

Engineering Standard

SAES-H-200

31 July 2004

Storage, Handling and Installation of Externally Coated Pipe

Paints and Coatings Standards Committee Members

Barouky, F.F., Chairman

Hammad, B.S., Vice Chairman

Al-Homayed, M.A.

Al-Khashram, M.S.

Al-Nujaim, S.A.

Al-Seba, Z.A.

Suller, A.A.

Saudi Aramco DeskTop Standards

Table of Contents

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

1 Scope

This standard covers the mandatory requirements governing the storage, handling and installation of line pipe and piping that have been externally coated with one of the following shop-applied coatings: fusion bonded epoxy (FBE), 3-layer polyethylene (3LPE), 3-layer polypropylene (3LPP), or Rayclad 120/B.

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.

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-204](#)

General Specification for Applying Heat-shrink Sleeves to Coated Pipe

[SAES-H-204V](#)

Approved Vendor Installation Procedures for Heat-Shrink Sleeves

[SAES-L-050](#)

Construction Requirements for Metallic Plant Piping

SAES-L-051

*Construction Requirements for Cross-Country
Pipelines*

4 Definitions

Responsible Standardization Agency (RSA): For purposes of this standard, RSA refers to the coatings engineer designated by the Manager, Consulting Services Department, as having the approval authority referred to in this standard.

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 coating (including internal coatings, if applied).

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.

Coated pipe shall not be rolled or dragged on the ground.

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

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.

5.2.2 FBE-Coated Pipes

FBE-coated pipes shall not be stacked directly against each other at any time during storage or transportation. They shall be separated by full encirclement, noncompressible 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 they will stay in place.

5.2.3 3LPE and 3LPP-coated Pipes

3LPE and 3LPP-coated pipes may be stacked directly against each other without the use of separation pads during storage and transportation.

The stacking height shall not exceed that which will cause deformation of the coating on the bottom layer by more than 20%. **Note:** This height is determined by the pipe coater.

The coated pipes shall be protected from direct sunlight in order to prevent UV degradation. This shall be done by either (a) covering the stacked pipes with tarpaulins or similar or (b) by applying a coat of white, acrylic-based paint over the PE or PP coating. Both the tarpaulins and the protective coating must be maintained in good condition for as long as the pipes are exposed to direct sunlight.

5.2.4 Rayclad 120/B

Pipes coated with Rayclad 120/B may be stacked directly against each other during storage. The stacking height shall not exceed that which will cause deformation of the coating on the bottom layer by more than 20%. **Note:** This height is determined by the pipe coater.

During transportation, each 12 m joint of pipe shall be separated by 3 full encirclement pads of 100 mm wide, 10 mm thick polyethylene or other soft padding material. Spacing and attachment requirements are the same as for FBE-coated pipe.

5.2.5 General Transportation Requirements

5.2.5.1 When coated pipes are transported, the bottom tier of pipe shall be supported by padded cradles. The cradles shall either be sized (scaloped) 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.

- 5.2.5.2 Non rigid systems for supporting the bottom tier of pipe, such as mattresses and chock blocks, shall not be used.
- 5.2.5.3 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.
- 5.2.5.4 If pipe saddles are used for square stacking, they shall be padded. The padding shall be at least 10 mm thick.
- 5.2.5.5 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.
- 5.2.5.6 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.
- 5.2.5.7 The transporting vehicle and the pipe support and restraint systems are subject to approval by the 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 Para. 5.1.)

6 Installation

6.1 Ditch Preparation

Ditch preparation shall be in accordance with SAES-L-050 and SAES-L-051.

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, 3LPE and 3LPP-coated pipes shall be externally coated in accordance with [SAES-H-002](#). Girth welds on pipe coated with Rayclad 120/B shall be coated with Raychem WPC 120, Canusa GTS-HT/ GTS-PP heat shrink sleeves, or Visco-elastic coating Stopaq (APCS-113C). **Note:** Consult the RSA 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 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 pipe surfaces shall be cleaned to near white metal, Sa2.5.
 - 6.3.2 Damaged FBE coating shall be repaired as follows:
 - 6.3.2.1 Areas smaller than 1450 mm² - use thermal melt sticks or an epoxy patching compound approved by the RSA. For stand-alone high temperature FBE coating, use an appropriate epoxy coating system recommended by the FBE powder manufacturer and approved by the RSA.
 - 6.3.2.2 Areas larger than 1450 mm² and smaller than 0.2 m² - use an epoxy patching compound approved by the RSA.
 - 6.3.2.3 Areas larger than 0.2 m² - use APCS-113A solvent free epoxy systems only.
 - 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 Manufacturer's recommendations. (See also Para. 7.1.5.1.)
 - 6.3.3 Damaged PE coating shall be repaired as follows:
 - 6.3.3.1 Isolated holidays less than 150 mm in any direction - Use one of the appropriate heat shrink patches in [SAES-H-204V](#) and follow the installation procedure. An average of no more than
-

1 field patch per 12 meter joint shall be acceptable for any consecutive 100 meters. Damage in excess of this shall be sleeved in accordance with paragraph 6.3.3.2 or cut out in accordance with paragraph 6.3.3.3. The patches shall overlap the adjacent, sound coating by at least 50 mm.

6.3.3.2 Holidays larger than 150 mm in any direction (including close spaced, individual holidays that cannot be covered by a single patch per paragraph 6.3.3.1) - Use one of the appropriate full encirclement heat shrink sleeves in [SAES-H-204V](#) and follow the installation procedure. The sleeve shall overlap the adjacent sound coating by at least 50 mm. Where more than one sleeve is required, the sleeves shall be overlapped by at least 50 mm. A total of no more than 3 meters shall be sleeved in the field in any consecutive 100 meters in mountain terrain or 1000 meters in other terrain. (See also Para. 7.1.5.1.). If sleeving in excess of 3 meters is required, see Para. 6.3.3.3.

6.3.3.3 Pipe with coating damage in excess of that covered in paragraphs 6.3.3.1 and 6.3.3.2 shall be cut out and replaced with new, mill-coated pipe.

6.3.4 Damaged PP coating shall be repaired as follows:

6.3.4.1 Damaged areas not exceeding 1450 mm² – Use melt sticks or a flame-spray powder system approved by the polypropylene manufacturer. An average of no more than 1 field repair per 12 meter joint shall be acceptable for any consecutive 100 meters. Damage in excess of this shall be repaired in accordance with paragraph 6.3.4.2 or cut out in accordance with paragraph 6.3.4.3. Consult with RSA to use APCS-113A Solvent free epoxy systems if applicable for the service conditions.

6.3.4.2 Damaged areas larger than 1450 mm² and smaller than 0.2 m² - Use a flame-spray powder system approved by the RSA. A total of no more than one such repair shall be allowed in the field in any consecutive 100 meters in mountain terrain or 1000 meters in other terrain. (See also Para. 7.1.5.1.)

6.3.4.3 Pipe with coating damage in excess of that covered in paragraphs 6.3.4.1 and 6.3.4.2 shall be cut out and replaced with new, mill-coated pipe.

6.3.5 Damaged Rayclad 120/B coating shall be repaired as follows:

- 6.3.5.1 Damaged areas not exceeding 64.5 cm² – Use Raychem PERP 120 heat shrink repair patches in accordance with the installation procedure in [SAES-H-204V](#), Section V. An average of no more than 1 field repair per 12 meter joint shall be acceptable for any consecutive 100 meters. Damage in excess of this shall be repaired in accordance with paragraph 6.3.5.2 or cut out in accordance with paragraph 6.3.5.3.
- 6.3.5.2 Damaged areas exceeding 64.5 cm² but not greater than 0.2 m² – Use either Raychem WPC 120 or Canusa GTS-PP heat shrink sleeves in accordance with the installation procedures in [SAES-H-204V](#), Sections III or X respectively. The sleeves shall overlap the adjacent sound coating by at least 50 mm. Where more than one sleeve is required, the sleeves shall be overlapped by at least 50 mm. A total of no more than one such repair shall be allowed in the field in any consecutive 100 meters in mountain terrain or 1000 meters in other terrain. (See also Para. 7.1.5.1.)
- 6.3.5.3 Pipe with coating damage in excess of that covered in paragraphs 6.3.5.1 and 6.3.5.2 shall be cut out and replaced with new, mill-coated pipe.

Fittings and appurtenances shall be coated in accordance with [SAES-H-002](#).

3LPE and 3LPP coatings that will be permanently exposed to direct sunlight (such as, at above/below ground transitions) shall be covered with adhesive outerwrap, aluminum sheathing, or other similar material approved by the RSA to prevent UV degradation.

Coated pipe that is stacked or strung along the right-of-way shall be protected from damage by loose rocks, etc. due to vehicle traffic.

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 burial, 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 2400 ± 50 volts DC
- PE and PP 25,000 ± 1000 volts DC
- Rayclad 120/B 15,000 ± 1000 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 heat shrink sleeves on field girth welds or in 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. (See [SAES-H-204](#).)

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 burial.
- 7.5 The Inspector shall keep a daily record of the number of coating repairs per joint required prior to burial.
- 7.5.1 If the daily record indicates an average of more than 5 construction-related holidays per 12 meter joint for FBE and more than 1 holiday per 12 meter joint for 3LPE, 3LPP, or Rayclad 120/B coated pipe, 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

31 July, 2004 Revised the "Next Planned Update". Reaffirmed the contents of the document and reissued with editorial changes