, conditions exist that will result in damage to the pipe coating.

5.3 Stringing Requirements

Externally coated line pipe strung along the right-of-way shall be supported on rock-free sand, sand bags, rubber tires, or similar compressible material to prevent coating damage. (See also the general handling requirements in paragraph 5.1.)

6 Installation

6.1 Ditch Preparation

Ditch preparation shall be in accordance with [SAES-L-350](#) and [SAES-L-450](#).

6.2 Girth Weld Area Protection

- 6.2.1 Protective sleeves made from welding blankets or similar nonflammable material at least 0.5 m wide shall be wrapped snugly around the coated ends of the pipes adjacent to the girth weld area while field welding is taking place in order to prevent weld spatter from burning through the coating. The sleeves shall be held in place by straps or other mechanical means to ensure a snug fit all around the circumference of the pipe.

- 6.2.2 The completed girth weld area on FBE-coated pipes shall be externally coated in accordance with [SAES-H-201](#). Girth welds on pipe coated with FBE shall be coated with FBE, Visco-elastic coating as per APCS-113C, or suitable liquid coating systems. Girth welds on liquid epoxy coated pipes shall be protected in accordance with [SAES-H-002](#).

Note: Consult the RUS to determine the proper coating system for the girth weld area in relation with the line temperature limitations.

6.3 Repairs

- 6.3.1 Unless specified otherwise, the sound coating adjacent to the coating defect being repaired shall be roughened for a distance of at least 50 mm using at least the equivalent of 80 grit emery paper. Exposed bare steel pipe surfaces shall be cleaned to near white metal, Sa 2.5 as per ISO 8501-1.

6.3.2 Damaged FBE Coating shall be repaired as follows:

- 6.3.2.1 Areas smaller than 14.50 cm² - use a two-component epoxy repair coating approved by the RUS. For stand-alone high temperature FBE coating, use an appropriate epoxy coating system recommended by the FBE manufacturer and approved by the RUS.
- 6.3.2.2 Areas larger than 14.50 cm² and smaller than 0.2 m² - use a two-component epoxy repair coating recommended by FBE manufacturer and approved by the RUS.
- 6.3.2.3 Areas larger than 0.2 m² - use fast curing solvent free epoxy systems only as per APCS-113A or other coatings recommended by FBE manufacturer and approved by RUS.
- 6.3.2.4 The repair coating shall overlap the adjacent sound coating by at least 10 mm to maximum 20 mm. Coating application shall be according to the FBE manufacturer's recommendations.

6.3.3 Damaged Liquid Epoxy Coating shall be repaired according to the requirements of APCS-113A and above criteria of paragraph 6.3.2. However, same existing liquid epoxy coating material shall be used in the repair. Use of other manufacturer's approved liquid epoxy coating shall be subjected to suitability confirmation and approval by previous coating manufacturer in writing, and shall be reviewed and approved by RUS prior to repair application.

6.3.4 Where APCS-113A is specified for repair, APCS-113C can be substituted provided that the following requirements shall be met.

- The maximum operating/service temperature involved with the pipes shall not exceed the limit of APCS-113C.
- The adhesion of the parent FBE shall have a value of 8 or greater as per ASTM D6677.
- The Visco-elastic coating system shall under no circumstances be applied over FBE coatings with integrity concerns. In such cases, the existing FBE on the area to be repaired shall be totally removed and the Visco-elastic coating shall be applied directly on the properly prepared bare steel.
- The overlap of the Visco-elastic and outer wrap onto the parent FBE (and extent thereof) shall be in accordance with the APCS-113C requirements or manufacturer's recommendation.

- The outer wrap of the Visco-elastic coating system shall be applied in full circumference around the pipe regardless of coating defect size.

7 Inspection and Quality Assurance

The coated pipeline shall be 100% inspected with a pulse-type DC holiday detector employing an audible signaling device immediately prior to placing underground, i.e., after the last boom. The electrode used for locating holidays shall be in direct contact with the coating (with no visible gaps) and provide complete coverage of the whole coated surface. All holidays shall be repaired and the repairs shall all be checked with a holiday detector to verify that they are adequate. This final inspection procedure shall be monitored by a Saudi Aramco Inspector.

7.1 Holiday testing in the field shall be done at the following voltages:

- FBE: 1,500 to 2,000 $\pm$ 50 volts DC
- Liquid Epoxy: 2,400 $\pm$ 50 volts DC

The travel rate of the detector's electrode shall not exceed 300 mm/s nor shall it be allowed to remain stationary while the power is on.

Holiday testing of repair areas shall be done at the voltage specified for the main pipeline coating unless specified otherwise in the Scope of Work or other applicable, mandatory document.

Holiday testing of APCS-113A/C coatings shall be done at the voltages specified in [SAES-H-002](#), APCS-113A/C.

- 7.2 The calibration of the holiday detector shall be checked at least twice per 8-hour shift against a calibrated voltmeter and adjusted as necessary. The functional operation of the holiday detector may be checked in the field by making an artificial holiday in the coating not more than 1.6 mm diameter. If the detector is working properly, it will reliably signal the presence of the artificial holiday thus produced.
- 7.3 The holiday detector shall be grounded directly to the pipe being inspected. The ground connection shall be made by removing a small area of coating and attaching the ground directly to the bare pipe in such a manner that electrical arcing does not occur. (If the pipe itself is grounded, it is permissible to ground the holiday detector directly to the earth.)
- 7.4 Defective locations shall be clearly marked with a crayon immediately upon discovery. The Inspector shall certify that the defective areas have been repaired prior to placing underground.

- 7.5 The Inspector shall keep a daily record of the number of coating repairs per joint required prior to placing underground.
- 7.5.1 If the daily record indicates an average of more than 5 construction-related coating damage per 12 meter joint, the cause of this damage shall be determined and corrected by the Contractor in such a manner that the damage level falls to less than this rate within 5 days of being advised of the problem.
- 7.5.2 If the coating defect rate is higher adjacent to the field girth weld area than elsewhere along the pipe length, the Contractor shall improve the means used to protect the girth weld area coating during welding.

Revision Summary

- 24 October 2011 Editorial revision to remove the committee members list and change the primary contact. Revised the "Next Planned Update."
- 7 February 2017 Major revision to remove 3LPE and 3LPP in the scope and their corresponding requirements in this standard as 09-SAMSS-114 (3-LPP) and 09-SAMSS-090 (3-LPE) were already deleted. Limit the scope to externally applied FBE coatings and added the requirements for liquid epoxy coatings as per APCS-113A. Remove deleted standard SAES-H-204. Include [09-SAMSS-113](#), industry standard ASTM D6677, and international standard ISO-8501-1 which were found relevant.