

# Materials System Specification

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09-SAMSS-036

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Thermal Insulating Coatings (APCS-5A/B)  
(First Draft)

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## Saudi Aramco DeskTop Standards

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# 1 Scope

This Specification establishes the requirements for qualifying individual coating products for use in Saudi Aramco's Approved Protective Coating system APCS-5A & APCS-5B.

APCS-5A is an external heat radiant insulating coating system up to 350 F (177 C). It is used to reduce the solar heat transfer into storage tanks, vessels and piping or other equipment. It can reduce the stored hydrocarbon temperature and the cooling water system. It can be used as an external coating for petroleum tanks to reduce the stock temperature, save inventory and minimize the hydrocarbon evaporation and air pollution.

APCS-5B is hot thermal insulating coating system for carbon steel and stainless steel service operating up to 500 F (260 C). It is an alternative system to the conventional bulk insulations for energy conservation in hot services. It can be applied for personal protection on hot piping, valves, tanks, vessels, column and heat transfer equipment

These coatings system shall be used when any of the following situations occur:

## 1.1 Initial Product Approval

This specification shall be given to coating manufacturers, or other vendors of coating products, that wish to obtain initial approval for products that have not previously been qualified for use by Saudi Aramco.

## 1.2 Purchase Requisitions/Purchase Orders

This specification shall be attached to Purchase Requisitions or Purchase Orders when those documents address the procurement of coating products that have not been previously qualified for use by Saudi Aramco.

This specification does not apply and should not be included with Purchase orders or requisitions for coating products that have been previously qualified per this specification. This specification should also not be included with purchase orders or requisitions for coated items or equipment when a Saudi Aramco approved protective coating system has been specified.

## 1.3 Periodic Product Compliance Checks

This specification may be used for periodic product compliance checks on previously approved coatings. It shall be given to the organization conducting the compliance tests.

# 2 Conflicts and Deviations

2.1 Any conflicts between this specification and other applicable Saudi Aramco Materials System Specifications (SAMSSs), Engineering Standards (SAESs), 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 specification 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

The selection of material and equipment, design, construction, maintenance, and repair of equipment and facilities covered by this specification shall comply with the latest edition of the references listed below, unless otherwise noted.

- a) The date of the Purchase Order.  
b) The date testing is begun when there is no Purchase order.

#### 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 Standard

[SAES-H-101](#)

*Approved Protective Coating Systems,*

APCS-5A

External Heat Radiant Insulating Coating System

APCS-5B

Hot Insulating Coating System for carbon steel and stainless steel service operating up to 500 F (260 C)

SAES-N-001

Basic Criteria, Industrial Insulation

Saudi Aramco Materials System Specification

[09-SAMSS-060](#)

*Packaging Requirements for Coatings*

#### 3.2 Industry Codes and Standards

American Society for Testing and Materials

ASTM A36

*Carbon Structural Steel*

ASTM B117

*Operating Salt Spray (Fog) Apparatus*

<i>ASTM D610</i>	<i>Evaluating Degree of Rusting on Painted Steel Surfaces (Primers)</i>
<i>ASTM D660</i>	<i>Evaluating Degree of Checking of Exterior Paints</i>
<i>ASTM D661</i>	<i>Evaluating Degree of Cracking of Exterior Paints</i>
<i>ASTM D714</i>	<i>Evaluating Degree of Blistering of Paints</i>
<i>ASTM D1654</i>	<i>Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments</i>
<i>ASTM D-3393</i>	
<i>ASTM D4541</i>	<i>Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion</i>
<i>ASTM-E903</i>	<i>Solar Reflectance</i>
<i>ASTM-E408</i>	<i>Emittance Value</i>
<i>ASTM-C-177</i>	<i>Thermal Conductivity</i>
<i>ASTM D1849</i>	<i>Package Stability of Paint</i>

The Society for Protective Coatings

*SP6*                      *Commercial Blast Cleaning*

*SP5*

*PA2*                      *Measurement of Dry Paint Thickness with Magnetic Gages*

*Vis 1*                      *Pictorial Surface Preparation Standards for Painting Steel Structures*

## 4 General Requirements

4.1 For purposes of this specification the Buyer's Representative shall be the Responsible Standardization Agency (RSA).

- 4.2 In order to qualify a coating system as acceptable under this specification, the coating supplier shall submit a certified test report documenting that the proposed coating system meets the qualification tests and requirements of this SAMSS. Preparation and testing shall be performed and/or witnessed by an independent laboratory or inspection agency. This report shall be submitted to the Saudi Aramco RSA for review. The RSA shall decide if the data presented by the Supplier satisfies all the requirements.
- 4.3 All initial product qualification tests shall be carried out at no cost to Saudi Aramco.

## 5 Qualification Tests and Requirements

### 5.1 Steel Panel Preparation

- 5.1.1 Test panels shall be ASTM A36 hot rolled Steel approximately 100 mm X 150 mm. Prior to preparing the surface, the condition of the test panel shall be equivalent to SSPC-Guide to Vis 1 Rust Grade A, Adherent Mill Scale. The minimum thickness of the test panel shall be 5 mm.
- 5.1.2 The test panels shall be abrasive blast cleaned to the required degree of cleaning in NACE/SSPC or ISO standard depending on the selected primers:
- Commercial Blast if the primer is based on moisture cured aluminum urethane
  - Near-White Metal Cleaning if the primer is polyamide epoxy operating up to 150C
  - White Metal cleaning if the primer is inorganic zinc for surface operating more than 150 C.

### 5.2 Coating Application

#### APCS-5A:

- 5.2.1 The primer shall be applied over the surface prepared steel panels in 5.1. The primer can be based on polyamide epoxy; moisture cured metallic filled urethane or inorganic zinc. The thickness of primer shall be applied in accordance to the coating data sheet.
- 5.2.2 After allowing the primer to cure for the minimum amount of time recommended by the coating data sheet, apply two-coats of the heat radiant coating at dry film thickness of 12-20 mils. The curing shall be strict in accordance with the data

sheet of manufacturers. Dry film thickness shall be measured in accordance with SSPC-PA2.

- 5.2.3 An approved clear coat based on acrylic shall be applied with dry film thickness of 2 mils (50 micron) to provide gloss and anti-contaminates.

#### APCS-5B

- 5.2.4 Apply approved polyamide epoxy primer in APCS-1B if the surface is less than 150C or apply inorganic zinc primer or high heat primer for surface temperature more than 150 C. The dry film thickness shall as per the coating data sheet.
- 5.2.5 After allowing the primer to cure for the minimum amount of time recommended by the data sheet, apply the hot insulating coating at 500 microns (20 mils) of dry film thickness.

### **5.3 Physical Properties**

Drying time:

Curing time:

Elongation:

Abrasion:

Impact:

### **5.4 Performance Tests**

#### APCS-5A

Coated carbon steel samples shall be tested third party lab and shows:

1-Solar Reflectance shall not be less than 80% as per ASTM-903. The coating shall be able to reflect more than 80% of solar waves (3% UV, 40 visible light, 57% infrared and far infrared)

2-Emittance Value shall not be less than 90% as per ASTM-408.

3- Flame Spread of 5 as per ASTM-E-84

4- Cross Hatch Adhesion per shall be 100% 5B per ASTM-3359

5-The coating shall pass 1500 hour of Salt fog test ASTM B-117 without any rusting, blistering and cracking.

6- Temperature resistance to 350 F (177 C)

## APCS-5B

Coated carbon steel samples shall be tested third party lab and shows:

- 1-Solar Reflectance shall not be less than 80% as per ASTM-903. The coating shall be able to reflect more than 80% of solar waves (3% UV, 40 visible light, 57% infrared and far infrared)
- 2- Emittance Value shall not be less than 90% as per ASTM-408.
- 3- Cross Hatch Adhesion shall be 100% 5B as per ASTM-B-3359
- 4- Its thermal resistance R when applied at 500 microns (20 mills) dry film thickness shall be equivalent to R-20 of Styrofoam as tested per ASTM-C-177.
- 5-The coating shall pass 1500 hour of Salt fog test ASTM B-117 without any rusting, blistering and cracking
- 6-The coating shall be formulated in water base in acrylic resins with more than two different types of the insulating ceramic spheres.
- 7-The chloride shall be less than 25 ppm and the total halogen shall not be more than 8800 ppm if it is being applied on stainless steel substrate.
- 8-For personnel protection and catching heat inside, APCS-5B must be tested and proved that each 1 mm dry-film coating thickness be able to reduce the temperature of surface by 40F.
- 9-Flame Spread of 5 as per ASTM-E-84
- 10- Temperature resistance to 500 F (260C)

## 6 Packaging Requirements

Coatings shall be packaged in accordance with [09-SAMSS-060](#).