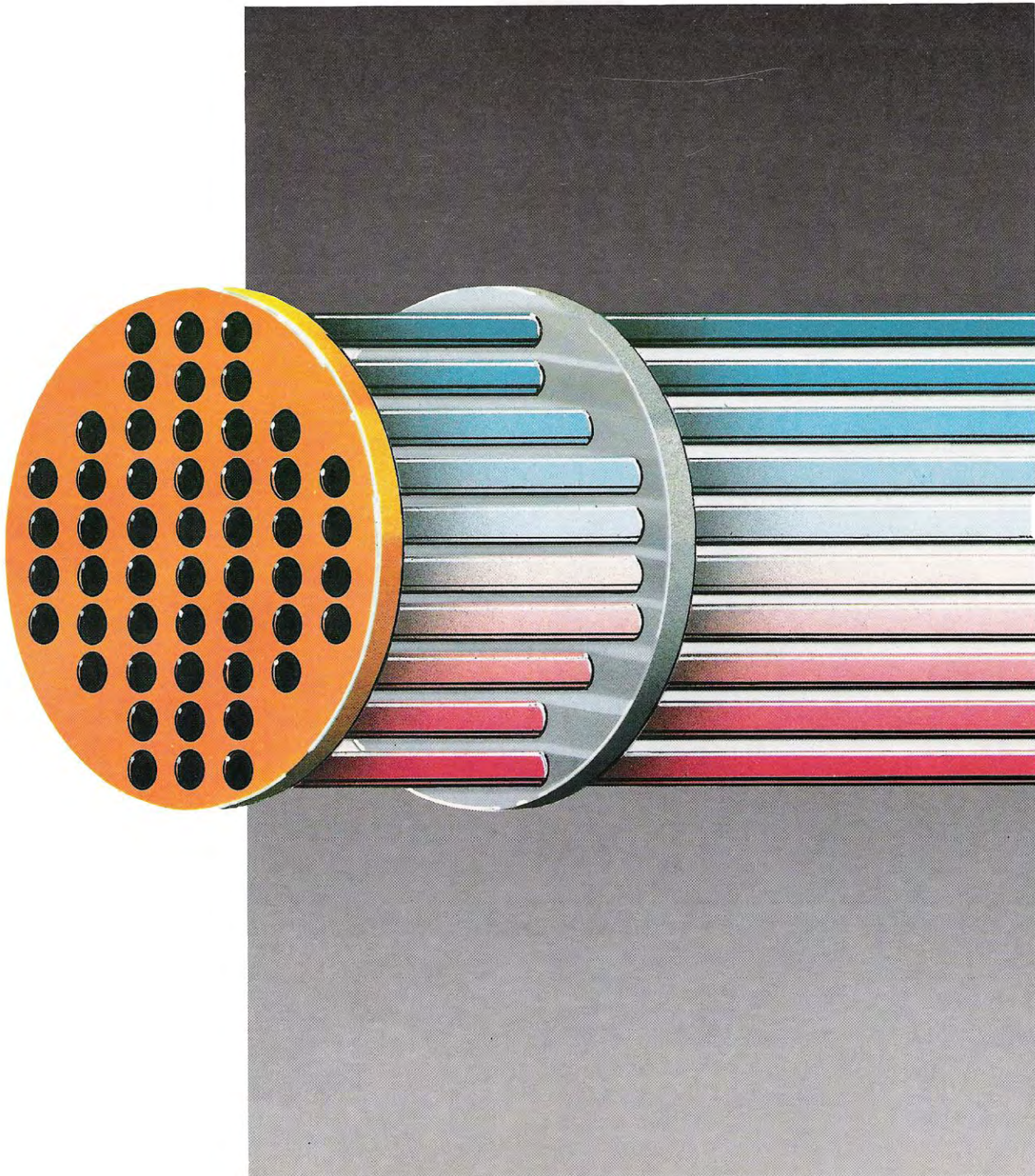


**...Against Corrosion and Incrustation
in Heat Exchangers**



Protection and Security Against Corrosion and Incrustation in Heat Exchangers

Well equipped and specialised production and industrial plant, is the best precaution against high investment and operational costs.

A protective coating against corrosion and incrustation assures the economical and efficient operation of plant, preventing damage which can incur considerable costs in repairs and maintenance.

With more than forty years experience in solving corrosion problems, SAEKAPHEN (as experts in competent corrosion protection) is prepared to help you.

The combination of our experience and extensive and close cooperation with our customers, has enabled us to develop economical coating systems and application procedures, to meet almost all demands.

Our laboratories provide ideal conditions in which to fulfil our claim to be, and to remain, "Number One" in the field of research and development.

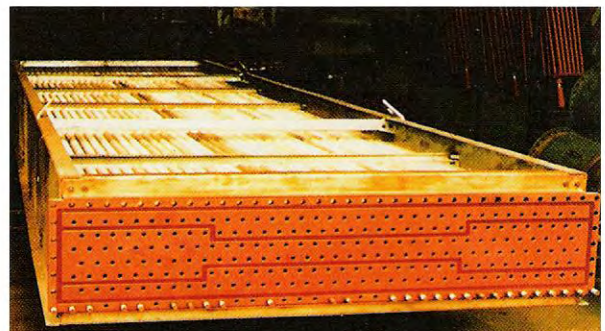
Our competence is based upon proven "know-how" together with SAEKAPHEN's considerable experience, and we are recognised worldwide as being reliable associates.



Heat exchanger shell, internally lined with Si 14 E



Condenser, tube-side coated with SAEKAPHEN-SI 14 E, with external metal spraying of zinc



Air cooler, coated with Si 14 EG, modified according to the special requirements for process in crude oil refineries

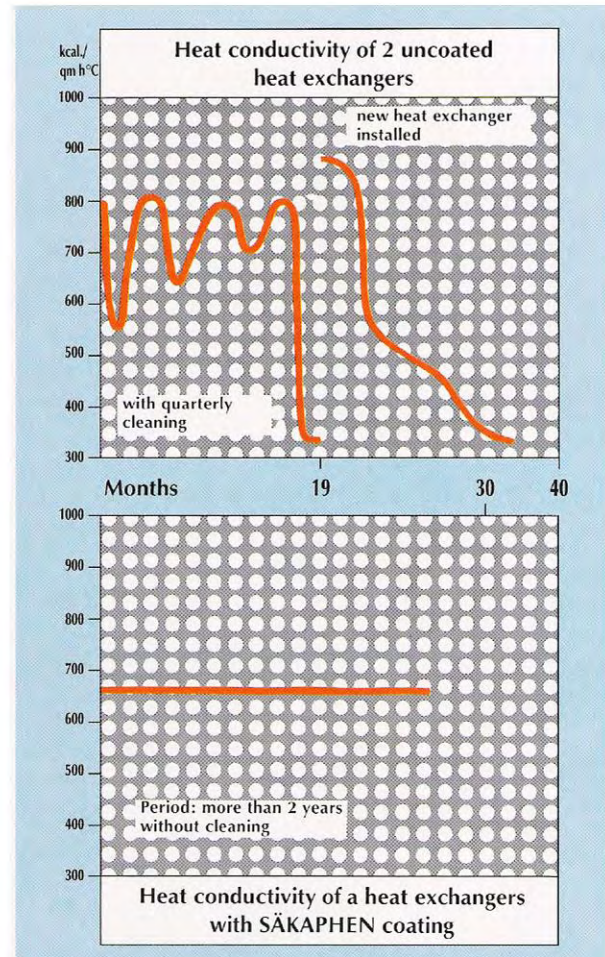
SAEKAPHEN Coatings Contain Optimum Properties

The coating materials of SAEKAPHEN are duroplastic synthetic combinations, which can be applied by flooding or spraying in several layers in accordance with special application techniques, and which are thermally cured in polymerization ovens.

After curing the coatings possess excellent adhesive properties, and assure a first class, hard, elastic and homogenic, pinhole-free protection against corrosion and incrustation in heat exchangers, coolers, condensers, evaporators, pipework etc.

SAEKAPHEN coatings are resistant to a great number of aggressive liquids such as, organic and inorganic acids and their salts, alkalies and all types of water and solvents.

Dependant upon the type, the cured coatings are generally recognised as safe, resistant to pressure and water vapour diffusion. They can also withstand temperatures up to 180°C(wet).



General Properties of the Heat Cured SAEKAPHEN Coatings:

- Surface Smooth, enamelled finish
- Film Thickness 200 to 250 microns
- Adhesion Excellent on all metals
- Temperature Up to 200°C
in constant service up to 180°C(dry).
Specific circumstances (humid/wet)
on request.
- Further Generally recognised as safe
and pressure resistant



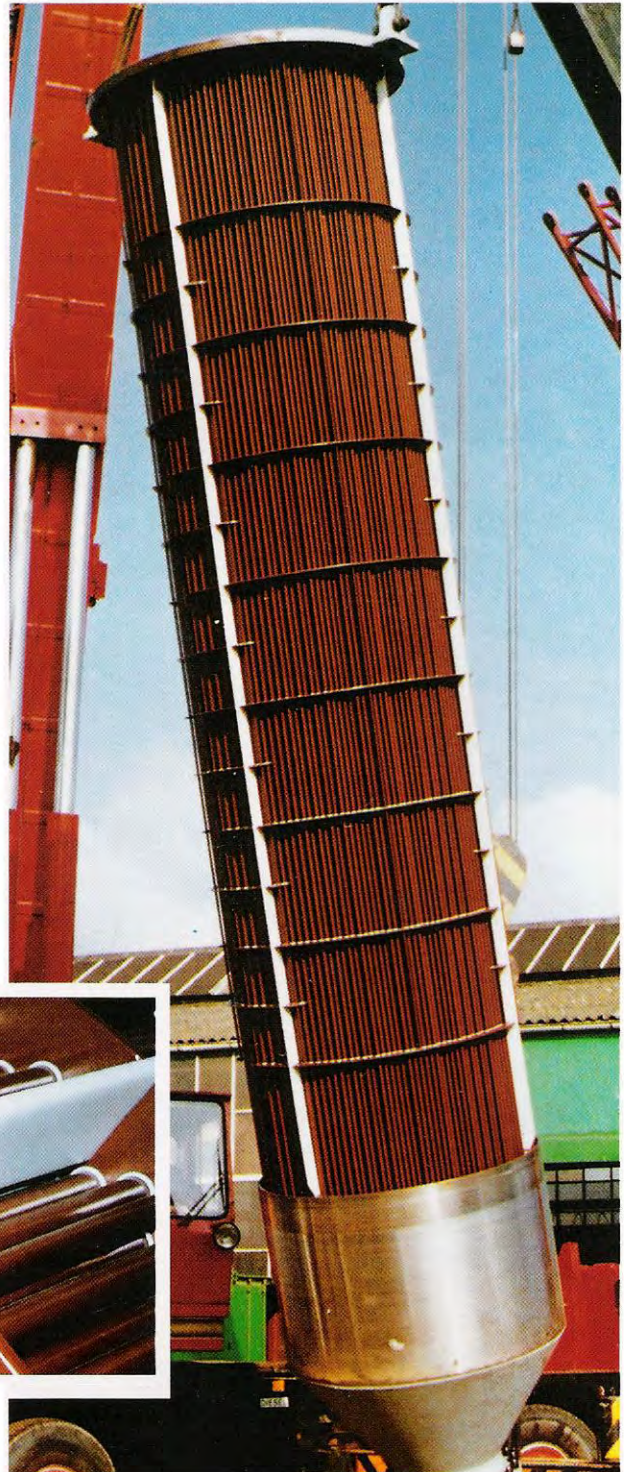
Floating head bundle of a distillation in a crude oil refinery. Tube side and shell side coated, after a service life Of 5 years

SAEKAPHEN Offers Perfected Coating Technologies

In addition to the manufacture of suitable coating materials for different requirements, SAEKAPHEN's range of services also includes the application in the SAKAPHEN workshops. Only perfected process technologies are applied which have been developed in our own development departments and which have been proven in the field of application.

Furthermore, the dimensions of our workshop facilities, together with the finest quality equipment, enables SAEKAPHEN to offer the possibility of carrying out baked coatings on objects sized 22 x 3.4 x 3.7 m or 16 x 4.3 x 4.7 m (l x w x h).

A further advantage for SAEKAPHEN's customers is that, in many countries heat cured coatings are applied on licensed premises.



Heat exchanger for the chemical industry, shell side coated with the SAEKAPHEN coating material Si 57 E

Economical and Efficient Solutions

Specialised, reliable coatings avoid incrustation on heat exchanger surfaces. In the absence of incrustation, the functional output is considerably higher and the heat transfer remains constant for a lengthy period of time. Thus, the service life of plant is substantially extended. A trouble-free operation is granted if a specialised coated, heat exchanger is permanently in service.

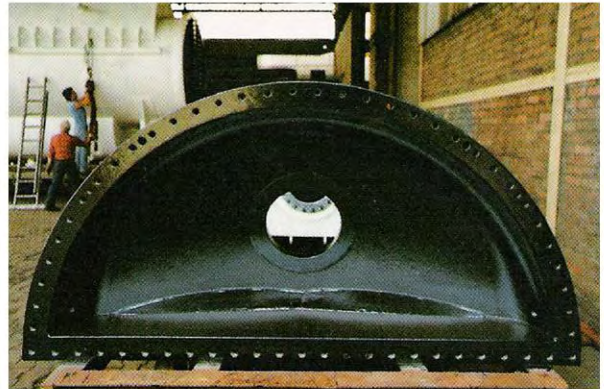
The application of specialised SAEKAPHEN coating systems can limit investment and operating costs.

Versatile Application For All Requirements

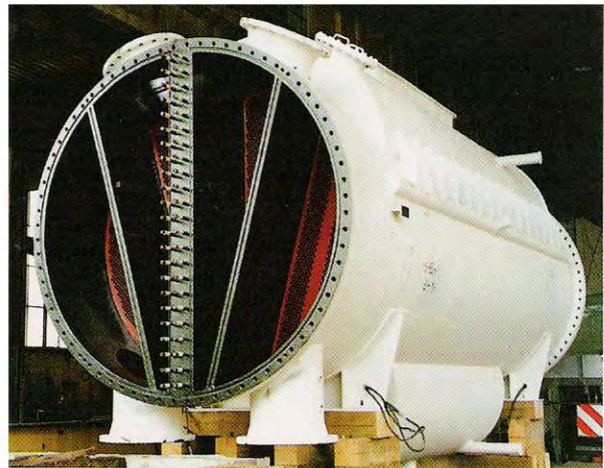
SAEKAPHEN coatings are well disposed to a versatile field of application. SAEKAPHEN can be applied anywhere – from the chemical, petrochemical and pharmaceutical industry to the food preparation and manufacturing industry.

SAEKAPHEN coatings and procedures have proved to be successful in refineries, power stations, cooling plants and in the preparation of water, as well as for the internal lining of tanks containing water endangering liquids.

When used on heat exchangers, SAEKAPHEN coatings have a particular advantage inasmuch as they can be applied to the tubeside even when they have small internal diameters.



Water box of a power station condenser, coated with SÄKATAR D extra



Power station condenser,
Tube plate coating with SÄKATONIT,
Pre-chamber coated with SÄKATAR D extra

The Special Product Properties and Fields Of Application of the SAEKAPHEN Coatings

Heat Cured Coatings

	Si 14 E	Si 14 EG	Si 57 E	Si 57 EG
Product Description	A heat cured coating, based on phenolic resins with hydrophobe and Smooth surface. Approved for use in potable water.	A heat cured coating, based on phenolic resins with a matt surface finish. Also available as a Modified product approved for foodstuffs.	A heat cured coating, based on epoxy phenolic resins, with hydrophobe and smooth surface. Approved for use in potable water.	A heat cured coating, based on epoxy phenolic resins, with a matt surface finish. Approved for use in potable water.
Product Data	Density: 1.25 <i>g/cms</i> Pendulum Hardness according to König: 182 secs. Elongation at Break: 1.1%	Density: 1.3 <i>g/cms</i> Pendulum Hardness according to König: 134 secs. Elongation at Break: 1.0%	Density: 1.15 <i>g/cms</i> Pendulum Hardness according to König: 203 secs. Elongation at Break: 4.4%	Density: 1.25 <i>g/cms</i> Pendulum Hardness according to König: 120 secs. Elongation at Break: 0.9%
pH Range	1 to 8	3 to 8	3 to 14	4 to 13
Resistant to	Salt solutions, cooling waters, gases, organic liquids from high acid to weak alkaline	Water vapour diffusion of aqueous, acid to slightly alkaline liquids and vapours	All cooling, brackish and sea water of high alkaline to weak acid degree	Alkaline to weak acid liquids and vapours
Fields of Application	Heat exchangers, air coolers, condensers, evaporators, fans, turbine rotors, transport and storage containers etc.	Codensers, condensate containers, thermal degasers as well as boilers and evaporators	Heat exchangers, condensers, evaporators, tanks, water preparation plants etc.	Codensers, condensate containers, thermal degasers, boilers and sea water desalination plants

For security, take advantage of our experience. SAEKAPHEN offers the total protection for your plant, in a reliable versatile and economical way

Cold Cured Coatings

HR 60 extra G

SÄKATAR-D extra

SÄKATONIT

Cold cured, two-component coating, based on epoxy resins, with smooth and glossy surface. Approved for use in potable Water.	Cold cured, two component coating, based on coaltar epoxy resins, with hydrophobe satiny/glossy surface and increased water vapour diffusion resistance.	Cold cured, thick-film coating, based on epoxy resins, with hydrophobe satiny/glossy surface.	Product Description
Minimum dry film thickness: 400 microns Pendulum Hardness According to König: 125 sec. Adhesive strength (in accordance with DIN ISO 4624): 39 N/mm ² Elongation at Break (in accordance with DIN 53455): 2.0 % Temperature + 120°C (dry) resistance: Humid/wet depending on liquid	Density: 1.5 g/cm ³ Pendulum hardness According to König: 74 secs. Temperature resistance: UP to 100°C water temperature	Density: 1.6 g/cm ³ Hardness according to Vickers: 16.0Kp/mm ² Elongation at Break: 1.8%	Product Data
2.5 to 13	4 to 14	2.5 to 13	pH Range
Acid to strong alkaline liquids, all waters including brackish, sea and deionised waters as well as in-organic salt solutions	Weak acid to strong alkaline liquids, Waters of all type-sea, brackish, cooling, and salt solutions	Acid to strong alkaline, aggressive liquids, waters of all type- sea, brackish, cooling, and salt solutions	Resistant to
Transport and storage tanks, pipework, silos, filters, channels, casings, water boxes, pumps, fittings	Washers, filters, tanks, waste Water and sea water plants, condensate containers and water boxes, tube plates and pipework	Tube plates of box-type condensers, turbine condensers, heat exchangers, coolers, evaporators	Fields of Application

Heat Cured Coating with outstanding smooth and hydrophobe surface

Si 14 E

Excellent high resistance against organic and inorganic acids as well as solvents

The SAEKAPHEN coating Si 14 E, based on an Elastified phenolic resin, has been approved in the field of chemical apparatus engineering due to its versatile use. It provides excellent resistance to organic and inorganic acids, organic solvents and exhaust gases.

Due to its great fields of application, Si 14 E can also be used as internal lining For transport Containers, railway cars and pipework. In addition, the lining protects all transport and storage goods against contaminations from the metal surface.

The combination of a smooth and hydrophobic surface with modern application methods provides the textile and paper industry with a coating material for machine cylinders. A variety of filter containers for potable water preparation have been protected with Si 14 E many years ago and are still in service.

When fully cured, the lining meets all the requirements of the German Health Authority in regard to plastic materials in contact with potable water and therefore has been approved for the protection of surfaces being in contact with potable water. A test report to this effect is available on request. Like all other SAEKAPHEN coatings, Si 14 E is tested in regard to a pinhole free performance, it can be put into service immediately after thermal curing.



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**Most important properties of the
SAEKAPHEN coating Si 14 E**

Heat cured coating based on a phenolic resin, with hydrophobic smooth surface, approved for use in potable water

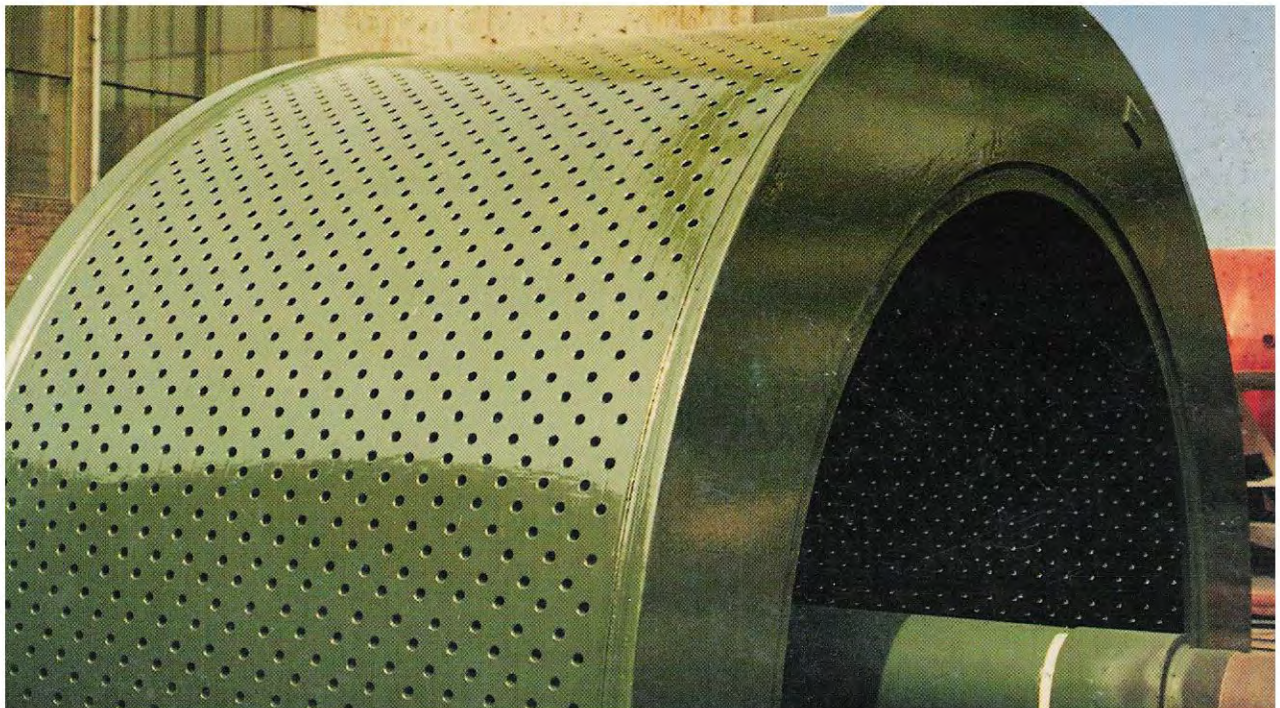
Dry film thickness approx. 200 µm.

Pendulum hardness
Acc. to König 182 sec.

Impact strength
acc. to DIN 55 66 9 560 mm/1 kg

Temperature
resistance 180 °C (dry)
humid/wet depending on
liquid upon request

pH-range 1-8



**Heat Cured Coating,diffusion
Resistant, with excellent
Protective properties**

Si 14 EG

**Approved since many years against acid
vapours, liquids and water vapour
mixtures**

The SAEKAPHEN coating Si 14 EG is a diffusion resistant coating material based on a modified phenolic resin.

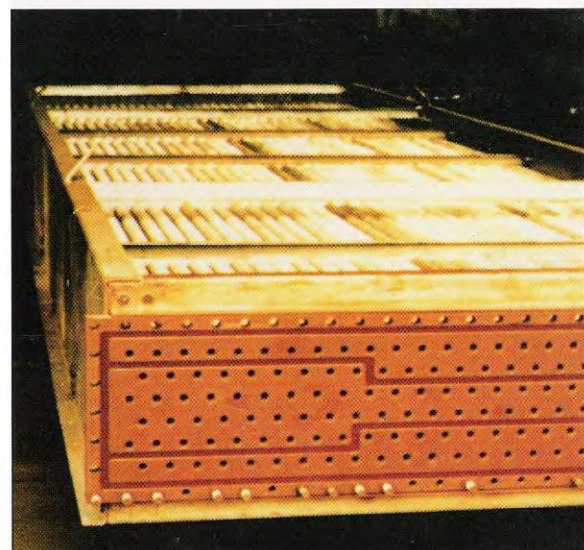
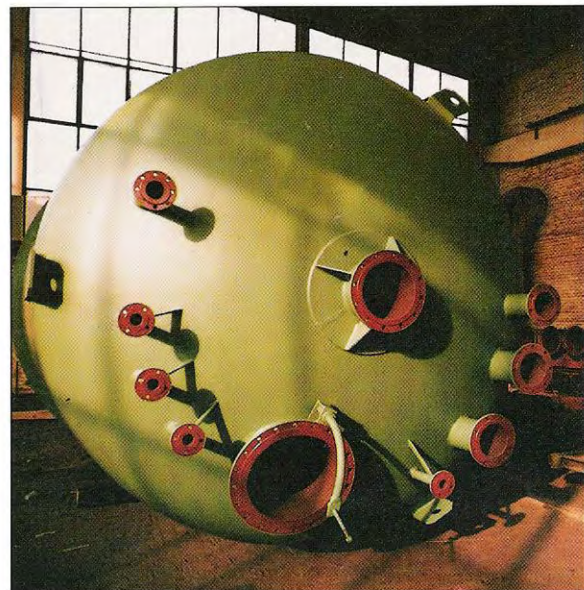
Normally, organic coatings, in spite of their high chemical resistance, are susceptible to diffusing liquids, particularly water vapours, and are, therefore, often destroyed.

SAEKAPHEN succeeded in developing a duroplastic coating of low film thickness being diffusion resistant which considerably improves the practical use of the organic coating material.

Beside the chemical resistance, Si 14 EG offers a thermal resistance to corrosive liquids – whether they are liquid or gaseous, and also in case of diffusion, particularly water vapour.

The method to determine a water vapour diffusion resistance has been developed by SAEKAPHEN and is known as SAEKAPHEN test.

The SAEKAPHEN coating Si 14 EG has been successfully approved for many years, against acid vapours and liquids as well as water vapour mixtures for the distillation of crude oil and protects air coolers, condensate containers and degasers against corrosion.



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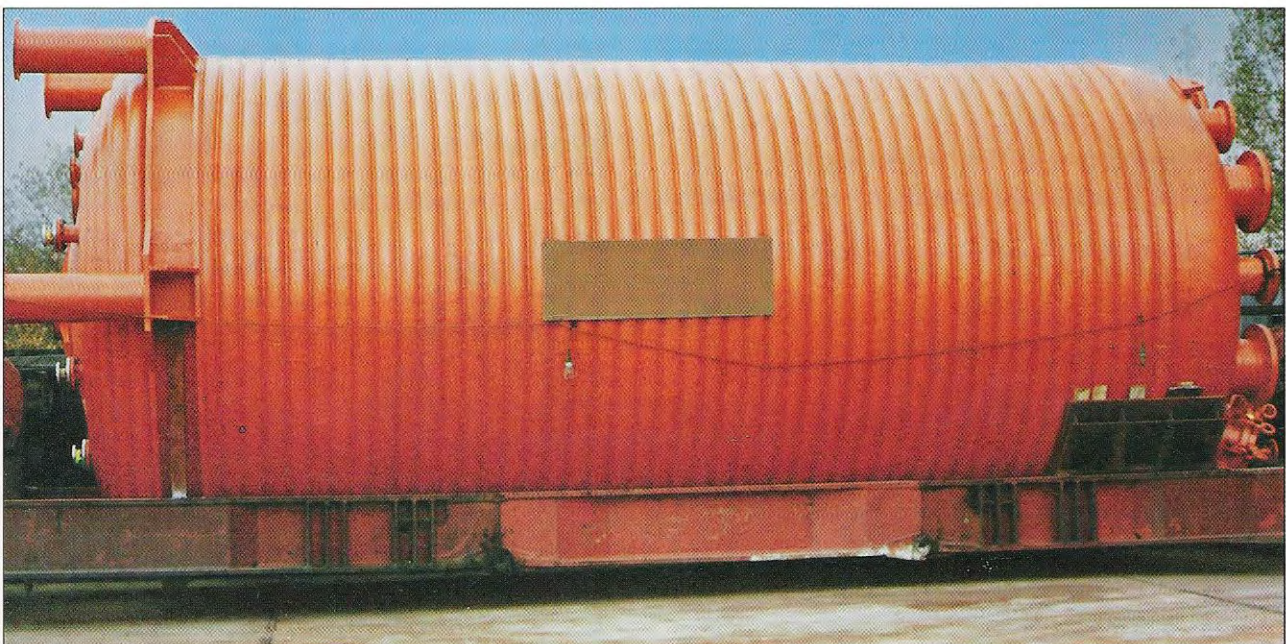
**Most important properties of the
SAEKAPHEN coating Si 14 EG**

Heat cured coating based on a phenolic resin, with
matt surface. Also available modified type with
Foodstuff approval

Dry film thickness	approx. 250 µm.
Pendulum hardness Acc. to König	134 sec.
Impact strength acc. to DIN 55 66 9	470 mm/1 kg
Temperature resistance	180 °C(dry) humid/wet depending on liquid upon request
pH-range	3-8

The modified type Si 14 EG 30, being
developed according to specific requirements,
can also be used for foodstuff applications.

It meets the requirements of the German
Foodstuff and Commodity Goods as well as
§ 175.300 of the US FDA Regulations.
Certificates are available.



An electrically conductive, heat cured lining for steel storage vessels

Si 17 E

A general purpose coating with resistance to a wide range of chemical conditions.

SAEKAPHEN coating Si 17 E is a thermo-setting system designed to provide protection for steel tanks and containers used for storing flammable liquids, chemicals, water pollutants, and meets the requirements of TRbF 401 (Technical Guideline for Storing Flammable Liquids).

SAEKAPHEN Si 17 E has been successfully used for many years for this duty and complies with the requirements of TRbF 401, having a test certificate from the Federal Authority for Material Testing (BAM). It is approved for use with aliphatic and aromatic solvents and is satisfactory for lining storage tanks containing chlorinated hydrocarbons.

This versatile coating permits containers lined with Si 17 E to be used for a wide variety of cargoes.

The coating system:

- Has low electrical resistance preventing the build-up of static electricity.
- Is approved by Federal Authority.
- Is pinhole free, smooth and easy to clean.
- Has high temperature resistance (up to 1800 C. dry).



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THE Most important properties are:

Dry film thickness	200 microns average
Surface	Smooth, satin
Hsrdness König Pendulum	148 sec.
Adhesive Strength	25 N/mm ² (Fracture in glue coat)
Temperature resistance	150 °C (humid) 180 °C (dry)
Resistance in the pH Range	2 to 8
Flexibility	(Impact test by falling sphere) 430 ± 10g at height of 2m Result: no cracks found when the coating was inspected
Resistivity (DIN 53 596)	<10(8) Ohm

We have stoving ovens in our workshops
for the cu ri ng of thermosetti ng coatings of
the following dimensions:
4.3 m x 4.7 m x 16.0 m long

In addition, SAEKAPHEN has the know-
how and the special equipment required
to line site built tanks with thermosetting
coatings.



Heat Cured Coating with Hydrophobic smooth surface

Si 57 E

Pinhole free corrosion protection - which leads to an extended lifetime of apparatus and containers

The SAEKAPHEN coating Si 57 E, based on a modified epoxy resin combination, is especially suitable for use on the cooling water side.

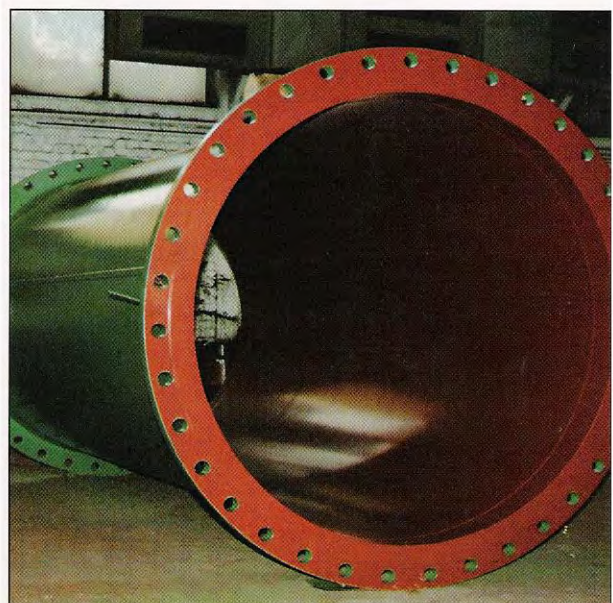
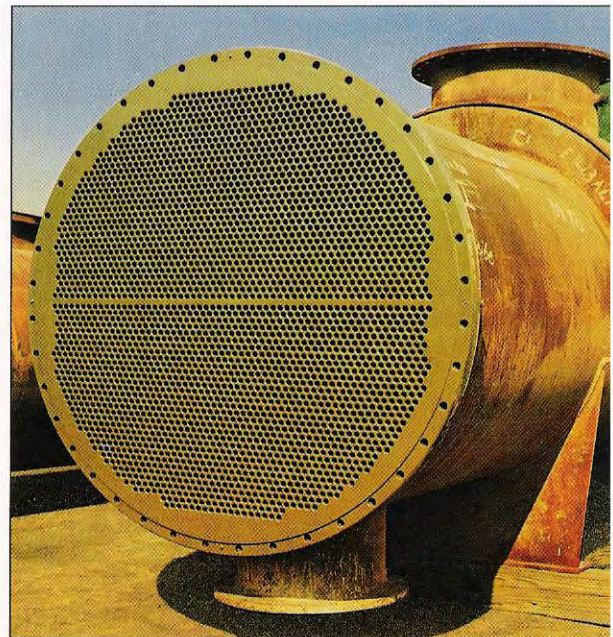
River, sea and brackish waters are responsible for considerable problems of corrosion and contamination in plant.

This coating has been proved over many years in a very special manner, due to its special advantages particularly the very good resistance to highly alkaline, such as ammonium, to weak acid liquids and all types of cooling waters.

With its pinhole free coating, Si 57 E contributes to extend the lifetime of plant and pipework for potable water supply and to save costs. The smooth and hydrophobic surface avoids the formation of dirt particles leading to incrustation.

Approved for use in portable water

In the field of application, the internal lining of heat exchanger tubes assures an even heat transmission. Shut-downs due to cleaning are reduced to a minimum.



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Si 57 E has been successfully applied as a reliable lining of heat exchangers, condenser, evaporators, containers, water preparation Plants, pipes etc.

**most important properties of the
SAEKAPHEN coating Si 57 E**

Heat cured coating based on a phenolic epoxy resin,
with hydrophobic smooth surface, approved for use
In potable water

Dry film thickness approx. 200 µm.

Pendulum hardness
Acc. to König 203 sec.

Impact strength
acc. to DIN 55 66 9 >1000 mm/1 kg

Temperature
resistance 180 °C(dry)
humid/wet depending on
liquid upon request

pH-range 3-14



Heat Cured Coating ,vapour Diffusion resistant in a wide pH- range

Si 57 EG

Optimum properties for the protection against highly alkaline to weak acid liquids and vapours

The SAEKAPHEN coating Si 57 EG is based on a modified epoxy resin combination, and it is resistant to diffusing liquids.

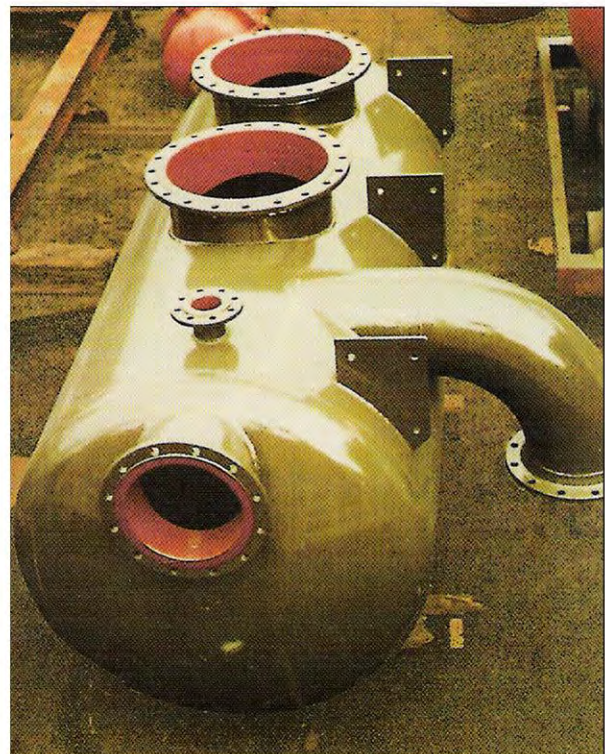
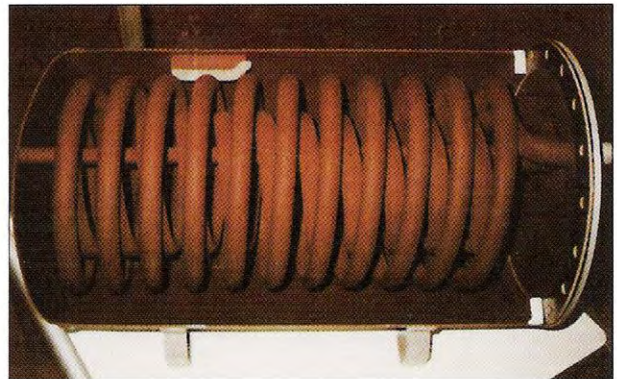
The field of application varies from weak acid to highly alkaline conditions created by installation parts being submitted to hot water and vapour. Si 57 EG has proved an excellent material for the coating of condensers, coolers, preheaters, thermal degasers, sea water evaporators, condensate containers and vessels for boiler feed water.

The vapour diffusion resistant coating offers excellent protection for hot water boilers made of carbon steel, even in cases of extreme strain, such as solar operation.

Si 57 EG is successfully applied for the coating of sea water distillation plants.

Approved for use in portable water

The coating material Si 57 EG, developed for these fields of application, meets the requirements of the German Health Authority in regard to plastic materials in contact with potable water for temperatures up to 90° C and the DVGW specification 270.



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**most important properties of the
SAEKAPHEN coating Si 57 EG**

Heat cured coating based on a phenolic epoxy resin, with a matt surface, approved for use in potable water

Dry film thickness approx. 250 µm.

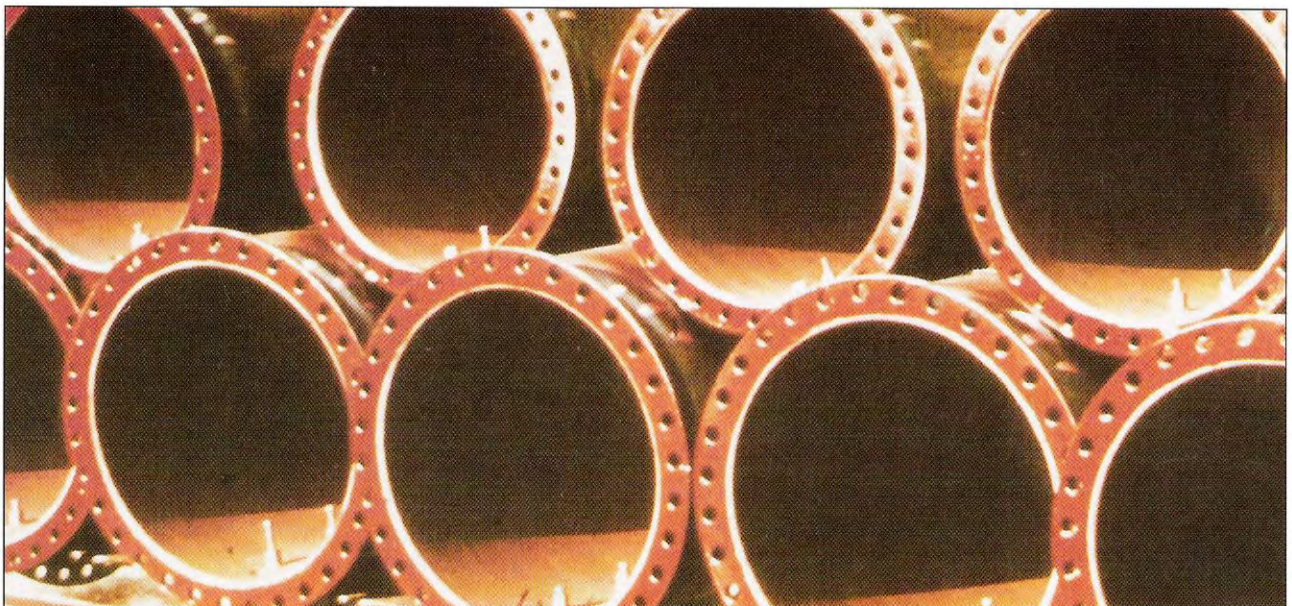
Pendulum hardness
acc. to König 120 sec.

Impact strength
acc. to DIN 55 66 9 530 mm/1 kg

Temperature
resistance 180 °C (dry)
humid/wet depending on
liquid upon request

pH-range 4-13

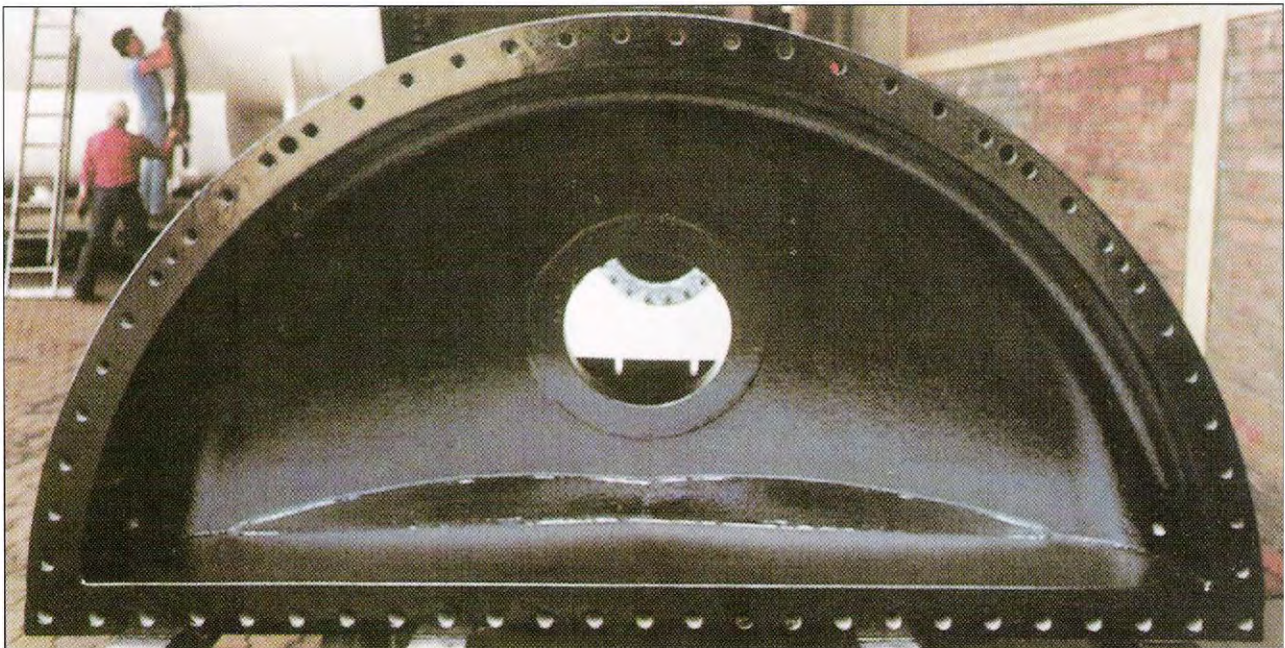
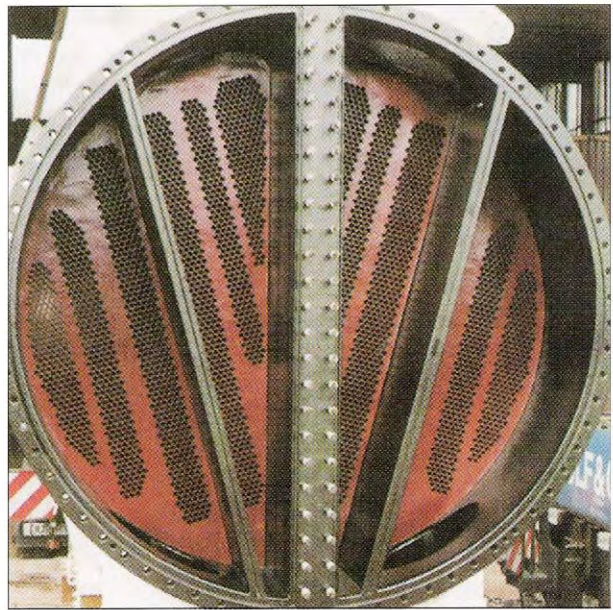
The type Si 57 EGA has especially been developed, in accordance with ARAMCO specification, for the coating of valves used in high pressure pipework for crack and hydrogenation gases containing H₂ S in the field of natural gas and oil gathering. This special type is pressure resistant up to 350 bar, insensitive to shock-type decompression and resistant to abrasion according to ASTM D 968-5.



Twin Component, Thick-Film Coating with excellent diffusion resistance

**Resistant to water temperatures up to
100°C and temperature differences of 80°C**

SAKA TAR D extra is a low solvent containing SAKAPHEN coating with hydrophobic surface based on a tar/epoxy combination. Film thicknesses up to 800 µm can be applied. The coating material can be applied in the workshop or on site. Combined with K80LS-Flat Coat material for the thick-film coating of tubeplates, SAKA T AR 0 extra is most suitable to protect water boxes of power station condensers and this material has been specified by apparatus manufacturers as well as end users.



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SAEKATAR D extra is resistant to weak acid to highly alkaline liquids and all types of water, including sea and brackish water, cooling water and salt solutions. Amongst others, it is also suitable for cooling water plant.

SAEKATAR D extra results in a highly abrasion and diffusion resistant coating with decontamination properties which can also be combined with cathodic corrosion protection. Due to its excellent adhesion properties, an optimum long term protection is achieved against corrosion and incrustation, even in extreme temperature fluctuation of 80°C. In dry conditions the coating can be resistant up to 150°C.

**Most important properties of the
SAEKAPHEN coating SAEKATAR D extra**

A cold cured, twin component coating based on a tar/epoxy resin combination with hydrophobic satin/gloss surface with excellent water vapour diffusion resistance

Pendulum hardness acc. to König	74 sec.
Impact strength acc. to DIN 55 66 9	220 mm/l kg
Temperature Resistance	max. 150 QC (dry) up to 100° C water temperature and 80° C temperature difference
pH-range	4 – 14

SAEKAPHEN-LICENSEE

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SAKAPHEN
COATINGS

SAEKAPHEN GmbH

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Produkte und Technologien gegen Korrosion und Inkrustation für viele Anwendungsbereiche

Wärmetauscher	Tanks
Lüftkühler	Silos
Schiffskühler	Behälter
Verdampfer	Bunker
Kondensatoren	
Rohrböden	Kesselwagen
Hauben	Waggons
Wasserkammern	Transportkübel
Armaturen	Container
Rohrleitungen	Schiffsladeräume
Kompressoren	Kläranlagen
Zentrifugen	Trinkwasserfilter
Ventilatoren	Kühltürme
Turbinen	Meerwasseranlagen
Apparate	Getränkeanlagen
Wäscher	Industrieböden
Filter	Fahrbahnen
Boiler	Stahlkonstruktionen
Kamine	Betonbauwerke

SÄKAPHEN Leistungen

Inspektion	Strahlentrostung
Service	Grundierung
Wartung	Beschichtung
Reparatur	Prüfung

Thermische und katalytische Beschichtungen, Strahlentrostungs- und Beschichtungsarbeiten werden in den SÄKAPHEN-Werken und von SÄKAPHEN auf in- und ausländischen Baustellen ausgeführt. SÄKAPHEN übernimmt weltweit Inspektions-, Service- und Reparaturaufgaben.

Products and technologies against corrosion and incrustation for many applications

Heat Exchangers	Tanks
Air Coolers	Silos
Marine Coolers	Vessels
Preheaters	Bunkers
Condensers	
Tube Plates	Rail Tank Cars
Channels	Waggons
Water Boxes	Hinged Buckets
Valves & Fittings	Containers
Pipework	Ship's Holds
Compressors	Treatment Columns
Centrifuges	Water Filters
Exhausters	Cooling Towers
Turbines	Desalination Plant
General Plant	Beverage Tanks
Scrubbers	Industrial Floors
Filters	Road Surfaces
Boilers	Steel Structures
Stacks	Concrete Structures

SÄKAPHEN Service

Inspection	Grit Blasting
Surveys	Priming
Maintenance	Coating
Repairs	Testing

Heat cured and catalyst cured SÄKAPHEN linings, grit blasting and coating in SÄKAPHEN plants and on site by SÄKAPHEN locally and abroad. SÄKAPHEN undertakes inspection, surveys and repairs world wide.

SÄKAPHEN-Licensees in:

. Austria	. Denmark	. Great Britain	. China	. Norway	. Switzerland	. Korea
. Belgium	. France	. Italy	. Spain	. USA	. Yugoslavia	