heat cured coating

cold cured coating

Sandblasting
Priming
Coating
Testing
Inspection
Repairing
Maintenance
Service

Your partnership for perfect

Application technologies and system

anti-corrosion and protection

SAEKAPHEN guarantees

in refineries, in petrochemical and chemical process plants

high profitability

Year after year billions are lost in highly industrialised countries due to corrosion and fouling.

More than 500.000 heat exchangers, condensers and air coolers have been coated on the tube- and on the shell-side

One issue of the trade journal HYDROCARBON PROCESSING concerning the problems caused by fouling in refineries, reported that, in 1995 alone, worldwide costs on the order of $ 4.5 billion were incurred in crude preheat trains.

SAEKAPHEN‘s research and development in materials intends to assist in overcoming these problems.

Where corrosion protection is concerned, **SAEKAPHEN** sets new standards.

For more than 50 years coating materials and application technologies have been developed, which provide a reliable corrosion protection and prevent fouling and have consequently become world famous under the name **SAEKAPHEN**.

SAEKAPHEN know-how

if perfect corrosion protection is required

from practical experience

This is SAEKAPHEN

Definition

The **SAEKAPHEN** coating is produced from complex mixtures of liquid thermosetting coatings and is applied to the equipments using flooding and spraying technologies.

It offers two coating technologies:

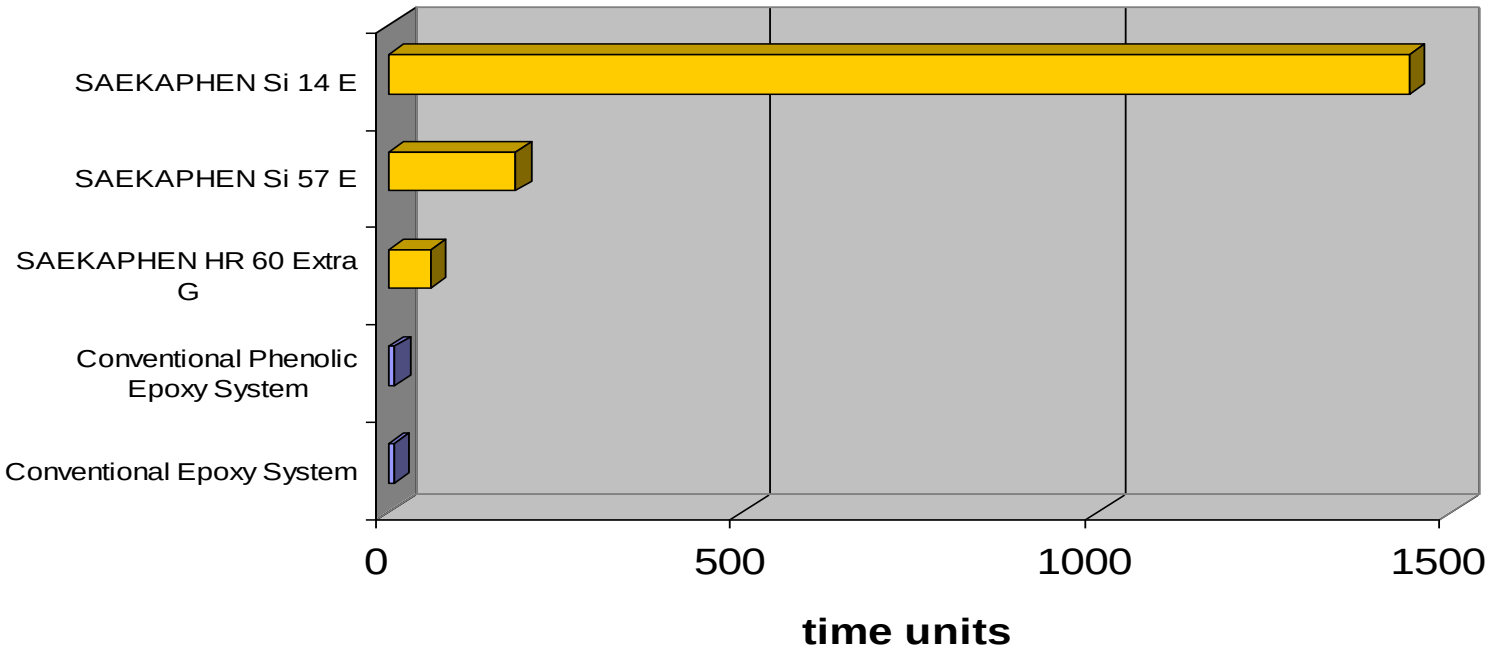
- Heat Cured Coating
- Cold Cured Coating

SAEKAPHEN product mix

heat cured material

SAEKAPHEN Material type	colour	surface	dry film thickness µ	density g/m³	solid volume ltr./ 100 kg	hardness (König) Imp./sec.	resistance	field of application
SAEKAPHEN Si 14 E	dark-green	hydrophob, smooth	200	1,39	27,41	190	high acid to slightly alkaline, salt solutions, cooling water. gases, organic liquids	heat exchangers, air coolers, condensers, evaporators, tanks
SAEKAPHEN Si 14 EG	red-brown	hydrophob, smooth	250	1,30	29,32	134	water vapour diffusion, slightly acid a. alkaline liquids and vapour	heat exchangers, condensers, condensate containers, thermal degasers
SAEKAPHEN Si 17 E	red-brown	hydrophob, smooth	200	1,44	30,13	143	liquid or gaseous KW, salt solutions, oils, acid to slightly akaline mediums to PH8	inside coating of tanks for storage of flammable liquids, class of isk AI/All and B, alphatic hydrocarbon
SAEKAPHEN Si 57 E	red-brown	hydrophob, smooth	200	1,16	30,10	200	high alkaline to acid, all cooling waters incl. brackish- a. sea-water	heat exchangers, condensers, evaporators, vessels, Water treatment plants
SAEKAPHEN Si 57 E-HC	black	Satin-finished	200	1,20	30,10	200	high alkaline to acid, all cooling waters incl. brackish- a. sea-water	heat exchangers, condensers, evaporators where a higher heat conductivity is required
SAEKAPHEN Si 57 EG	grey-olive	matte	250	1,24	29,52	120	water vapour diffusion in, alkaline to low acid liquids	condensers, condensate, containers, degasers a. boilers

Chemical Resistance of SAEKAPHEN Coatings vs. conventional Coatings



The chemical resistance was tested in a laboratory test by dipping the coated panel in a SAEKAPHEN-specific unique solvent mixture containing i.e. chloro-acetic acid and methylenen chroride

Two heat exchangers with welded tubes

without **SAEKAPHEN**

with **SAEKAPHEN**

Practical example 2 parallel operating heat exchangers, operating time 2 years without cleaning.

Basic Resistance Chart

		SAEKAPHEN Materials
Oxides		
hydrogen peroxide	oxidizing	Si 14E
carbon monoxide		Si 14E/EG
carbon dioxide, carbonic acid		Si 14E/EG
sulphur dioxide, sulphurous oxide		Si 14E
sulphur trioxide		Si 14E
silicon dioxide		Si 14E
Superoxide		Si 14E
Acids		
hydrochloric acid, chloric acid gas		Si 14E
nitric acid	oxidizing	Si 14E
hydrogen sulphide, hyrosulphide		Si 14E
sulphuric acid		Si 14E
ethanoic acid, acetic acid		Si 14E

Alkaline Solutions		
calcium hydrate, hydroxide		Si 57E/EG
kalihydrat, caustic potash solution		Si 57E/EG
sodium hydroxide, caustic soda hydrated		Si 57E/EG
ammonia		Si 57E/EG
Sulphates		
calcium sulphate, calc.sul. Hemihydrated	Si 14E/EG	Si 57E/EG
copper sulphate	Si 14E	
sodium sulphate, Glauber´s salt	Si 14E/EG	
Carbonates		
calcium carbonate, calcareous	Si 14E	Si 57E
potassium carbonate	Si 14E	Si 57E
sodium carbonate	Si 14E/EG	Si 57E/EG

Nitrates		
potassium nitrate	Si 14E/EG	Si 57E
sodium nitrate, Chile salpeter	Si 14E/EG	Si 57E
Chlorides		
sodium chloride, common salt	Si 14E	Si 57E/EG
ammonium chloride, salmiac	Si 14E	Si 57E/EG
Solvents		
acetone	Si 14E/EG	
ethyl acetat, acetic ether	Si 14E/EG	
formaldehyde, formalin	Si 14E	Si 57E
octane	Si 14E/EG	
ethhyl alcohol, benzine, alcohol	Si 14E/EG	
Cooling Water		
seawater, brackish water, river water	Si 14E/EG	Si 57E/EG

SAEKAPHEN product mix

cold cured material

SAEKAPHEN Material type	colour	surface	dry film thickness µ	density g/m³	solid volume ltr./ 100 kg	hardness (acc.König* ShoreD**) Imp./sec.	resistance	field of application
SAEKAPHEN HR 60 extra G	green, red, grey	smooth, glossy	400-500	1,50	60,3	120*	high alkaline to acid mediums, brackish, sea a. deionized water as well as inorgranic salt solutions	tanks, silos, filters, vessels
SAEKAPHEN HR 60 extra TG	red, grey red-brown	matte	300-350	1,40	33,1	100*	sightly acid to alkaline aqueous mediums water to 100°C a. water vapour diffusion	desalization plants, condensation tanks, process water tanks, metal pipelines
SAEKAPHEN K 80 LS	red-brown	satin-finished	400-max. 800	1,40	66,4		acids to high alkaline aqueous, mediums water to 100°C a. water vapour diffusion	water tanks in power stations, turbine condensers, heat exchangers, coolers evaporating a. cooling water pipelines
SAEKALINE	red-brown, white	smooth, glossy	mind. 700	1,55	64		water to 100°C a. temperature drop to the surface, temperature difference up to 80°C	boilers a. other water heaters for drinking nondrinking water, KTW recommendation a. all ranges of cold a. heat water
SAEKA-Flake 900	beige	smooth	1000	1,28		87**	aggressive media of chemical industry, high acid ranges a high temperatures	flue gas desulfurizing plants, tanks, pipelines, tanks, vessels, pipes
SAEKA-Flake 900 Black	black-grey	smooth	1000	1,32		87**	sightly alkaline to high acid mediums, sea-water, inorganic salt solutions, flue gas, electrostatic derivation ability	storage tanks, containers, flue gas channels,disulfurizing plants,process tanks, washing towers, gas purifying plants
SAEKATAR D extra	black, red-brown	matte	mind. 500	1,5	79,5	74*	good chemical resistance, high temperature toad, higher water vapour diffusion	power stations, nuclear power stations, cooling water pipelines, tanks

SAEKAPHEN-coated equipment has been widely used for many years by industries such as refineries, fertilizer, petrochemical and chemical plants, particularly refrigeration, crude oil distillation and water treatment.

Application

This is what SAEKAPHEN can do

prevents corrosion

prevents fouling, allowing a considerably

lower fouling factor when designing new heat exchangers

is resistant to water vapour and to extreme temperature fluctuations

has a long life at temperatures ranging
from -20°C to +220°C

is non-conductive

SAEKAPHEN

the perfect alternative for protection against corrosion

Coating Technology

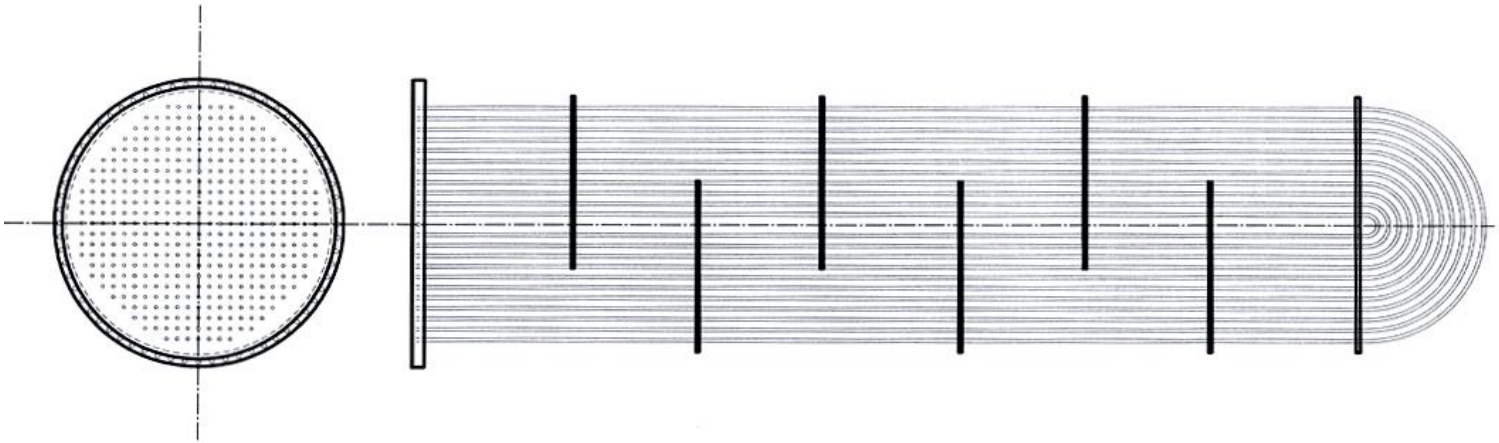
Heat Exchanger to be SAEKAPHEN Treated Require Specific Constructional and Surface Conditions

In accordance with

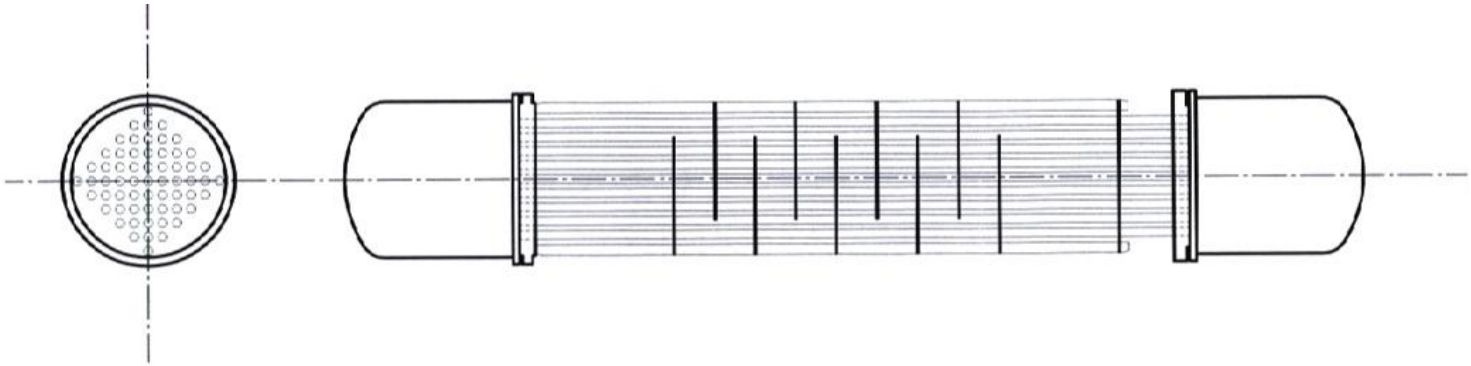
DIN EN 14879-1

Some typical constructions of heat exchanger.

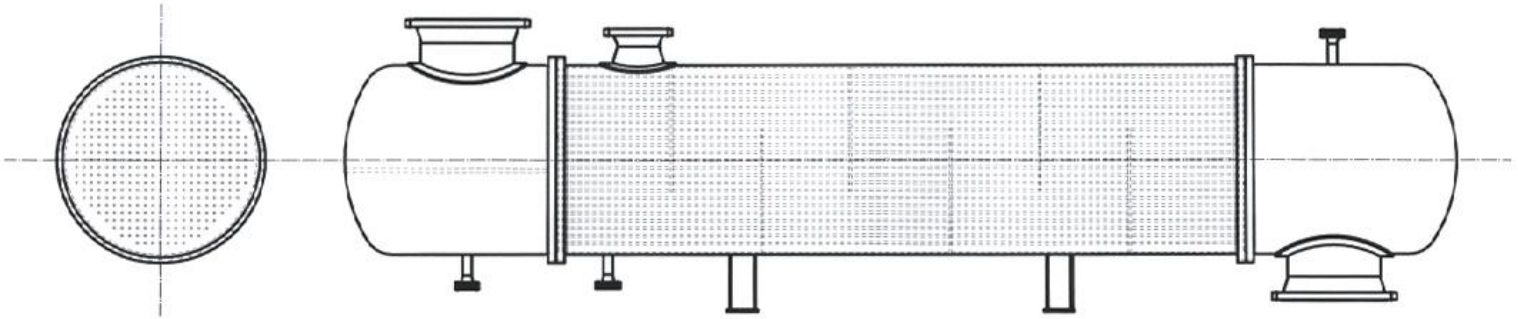
U-Tube bundle



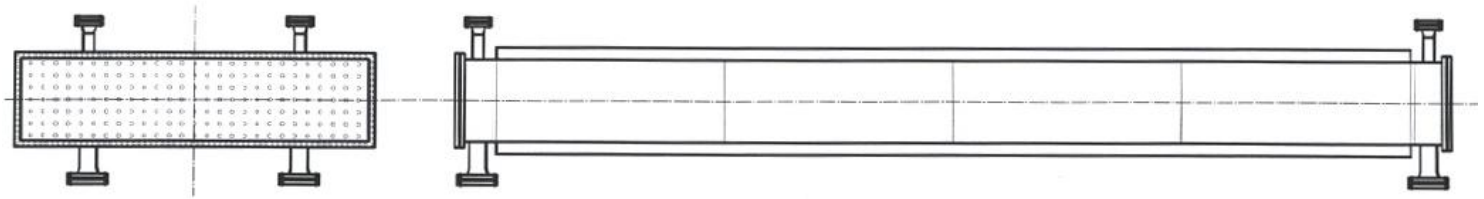
Floating-Heat Exchanger

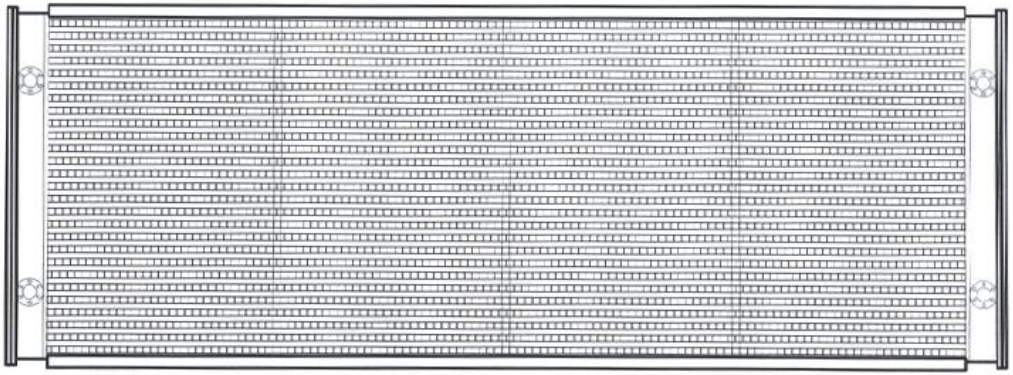


Tubular-Heat Exchanger



Air cooler

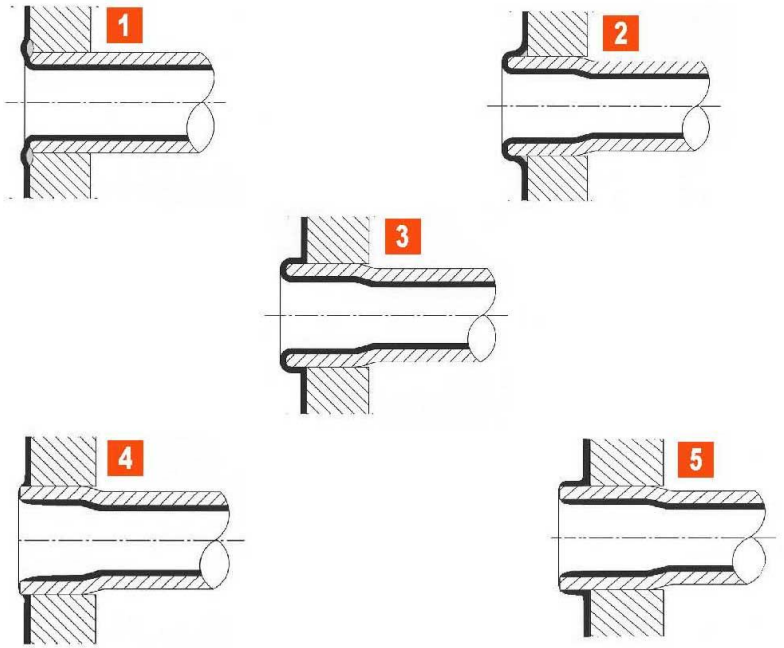




Constructional conditions for SAEKAPHEN coating

on the tube side of tube bundles in accordance with DIN EN 14879-1

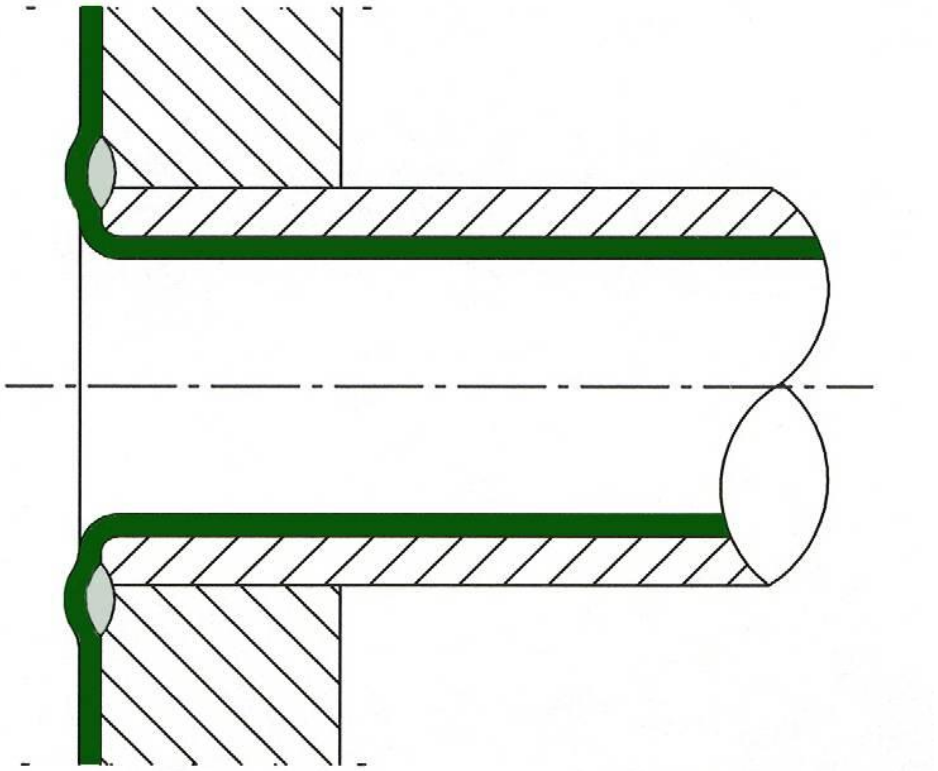
different alternatives
of the tubes ends
welded / expanded on the
tube sheets from optimezed
best solution (1)
to poorest solution (5)



Best solution: Welded tubes with rounded tube edges

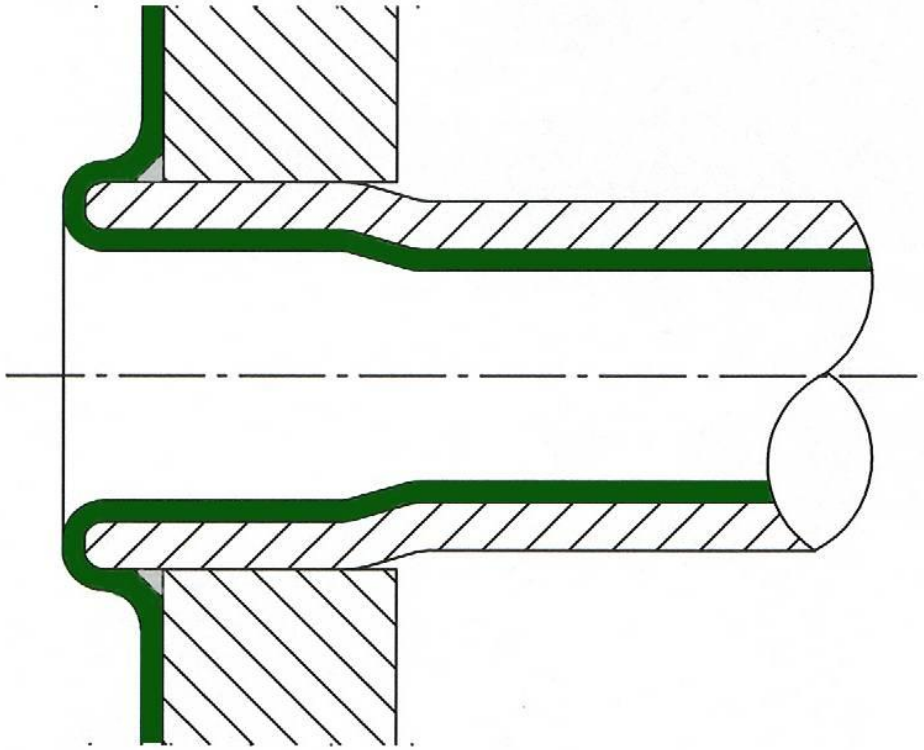
on the tube sheets in accordance with DIN EN 14879-1

(main part of coated heat exchanger in Europe)



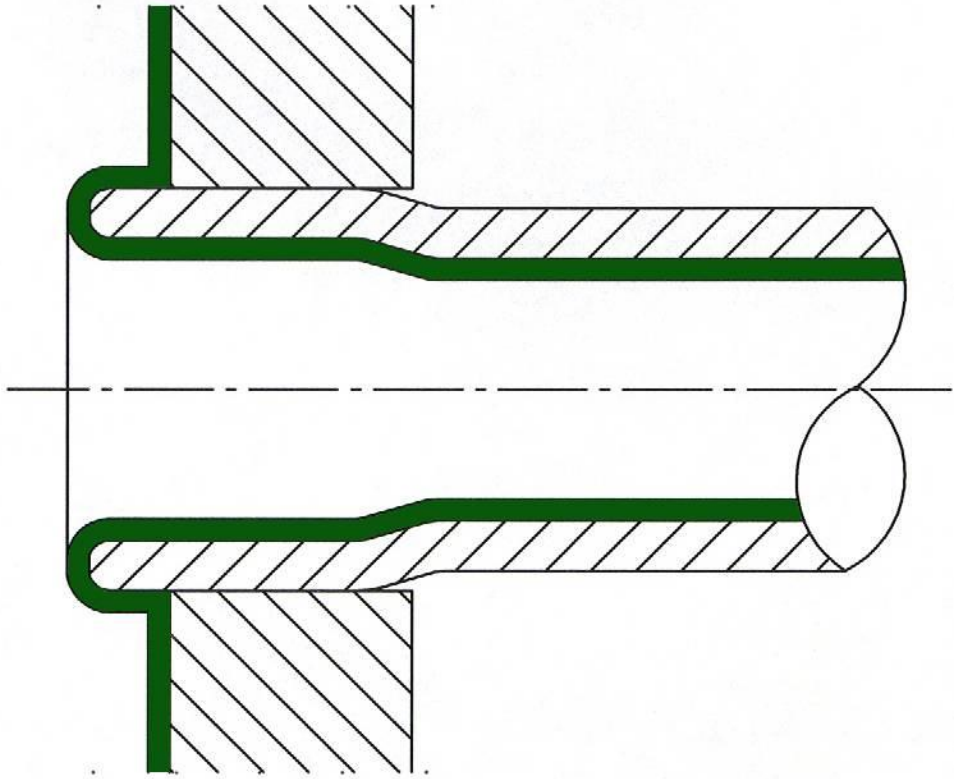
1

Alternative solution: Jut put tube ends, seal expanded tubes, rounded tube edges and seal welding for protection from capillary faults in accordance with DIN EN 14879-1



2

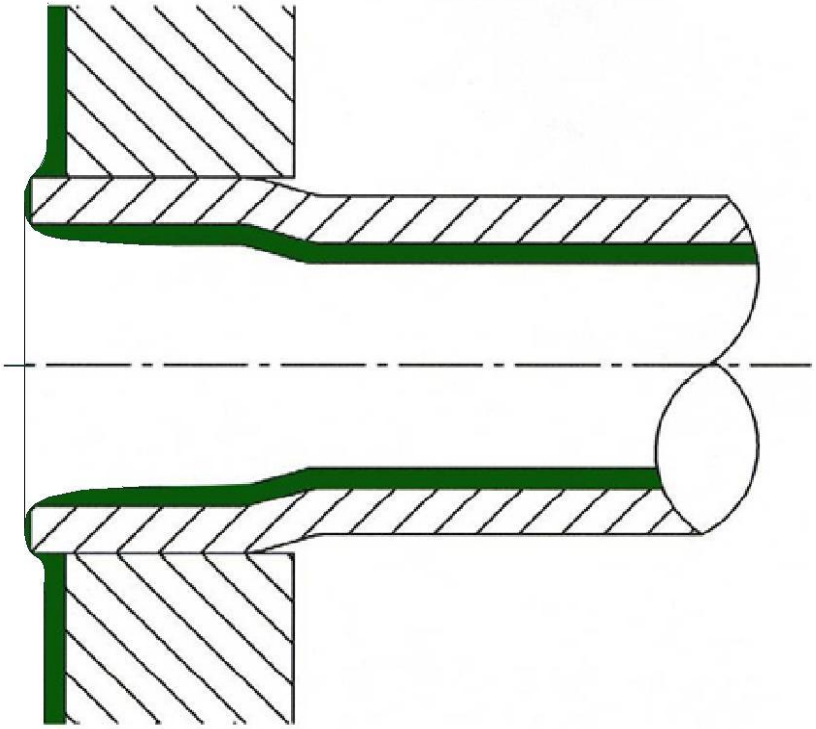
Insignificant solution: Jut out tube ends rounded tube edges seal expanded without seal welding. Capillary faults between tube sheets and the shell side of the tube within the boring without recommendation



3

Poor solution

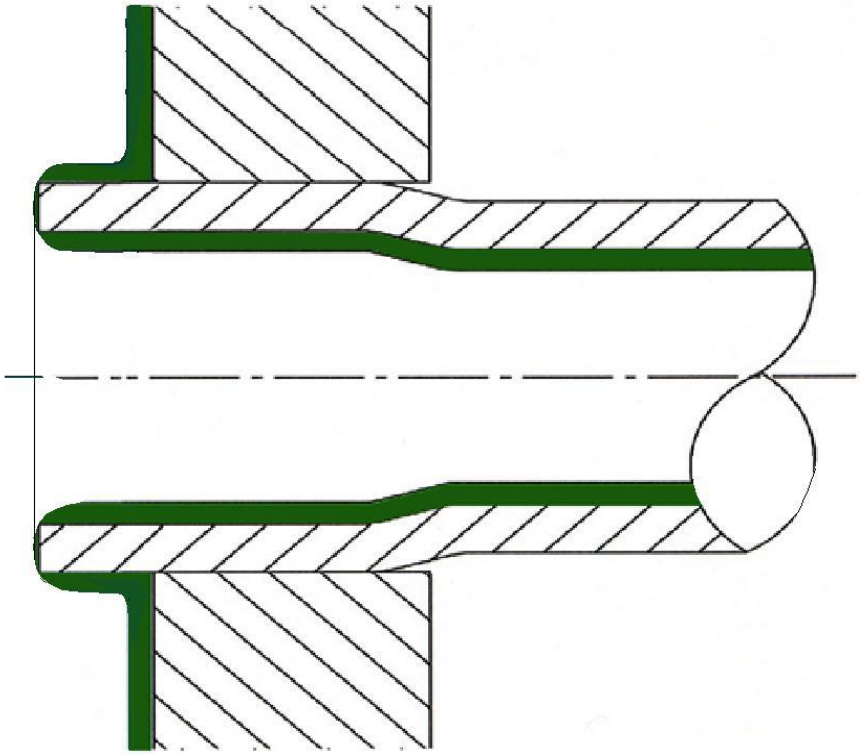
Seal expanded tubes, jut out tube ends not rounded, without seal welding. Faulty quality of coating



4

Worst solution has to be treated ahead

Seal expanded tubes, long jut out tube ends not rounded tube, edges (sharp edges), and no seal welding. Faulty quality of coating



5

Surface preparation by sand blasting

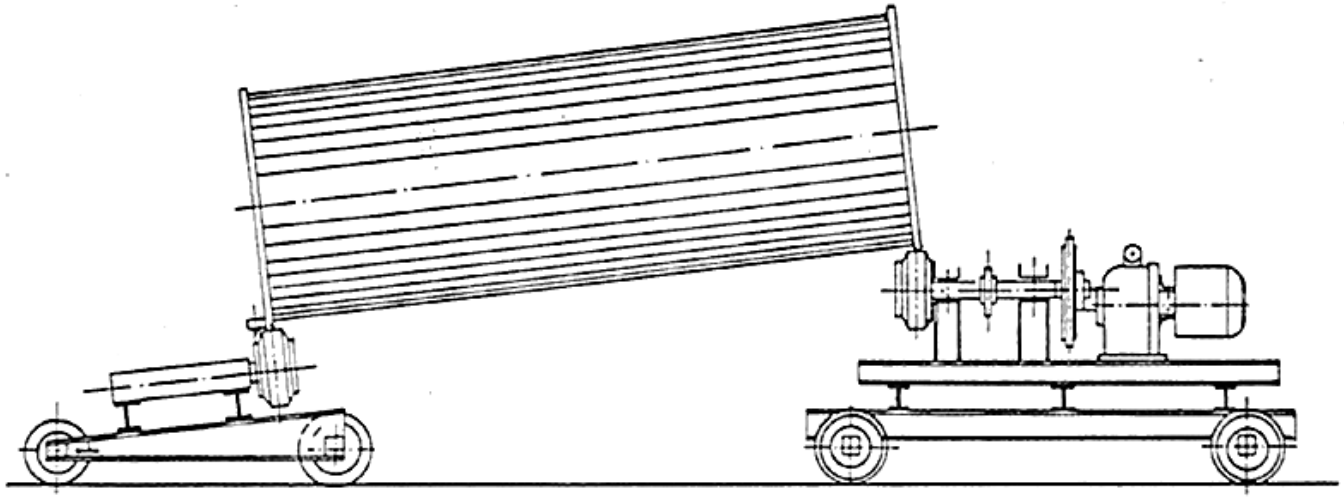
Before starting the surface preparation by sandblasting the construction has to be inspected in accordance with the DIN guidelines, especially the DIN EN 14879-1.

The internal surface of the tubes shall be sandblasted tube by tube either by hand or with an automatic sandblasting machine. The grade shall be Sa 3 with a roughness of 40 - 60 micrometer guaranteeing high adhesion of the SAEKAPHEN coating.

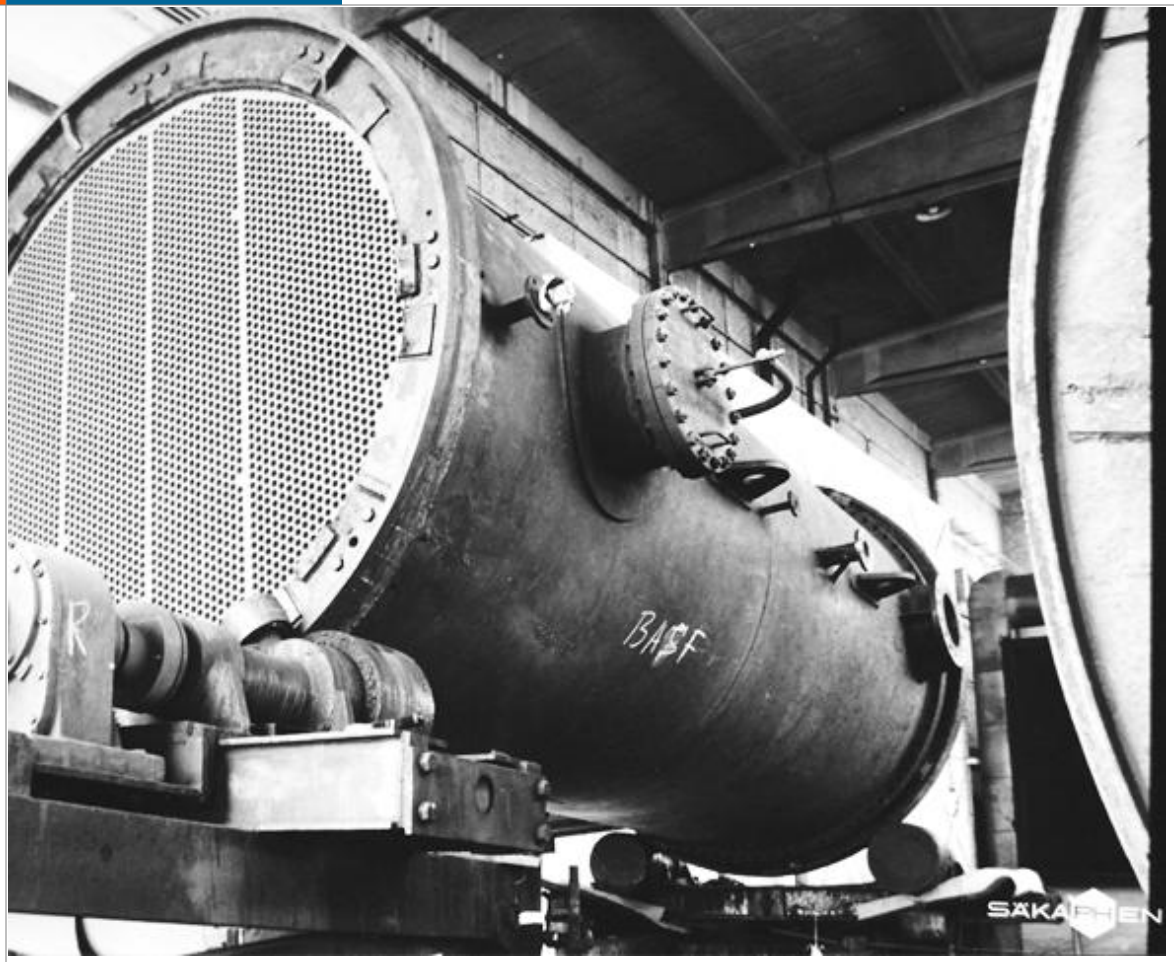
sand blasting, manual and mechanical

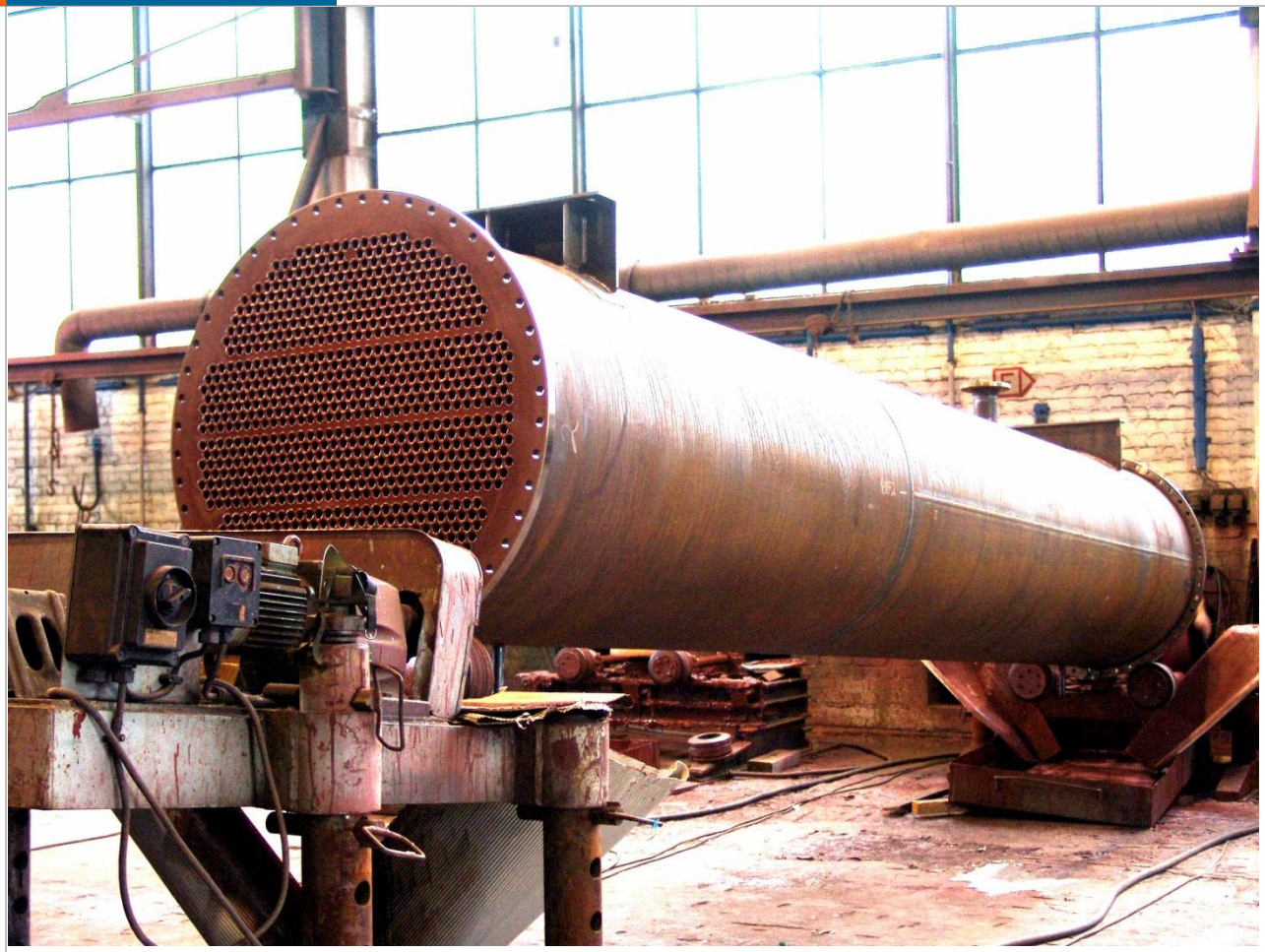
Coating flooding technology

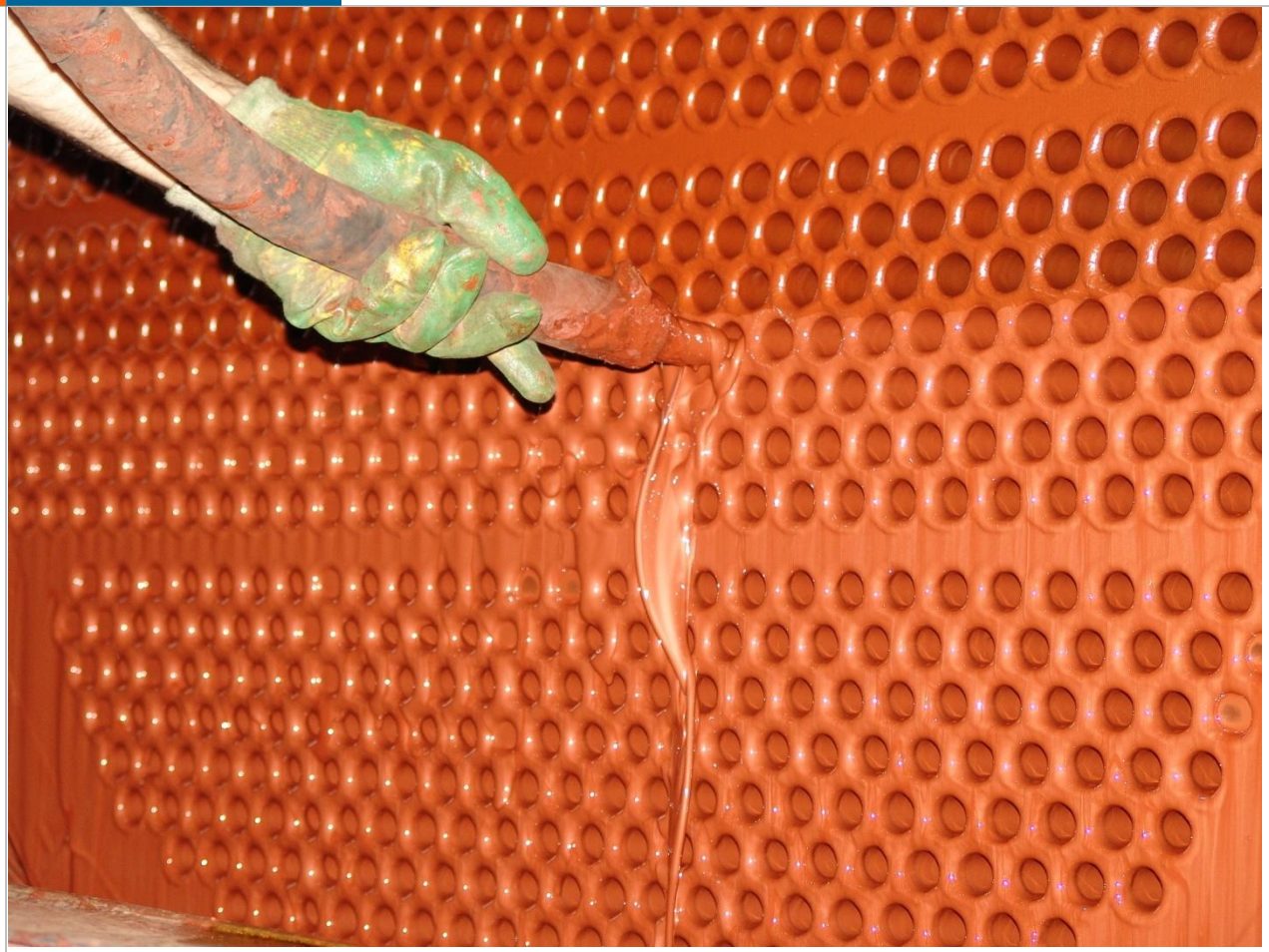
The Know how of SAEKAPHEN



- SAEKAPHEN - MOVIE


BASF
SAKAPHEN





Baking process

The units to be protected have to be baked after each layer of the heat cured coating.

Prebaking temperature: 120 - 150 °C, final baking: 200 - 220 °C.

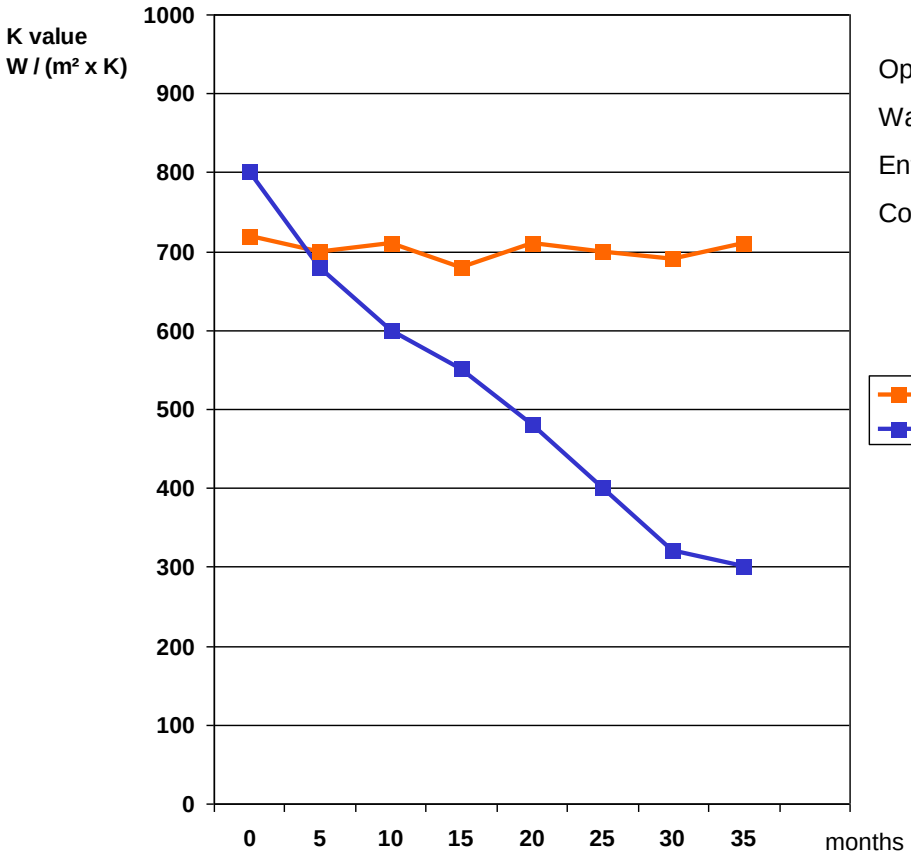
testing equipment

Film-Thikness Measurement

testing equipment

Pinhole or Sparkling Test

Dependence of heat transfer on operating time



Operating period in days

Water-cooled condensers, parallel operation

Entry temperature of condensate: 98 – 103 °C

Cooling water speed: 0.3 m/sec.

A practical example

The heat transfer of a new uncoated heat exchanger amounted to 800 W/mK. After an operating of approx. 2 months, the heat transfer was reduced to 600 W/mK as a result of increasing fouling and incrustation.

After approx. 19 months of operation and interim high-pressure cleaning, the heat transfer was reduced to approx.
350 W/mK.

The heat exchanger was then decommissioned.

SAEKAPHEN - the Alternative

A heat exchanger coated with **SAEKAPHEN**, operated at the same location and under the same conditions, has been operating for approx. 3 years without any cleaning and with a constant heat transfer of approx. 625 W/mK.

This heat transfer corresponds to the heat transfer of an uncoated tube after approx. 2 months of operation.

Application

Economic Benefits

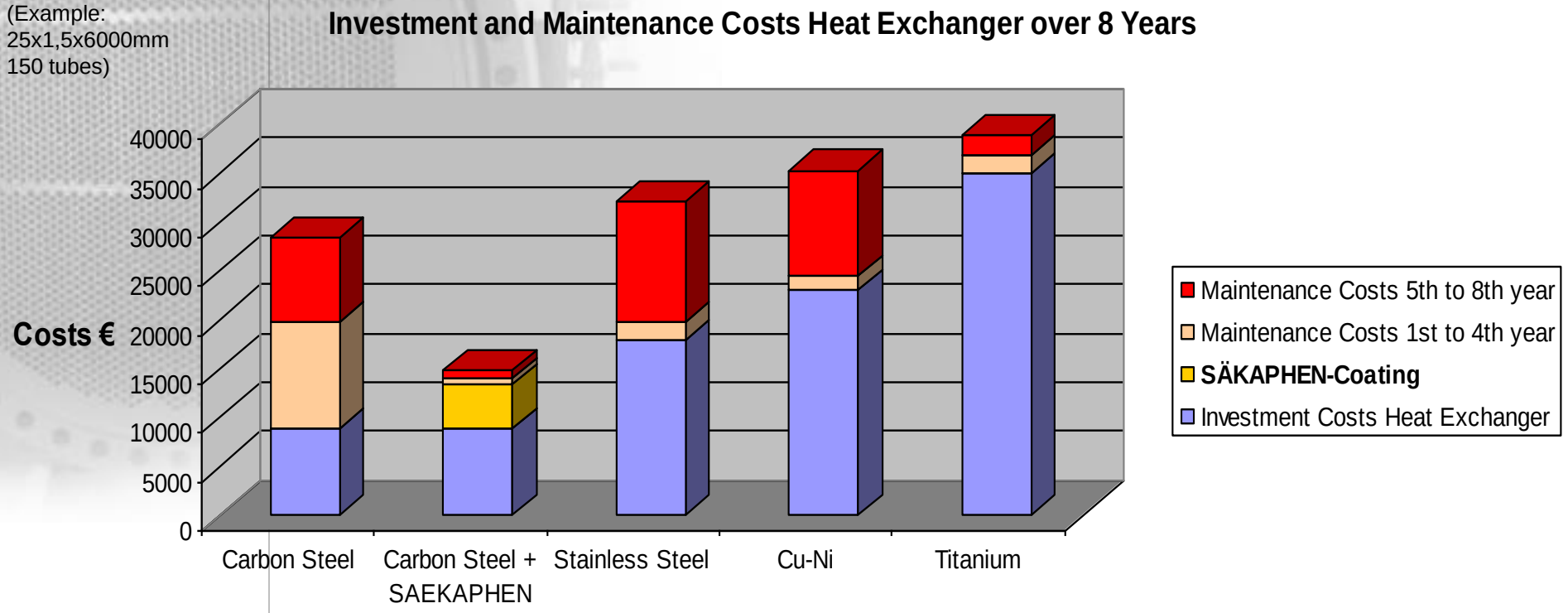
SAEKAPHEN
- the optimum solution against corrosion

Capital costs are reduced due to the usage of simple carbon steel

Operational costs are reduced as fouling/scaling on the tube surfaces of the heat exchanger are prevented.

It will prolong the life of the units coated to average durability of 10 to 15 years.

Total Cost for Heat Exchanger
(Example:
25x1,5x6000mm
150 tubes)



SAEKAPHEN Coating Pricing Range

Total Surface Area	Price Range per sqm
Below 10 sqm	**€ 500 to € 218**
10 sqm to 30 sqm	**€ 218 to € 131**
Above 30 sqm	**€ 131 to € 60**

NACE JUBAIL

SAKAPHEN

Tag No.	E 2352	SHELL & TUBE	Job No.			
Location	OXO C4	HEAT EXCHANGER	Page	4/14	Rev	0
Datasheet Ref. No	TCP/OXO/E2352/2004					

Construction Of One Shell

	Rev			Shell	Tube
1		Design Pressure, internal	barg	3	6
2		Design pressure, external	barg	FV	
3		Max Design Temperature	°C	200	200
4		Min Design Temperature	°C	5	5
5		Test Pressure (hydrostatic)	barg	4.5	9.0
6		Stress factor, design		Acc. to code	Acc. to code
7		Stress factor, test		Acc. to code	Acc. to code
8		No. Passes per shell		1	2
9		Corrosion allowance	mm	1.6	1.6
10		Corrosive component in fluid			
11		Joint efficiency	%	100	100
12		Radiographic examination		Acc. to code	Acc. to code
		Nozzle Loads		See page 9	See page 9
		Other Loads			
15		Pressure design to		ASME VIII DIV. 1 / TEMA CL.B	ASME VIII DIV. 1 / TEMA CL.B
16		Material to		ASME	ASME
17		Heat treatment		Acc. to code	Acc. to code
18		Non destructive testing		Acc. to code	Acc. to code
19		Shot-blasting / Painting		3)	
20		Surface Treatment		3)	SAKAPHEN
21		Cladding/Lining			
22		Construction tolerances		Acc. to TEMA / BC Standard 14-710-01	
23		Type of welded joints		Refer to BC Standard 14-133-01 and page 10 of this specification	
24		Rating of welded joints		Acc. to code	
25		Support type			
26		Shell diameter	mm	219	56
27		Shell nominal diameter	mm	200	57
28		Shell wall thickness	mm	4	58
29		Type of shell cover			59
30		Shell cover thickness	mm	2)	60

26		Shell diameter	mm	219	56		Cross baffles		Yes
27		Shell nominal diameter	mm	200	57		No of baffles		13
28		Shell wall thickness	mm	4	58		Baffles type		Segmental
29		Type of shell cover			59		Cut (Vertical/horizontal)		Horizontal

6) According to TEMA Class B

BASF Petronas Chemicals specify SAEKAPHEN

BASF Aktiengesellschaft **BASF**

Specification Sheet Technisches Blatt Continuation Fortsetzung	Tubular - Heat Exchanger Rohrbündel - Wärmeaustauscher	Job-No.: Job-Nr.:	Bldg: U150 Bau:
		Eqpt-No.: Pos.-Nr.:	W204C/D
		Page 5 of 15 Blatt von	

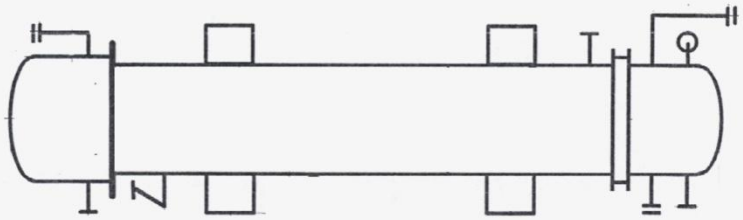
Surface Treatment, Surface Protection / Oberflächenbehandlung, Korrosionsschutz

[X] Primer for carbon steel parts acc. to WN 33-001-1 Grundbeschicht. f. Teile aus C-Stahl n. figure 6.2 Ziffer	[X] Austenitic stainless steel acc. to WN 82-043 Nichtrostende, austenit. Stähle n.
[X] Final coat acc. to WN 33-001-1 Gesamtbeschichtung nach / figure 7.2.3 Ziffer	[X] Stove enameling acc. to DIN 28051 / DIN 28053 / DIN 28054 / DIN 28055 Einbrennlackierung nach
[ ] Grinding and polishing acc. to WN 7-044 Schleifen und Polieren nach max. roughness peak – to – valley height Zulässige größte Rautiefe allowed Rmax µm R max.	[ ] Glass lining acc. to DIN 28063 Emaillierung nach
	[ ] Hot – dip - galvanizing Feuerverzinkung acc. to DIN 50976 (for parts) nach (für Bauteile) and DIN 267-10 (for bolts / nuts) und (f. Schrauben / Muttern)
[X] Lining acc. to DIN 28051 / DIN 28053 / DIN 28055 Auskleidung nach	Material Material: Säkaphen Si57E

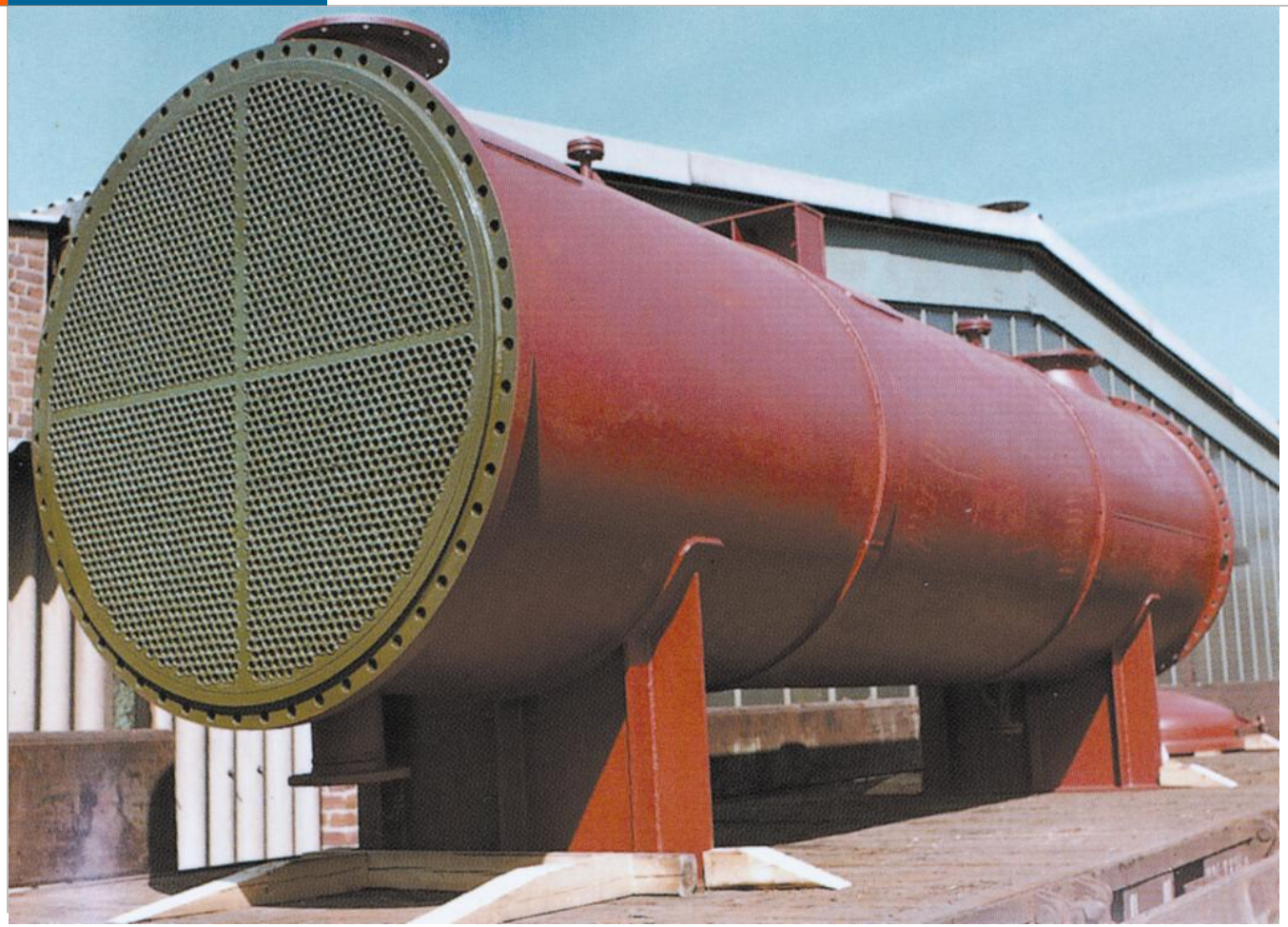
WN = BASF Standard

Notes / Bemerkungen

[X] Selection and sizing of wall thicknesses by manufacturer. The proposal shall include the chosen wall thicknesses. Auswahl und Auslegung der Wanddicken erfolgen durch den Hersteller. Die gewählten Wand - dicken sind im Angebot zu nennen.
[ ] The specified wall thicknesses are minimum values. No additional loads are considered. In case the structural and / or stress calculations reveal the need for increased wall thicknesses locally, bracing ribs and / or pads, these are part of contracted performance / delivery. Die angegebenen Wanddicken sind Mindestwerte. Sie berücksichtigen keine Zusatzlasten. Ergeben sich aus Statik und / oder Festigkeitsberechnung örtlich dickere Wände, Verstärkungs - bleche und / oder –ringe, gehören diese zum Leistungs- und Lieferumfang.
[X] Heavier wall thickness and / or bracing pads necessary because of external pressure are part of contracted performance / delivery. Werden für äußeren Überdruck dickere Wände und / oder Versteifungsringe notwendig, gehören diese zum Leistungs- und Lieferumfang.
[ ] Spare gaskets are within scope of supply for the following flange connections: Reservedichtungen sind im Lieferumfang für folgende Flanschverbindungen enthalten:

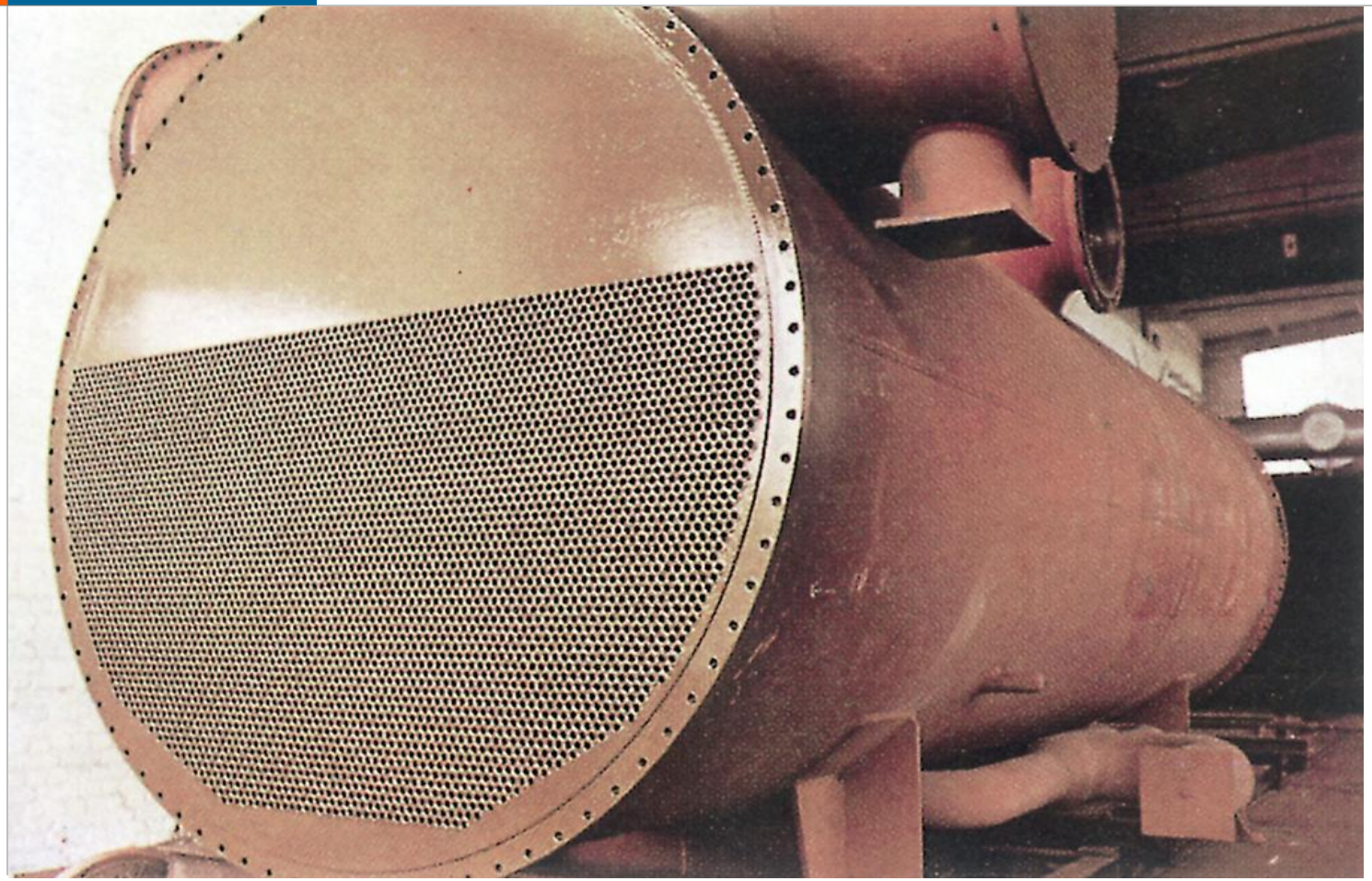


BASF Germany specify SAEKAPHEN



circulation water condenser, ordered by Fertilizer Plant, Kuwait

some tube bundles (shell- and tube-side coated)



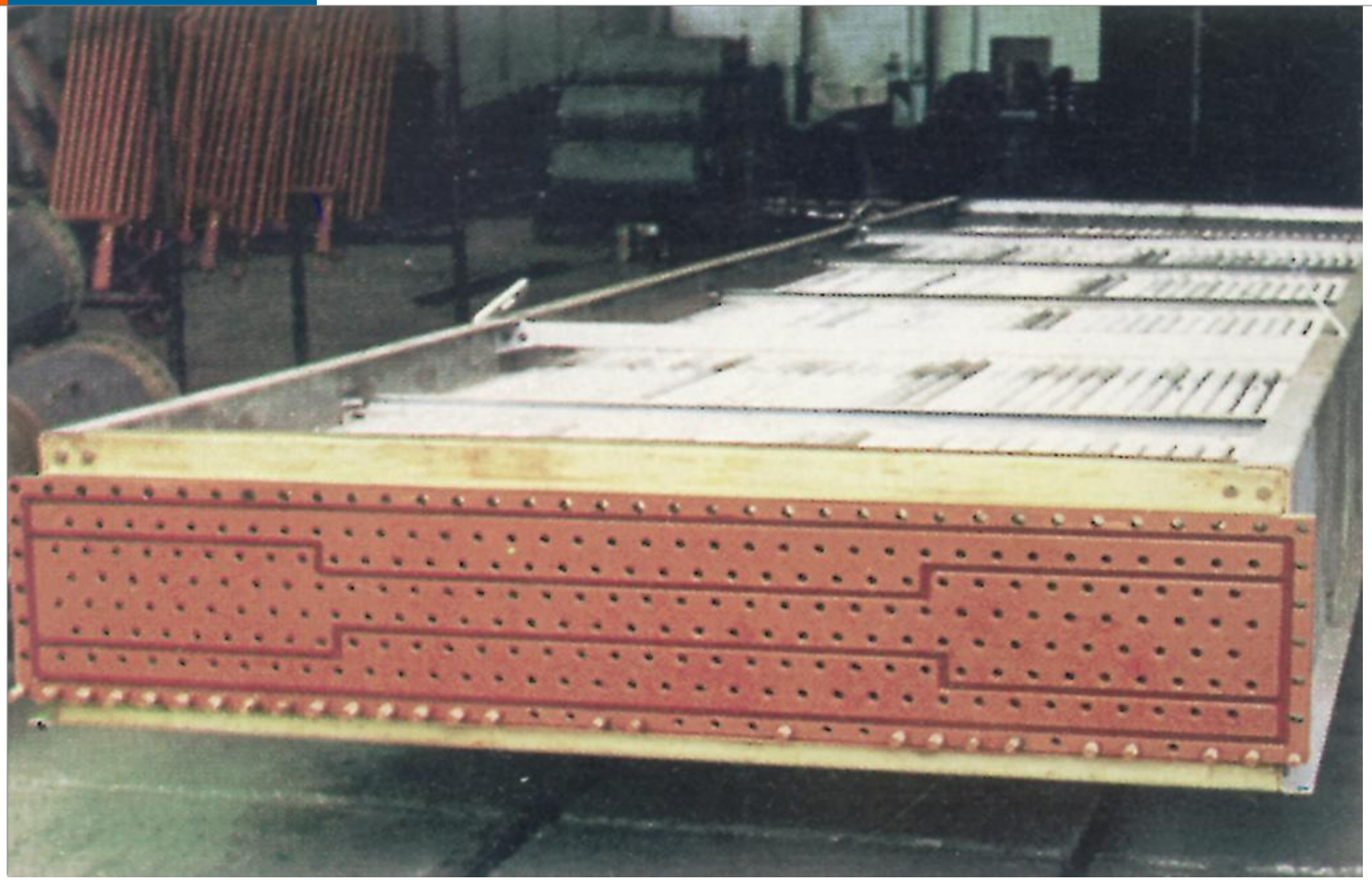
turbine condenser (tube-side coated), ordered by

BP Deutschland, Germany

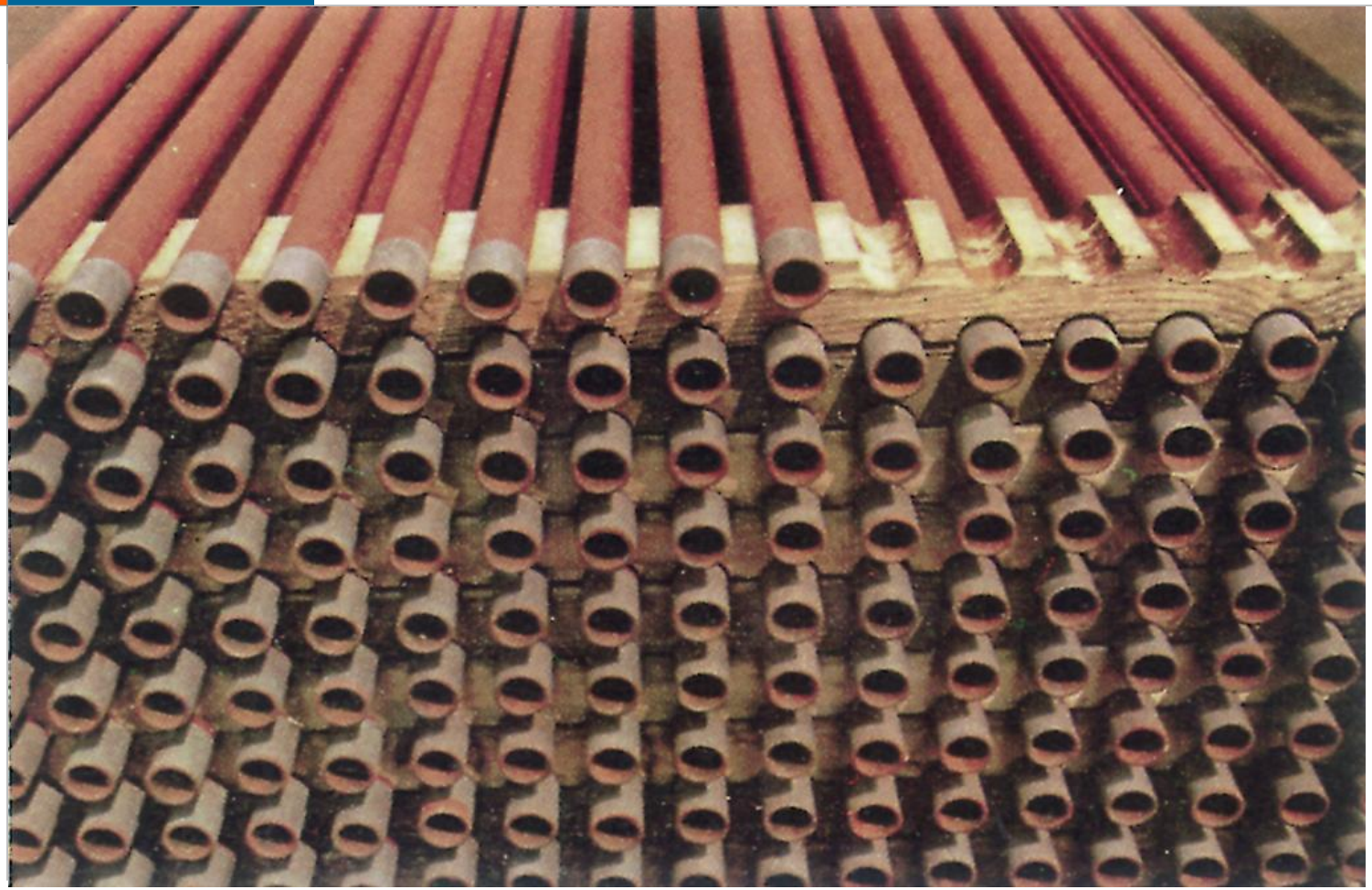
condenser for power plant (ordered by Siemens AG; before coated)

condenser after tube-side coating

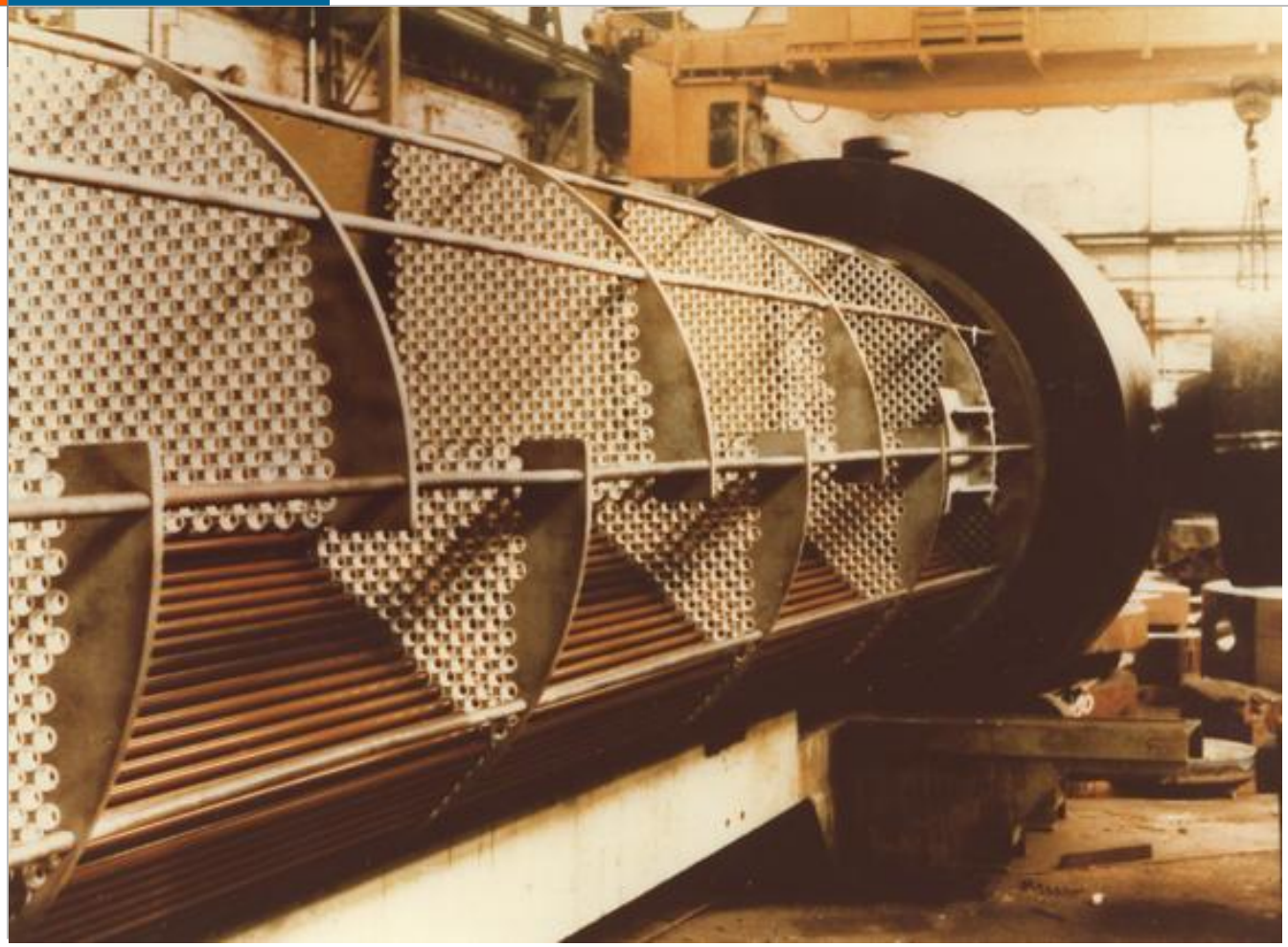
condenser ready for shipment



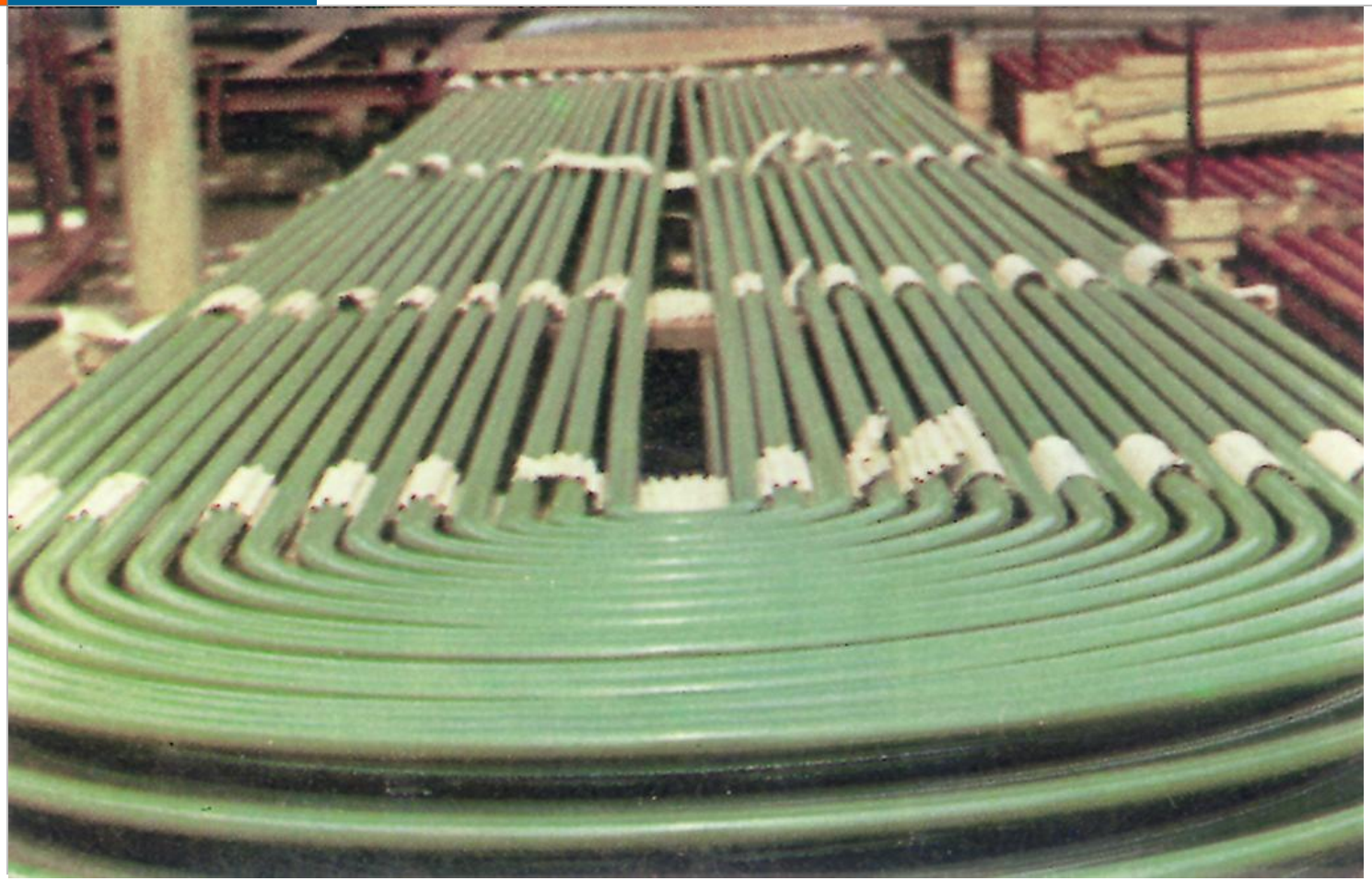
air cooler (tube-side coated), odered by Caltex, Germany



shell-side coated tubes (tube by tube)



assembling of shell-side coated tubes and tube sheets



shell-side coating of U-tube bundle

The SAEKAPHEN heat cured coating technology

The special know how with long experience - of SAEKAPHEN does not only apply to the coating of heat exchanger, tube bundle, condenser and air cooler but also to tanks, vessels and road- or railway containers.

Size of Heat exchanger to be coated with SAEKAPHEN heat-cured material up to:

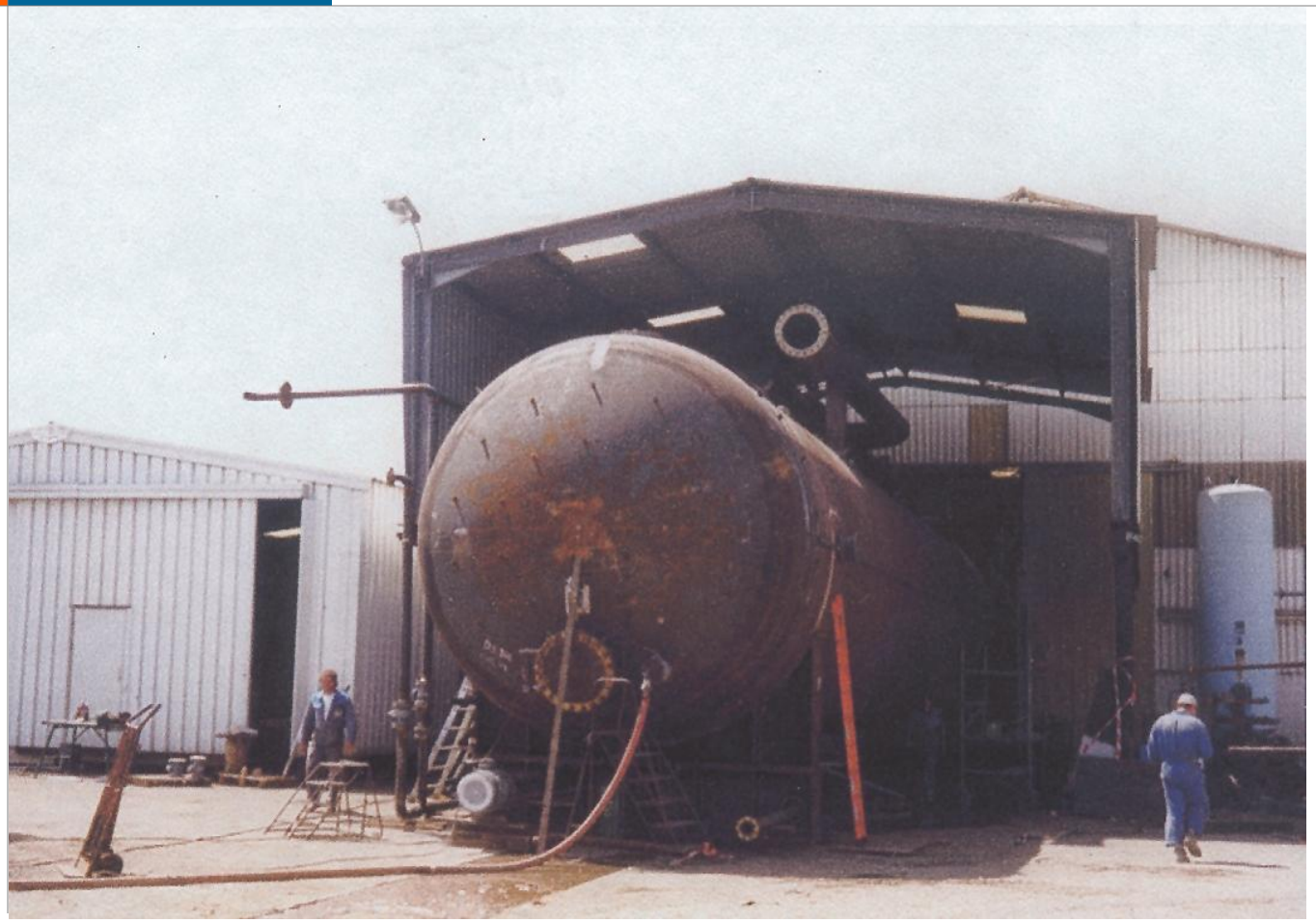
4,0 m in diameter, 16,0 m in length

Heatcured coating of longer units requires a special movable polymerisation oven, available only at the workshop of the belgian licencee.

another road container coated

heat cured coating Si 14E of railway container

heat cured coating Si 14E of a storage tank



storage tank internal coated with SI14E

high pressure coated with SI14E

internal heat cured coating Si 14E of a channel

internal heat cured coating Si 14E of drinking water tanks

SAEKAPHEN - leading manufacturer of special coating Material and applicator of special coating technologies

Heat cured coatings

Cold cured coatings

SAEKAPHEN - leading manufacturer of special coating materials and applicator of special coating technologies

Customer profile

National/international engineering companies

End customers: refineries, fertilizer plants, chemical and petrochemical industry power plants, pharmaceutical industry, sugar industry, breweries, wine producers, and the food and beverage industry.

Equipment manufacturers: producers of heat exchangers, chemical equipment, tanks and silos, pipelines, vessels, road and rail-road containers

Range of coatings:

Heat cured coating of heat exchanger with expanded or welded tubes, U-tube bundles, condensers, tube sheets, air coolers, preheaters, storage tanks, vessels, road and railroad containers, hot-water boilers, turbine motors and pipelines.

Cold cured coatings of storage tanks, transportation vessels, containers, silos, boilers, filters, pipelines, chimney components used for flue gas desulphurisation

SAEKAPHEN - Offering competence and experience in anti-corrosion protection. Optimum product quality and service. Setting the standard for process and operational reliability.

coating Workshop in Damman, K.S.A

of our Licensee Al-Qhatani


EASTERN MORRIS CRANES CO.
SWL 40t

coating Workshop in TELUK KALONG, Malaysia

of our Licensee UMW SAEKAPHEN COATING SDN BHD


UTAMAKAN

coating Workshop in Gwangyang-City, Korea

of our Licensee Saekaphen Korea Co., Ltd.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SAEKAPHEN LICENSEES

World-wide licensees


SOUTH-KOREA, Gwangyang


DENMARK, Hvidovre


SPAIN, Cantabria


FRANCE, St. André


U.K, West Yorkshire


ITALY, Milano


USA, Wisconsin


USA, Texas


AUSTRIA, Kleinneusiedl


BELGIUM, Trazegnis


KINGDOM OF SAUDI ARABIA, Dammam


POLAND, Gliwice


PORTUGAL, Lisboa


MALAYSIA, Kuala Lumpur

New Licensee for Oman

- **AITS**
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- P. O. Box 51,
- P. C. 124, Al-Rusayl
- Muscat/ Sultanate of Oman
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Thank you