

Engineering Standard

SAES-H-002V

31 July 2004

Approved Saudi Aramco Data Sheets
for the Pipeline Maintenance External Coatings

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Saudi Aramco DeskTop Standards

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Previous Issue: 30 September 2001 Next Planned Update: 1 August 2007

Revised paragraphs are indicated in the right margin

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1 Kansai - Approved Materials

APCS-113B

Kansai Barrier SA

100% Solids Epoxy

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Manufacturer - Approved Saudi Aramco Data Sheet

APCS-113B

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Type of Coating : High Solids Epoxy (Putty)
Manufacturer : Kansai Paint Col. Ltd.
Product Name : Kansai Barrier SA
SAMS S/N : 09-697-835

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1. Storage

1.1 Shelf life, sheltered storage at 35°C maximum : 2 years

2. Mixing

2.1 No. of Components : 2
2.2 Mixing Ratio : 2.35 to 1.00 by volume
2.3 Thinner : Do not thin
SAMS S/N :
2.4 Thinning Requirements : N/A
2.5 Induction Time : Nil
2.6 Pot Life : 2 hours at 25°C
0.7 hour at 40°C
0.4hour at 50°C

3. Application

3.1 Maximum Allowable Substrate Temperature : 100°C
3.2 Typical Wet Film Thickness Per Coat : 1000-7000 micrometers
3.3 Typical Dry Film Thickness Per Coat : 1000-7000 micrometers
3.4 Theoretical Coverage at 25 Micrometers : 1.44 kg/m²/1000 micrometers
3.5 Minimum Number of Coats : 1

Manufacturer - Approved Saudi Aramco Data Sheet

APCS-113B - Kansai Barrier SA (Cont'd)

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3.6 Drying Time

Substrate Temperature	To Handle	Recoat Interval		To Immersion	
		Minimum	Maximum	Water	Buried
10°C	5 Hours	24 Hours	7 Days	Immediately	24 Hours
30°C	5 Hours	24 Hours	7 Days	Immediately	24 Hours
50°C	1 Hour	6 Hours	5 Days	Immediately	5 Hours

3.7 Recommended Equipment

Airless Spray:

Hi-Vis Coater/Graco Monarch

Roller or Brush:

Application: sponge type made of synthetic fiber resistant to solvent.

Smoothing: short synthetic fibers resistant to solvent. Wet sponge with solvent, this is intended to ensure a smooth surface and eliminate holidays. If temperature is greater than 70°C, use brush slightly wet with solvent.

4. Technical Properties

4.1	Volume Solids (ASTM D2697)	:	100%
4.2	Product Weight (ASTM D1475)	:	
4.3	Viscosity (ASTM D562)	:	N/A
4.4	Flash Point (ASTM D93 or D56)	:	N/A

Approval Date: September 3, 1997
Replaces: April 25, 1987

2 Hempel's - Approved Materials

APCS-113A	Nap-Gard 7-0055 or Hempadur 8553	High Volume Solids Epoxy	
---- do ----	Hempadur 87540	Very High volume Solids Epoxy	

Manufacturer - Approved Saudi Aramco Data Sheet

APCS-113A

Type of Coating : High Volume Solids Epoxy
Manufacturer : Hempel's Marine Paints Saudi Arabia Ltd.
Product Name : Nap-Gard 7-0055 or Hempadur 8553
SAMS S/N : 09-697-831 20-L kit
 : 09-697-833 0.5-L kit
 : 09-697-837 5-L kit
 : 09-697-839 10-L kit

1. Storage

1.1 Shelf life, sheltered storage at 35°C maximum : 2 years

2. Mixing

2.1 No. of Components : 2
2.2 Mixing Ratio : 4 to 1 by volume
2.3 Thinner : Hempel's 0845
2.4 Thinning Requirements : 5% maximum
2.5 Induction Time : Nil
2.6 Pot Life : 3 hours at 25°C
 : 1 hour at 40°C

3. Application

3.1 Maximum Allowable Substrate Temperature : 90°C
3.2 Typical Wet Film Thickness Per Coat : 625 microns
3.3 Typical Dry Film Thickness Per Coat : 500 microns
3.4 Theoretical Coverage at 25 Micrometers : 32 M²/L
3.5 Minimum Number of Coats (Spray Application) : 1

Manufacturer - Approved Saudi Aramco Data Sheet
APCS-113A - Nap-Gard 7-0055 or Hempadur 8553 (Cont'd)

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3.6 Drying Time

Substrate Temperature	To Handle	Recoat Interval		To Immersion	
		Minimum	Maximum	Water	Buried
10°C	24 Hours	24 Hours	21 Days	3 Days	1.5 Days
30°C	12 Hours	12 Hours	7 Days	18 Hours	14 Hours
50°C	3 Hours	3 Hours	5 Days	6 Hours	4 Hours

3.7 Recommended Equipment

Airless Spray	:	Tip Size: 0.021 to 0.023 inch Fluid Pressure: 2,900 psi
Conventional Spray	:	Tip Needle: 0.070; Air Cap; High Volume.
Roller	:	Use synthetic ½ inch NAP or greater.
Brush	:	May be applied by brush; however, additional coats will be required to obtain dry film thickness.

4. Technical Properties

4.1	Volume Solids (ASTM D2697)	:	78 to 82%
4.2	Product Weight (ASTM D1475)	:	1.67 to 1.73 Kg/L
4.3	Viscosity (ASTM D562)	:	80 to 90 KU
4.4	Flash Point (ASTM D93 or D56)	:	29°C

Note: When marketed from the United States, the product is designated Nap-Gard 7-0055.
When locally manufactured, the product is called Hempadur 8553.

Approval Date: September 3, 1997
Replaces: August 23, 1995

Manufacturer - Approved Saudi Aramco Data Sheet

APCS-113A

Type of Coating : 100% Solids Epoxy
Manufacturer : Hempel's Marine Paints Saudi Arabia Ltd.
Product Name : Hempadur 87540
SAMS S/N : 09-000-497

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1. Storage

1.1 Shelf life, sheltered storage at 35°C maximum : 2 years

2. Mixing

- 2.1 No. of Components : 2
2.2 Mixing Ratio : 2 to 1 by volume
2.3 Thinner : N/A
2.4 Thinning Requirements : N/A
2.5 Induction Time : N/A
2.6 Pot Life : N/A, for plural component

3. Application

- 3.1 Maximum Allowable Substrate Temperature : 90°C
3.2 Typical Wet Film Thickness Per Coat : 500 to 625 microns
3.3 Typical Dry Film Thickness Per Coat : 500 to 625 microns
3.4 Theoretical Coverage at 25 Micrometers : 40 M²/L
3.5 Minimum Number of Coats (Spray Application) : 1

Manufacturer - Approved Saudi Aramco Data Sheet

APCS-113A - Hempadur 87540 (Cont'd)

3.6 Drying Time

Substrate Temperature	To Handle	Recoat Interval		To Immersion	
		Minimum	Maximum	Water	Buried
10°C	4 Hours	8 Hours	3 Days	6 Days	3 Days
30°C	1 Hour	3 Hours	2 Days	2 Days	1 Day
50°C	20 Minutes	2 Hours	2 Days	8 Hours	4 Hours
60°C	10 Minutes	1 Hour	2 Days	4 Hour	2 Hours

3.7 Recommended Equipment

Airless Spray

: Tip Size 0.025 inch
Fluid Pressure 2,500 psi

4. Technical Properties

4.1	Volume Solids	(ASTM D2697)	:	100%
4.2	Product Weight	(ASTM D1475)	:	1.8 Kg/L
4.3	Viscosity	(ASTM D562)	:	
4.4	Flash Point	(ASTM D93 or D56)	:	121°C

Approval Date: September 30, 1997
Replaces: New

3 International Paint - Approved Materials

APCS-113A

Interzone 485

99% Solids Epoxy

Manufacturer - Approved Saudi Aramco Data Sheet

APCS-113A

Type of Coating	:	Ultra High Volume Solids Epoxy	
Manufacturer	:	International Paint Saudi Arabia Ltd.	
Product Name	:	Interzone 485	
SAMS S/N	:	09-000-497	

1.	Storage			
1.1	Shelf life, sheltered storage at 35°C maximum	:	12 months	
2.	Mixing			
2.1	No. of Components	:	2	
2.2	Mixing Ratio	:	4 PARTS EAA485: 1 PART EAA486	
2.3	Thinner	:	GTA203	
	SAMS S/N	:	09-000-498	
2.4	Thinning Requirements	:	UPTO 3% max	
2.5	Induction Time	:	N/A	
2.6	Pot Life	:	45 minutes at 25°C 30 minutes at 40°C	
3.	Application			
3.1	Maximum Allowable Substrate Temperature	:	100°C	
3.2	Typical Wet Film Thickness Per Coat	:	600 - 1000 micrometers	
3.3	Typical Dry Film Thickness Per Coat	:	600 - 1000 micrometers	
3.4	Theoretical Coverage at 25 Micrometers Dry Film Thickness	:	39.6 M ² /L	
3.5	Minimum Number of Coats	:	1	

Manufacturer - Approved Saudi Aramco Data Sheet

APCS-113A – Interzone 485 (Cont'd)

3.6 Drying Time

Substrate Temperature	To Handle	Recoat Interval		Water	Burial Dry Soil
		Minimum	Maximum*		
10°C	72 Hours	72 Hours	21 Days	2 days	2 days
25°C	24 Hours	24 Hours	10 Days	1 day	1 day
40°C	12 Hours	12 Hours	7 Days	1 day	1 day

* Before overcoating after exposure in a contaminated environment, clean thoroughly by high pressure fresh water hosing and allow to dry.

3.7 Recommended Equipment

Airless spray	:	0.030 in. tip; Remove all filters 45:1 ratio pump preferred 4,000 psi
Conventional spray	:	Not recommended
Brush and Roller	:	Not recommended

4. Technical Properties

4.1	Volume Solids	(ASTM D2697)	:	99%
4.2	Product Weight	(ASTM D1475)	:	1.10 Kg/L
4.3	Viscosity	(ASTM D562)	:	40-50 poise (BRT)
4.4	Flash Point	(ASTM D93 or D56)	:	63°C (base)

Approval Date: March 31, 2004
 Replaces: New

4 Sigma's - Approved Materials

APCS-113A	Sigmarite EPH 7497	100% Solids Epoxy
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Manufacturer - Approved Saudi Aramco Data Sheet

APCS-113A - Sigmarite EPH 7497 (Cont'd)

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3.6 Drying Time

Substrate Temperature	To Handle	Recoat Interval		To Immersion	
		Minimum	Maximum	Water	Buried
10°C	30 Hours	1-½ Days	90 Days	1 Day	1 Day
30°C	10 Hours	16 Hours	30 Days	12 Hours	7 Hours
50°C	4 Hours	4 Hours	10 Days	6 Hours	4 Hours

3.7 Recommended Equipment

Airless Spray	:	Tip Size: 0.021 inch Fluid Pressure: 3,000 psi
Conventional Spray	:	N/A
Brush	:	Suitable for touch-up, repairs, and stripe coating

4. Technical Properties

4.1 Volume Solids (ASTM D2697)	:	100%
4.2 Product Weight (ASTM D1475)	:	1.28 to 1.32 Kg/L
4.3 Viscosity (ASTM D562)	:	35 to 40 poise **
4.4 Flash Point (ASTM D93 or D56)	:	65°C

** - Conversion to KU not available.

Approval Date: October 23, 1998
Replaces: New

5 Sipco - Approved Materials

APCS-113A Solvent free Amine Cured Epoxy Coating 100% Solids Epoxy

Manufacturer - Approved Saudi Aramco Data Sheet

APCS-113A

Type of Coating : Solvent free Amine Cured Epoxy Coating
Manufacturer : Saudi Industrial Paint Co. (SIPCO)
Product Name : SIPOXY SHIELD 656
SAMS S/N : 09-000-497

1. Storage

1.1 Shelf life, sheltered storage @ 35°C maximum : 1 year

2. Mixing

2.1 No. of Components : 2
2.2 Mixing Ratio : 2.5 Base: 1 hard. by volume
2.3 Thinner : N/A*
* for cleaning equipment use Thinner 741/Thinner 780
SAMS S/N :
2.4 Thinning Requirements : N/A
2.5 Induction Time : N/A
2.6 Pot Life (mixture) : 65 min @ 25°C
40 min @ 40°C
5 min @ 60°C
N/A for Plural component

3. Application

3.1 Maximum Allowable Substrate Temperature : 90°C
3.2 Typical Wet Film Thickness Per Coat : 600-1000 microns
3.3 Typical Dry Film Thickness Per Coat : 600-1000 microns
3.4 Theoretical Coverage @ 25 Micrometers : 40 M²/L
Dry Film Thickness
3.5 Minimum Number of Coats (spray application) : 1

Manufacturer - Approved Saudi Aramco Data Sheet

APCS-113A - SIPOXYSHIELD 656 (Cont'd)

3.6 Drying Time

Substrate Temperature	To Handle	Recoat Interval		To Immersion	
		<i>Minimum</i>	<i>Maximum</i>	<i>Water</i>	<i>Buried</i>
10°C	36 Hours	36 Hours	30 Days	84 Hours	60 Hours
30°C	10 Hours	10 Hours	9 Days	36 Hours	24 Hours
50°C	3 Hours	3 Hours	5 Days	8 Hours	5 Hours
60°C	90 Minutes	90 Minutes	3 Days	4.5 Hour	3 Hour

3.7 Recommended Equipment

- Airless Spray(min 60:1 pump) : Tip size: 0.021 to 0.029 inch
Nozzle Pressure:
3,200-4,100 psi
- Twin Feed Application with inline heater : for details contact SIPCO TSD
- Conventional Spray : Not recommended
- Brush/Roller : For touch-up only

4. Technical Properties

- 4.1 Volume Solids (ASTM D2697) : 100 %
- 4.2 Product Weight (ASTM D1475) : 1.35 Kg/L
- 4.3 Viscosity (ASTM D562) :
- 4.4 Flash Point (ASTM D93 or D56) : 121°C

Approval Date: May 31, 2004
 Replaces New

Manufacturer - Approved Saudi Aramco Data Sheet

APCS-113C

Type of Coating	:	Visco-Elastic Coating System
Manufacturer	:	STOPAQ
Product Name	:	STOPAQ
SAMS S/N	:	09-000-444 (CZH Paste); 09-000-436/438/442 (Wrapping-band CZH), 09-000-439/440 (Outer Wrap); and 09-000-441 (Fiber CZ)

Application Procedure

1. Scope

- 1.1 This specification covers the surface preparation and application/installation procedure for the STOPAQ[®] coating system on pipelines and piping, that are buried below ground.
- 1.2 The STOPAQ[®] system consists of the following:
 - a) Wrapping-band CZ H.
 - b) Polyvinyl Chloride (PVC) or PP Outer Wrap.

2. Condition of Steel Pipe Prior to Surface Preparation

- 2.1 Remove all weld spatters and slag.
- 2.2 Remove loose coating and/or heavy layers of rust.
- 2.3 Moisture condensation on the steel substrate is not allowed.

3. Surface Preparation Requirements

- 3.1 Blast cleaning is recommended if the pipe length is more than one meter. Surface profile is not critical but if blast cleaning is employed, commercial blasting to achieve a profile Sa-2 is acceptable.
 - 3.2 The type and particle size of the abrasive material are not critical. Recycled abrasive can be used.
 - 3.3 For a pipe length of less than one meter, tool cleaning (wire brushing) according to SSPC SP 2 is acceptable.
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- 3.4 Any sharp metal protrusions exceeding 0.8 mm in height should be ground to prevent the possibility of the polyethylene layer being torn.

4. **Application of the STOPAQ® System**

- 4.1 The steel pipe temperature should not exceed 70°C during the application.
 - 4.2 The steel pipe should not be wet or moist during the application. If it is wet, the pipe should be dried with a dry rag.
 - 4.3 It is acceptable to apply the STOPAQ® system over an existing coating that is bonded strongly to the steel pipe.
 - 4.4 Before starting the wrapping of the wrapping-band CZ H, the following items should be ensured.
 - a) Allow proper accessibility to the pipeline from all directions for free movement of labor during the application.
 - b) In "Subkha" areas, the bell hole should be drained properly and continuously for a dry working condition during the application.
 - c) Use the adhesive version of the wrapping-band CZ H in areas of significant transition in the pipeline such as the welds on metal sleeves. This adhesive version is used to enable a gradual transition from the higher edge of the metal sleeve to the original pipe body.
 - d) Apply the wrapping-band CZ H over the Adhesive CZ H within three (3) hours after the adhesive application.
 - 4.5 The Wrapping-band shall be applied onto the steel pipe without tension.
 - a) The first wraparound of the wrapping-band is done without advancing the roll. One complete circumferential wrapping around the pipe is made before starting the next wrapping.
 - b) After the first wraparound is finished, successive wraps should be performed with a minimum overlap of 10 mm or larger regardless of the width of the roll.
 - c) When a roll of the wrapping-band is finished, the next roll should be used starting at a distance of at least 100 mm before the end of the finished roll.
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- d) After the pipe is completely wrapped, another circumferential wrap is done at the pipe end. This acts as a "seal" to ensure that the end of the wrapping-band will not be removed.
- e) Any areas of blisters or slackening of the wrapping-band shall be pressed or "massaged" by hand to improve the wrapping.

4.6 The outer wrap over the wrapping-band shall be applied with tension.

- a) The wrapping of the outer wrap shall start 10 mm from the start of the wrapping of the wrapping-band. This will enable a 10 mm of the wrapping-band to remain exposed.
- b) The first wrap of the outer wrap over the wrapping-band CZ H is done without advancing the roll.
- c) Subsequent wraps with 50% longitudinal overlap should be maintained regardless of the width of the roll.
- d) If a roll of outer wrap is finished, the succeeding roll should be initiated at a distance of at least 25 cm before the end of the finished outer wrap roll.
- e) When the entire length of visco-elastic coated pipe has been over-wrapped with an outer wrap, a final wrapping similar to the first wrap as in (4.6.b, c, and d) must be repeated.
- f) Any areas showing blisters or irregularities as a result of entrapped air should be removed with by using roller. The rolling action should be done longitudinally along the pipe, starting from the blister toward the edge of the outer wrap.
- g) Backfilling can be performed immediately after the applied coating system has been checked, inspected, and approved by the inspector.

5 Patch Repair

5.1 Patch repair is done when the coating is removed to visually inspect the substrate or mechanically damaged. The patch repair procedure shall be as follows:

- a) Cut out the damaged area using a sharp blade cutter. Chamfer the surrounding coating.
 - b) Use new patch of wrapping band to cover the area where the coating is removed. Do not overlap the patch on the sound coating.
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Use several strips of the wrapping and if necessary to be applied next to each another (minimum 10 mm overlap with one another).

- c) Install the outer wrap over the Wrapping band patch.
- d) Make several wraparounds over the new patch of wrapping band until it is completely covered, and the outer wrap is at least 100 mm away from the edges of the Wrapping-band.

6. Testing Methods and Equipment

6.1 Holiday Detection

Holiday detection test is not normally recommended, but if required the following procedure is followed to determine inadequately coated areas.

- a) Use a high-voltage, "spark" holiday detector at a voltage ranging from 15,000 to 25,000 volts. Use a full-circle coiled spring electrode.
- b) Move the probing electrode over the pipe surface in one direction at a rate approximately 0.3 m/second. Mark defective areas.
- c) Marked areas should be repaired as per paragraph 5.

6.2 Dew Point

- a) Control of dew point is important to prevent moisture condensation on the steel pipe substrate during the application of this coating system.
- b) The substrate temperature shall be 5°F higher than the dew point. Do not apply the coating when the pipeline temperature is less than 5°F above the dew point.

6.3 Relative Humidity

Relative humidity shall not exceed 85% to ensure that no condensate is forming on the substrate during application.

6.4 Chloride Contamination

The performance of Visco-Elastic coating is not affected with the presence of chloride salts higher than the permissible (40 mg/cm²)
Water wash for decontamination is not required.

7. Materials Handling

Visco-Elastic coating system is a durable in a broad range of field storage conditions. For achieving best results, the product shall be stored as follows:

7.1 Long Term Storage

All Visco-Elastic coating system components shall be stored in a proper closed warehouse at storage temperature not exceed 30°C.

7.2 Short Term or On-Site Storage

All Visco-Elastic coating system components are not recommended to be stored directly under sunlight for more than eight (8) hours.

Revision Summary

31 July, 2004

Revised the "Next Planned Update" and reissued with editorial changes.