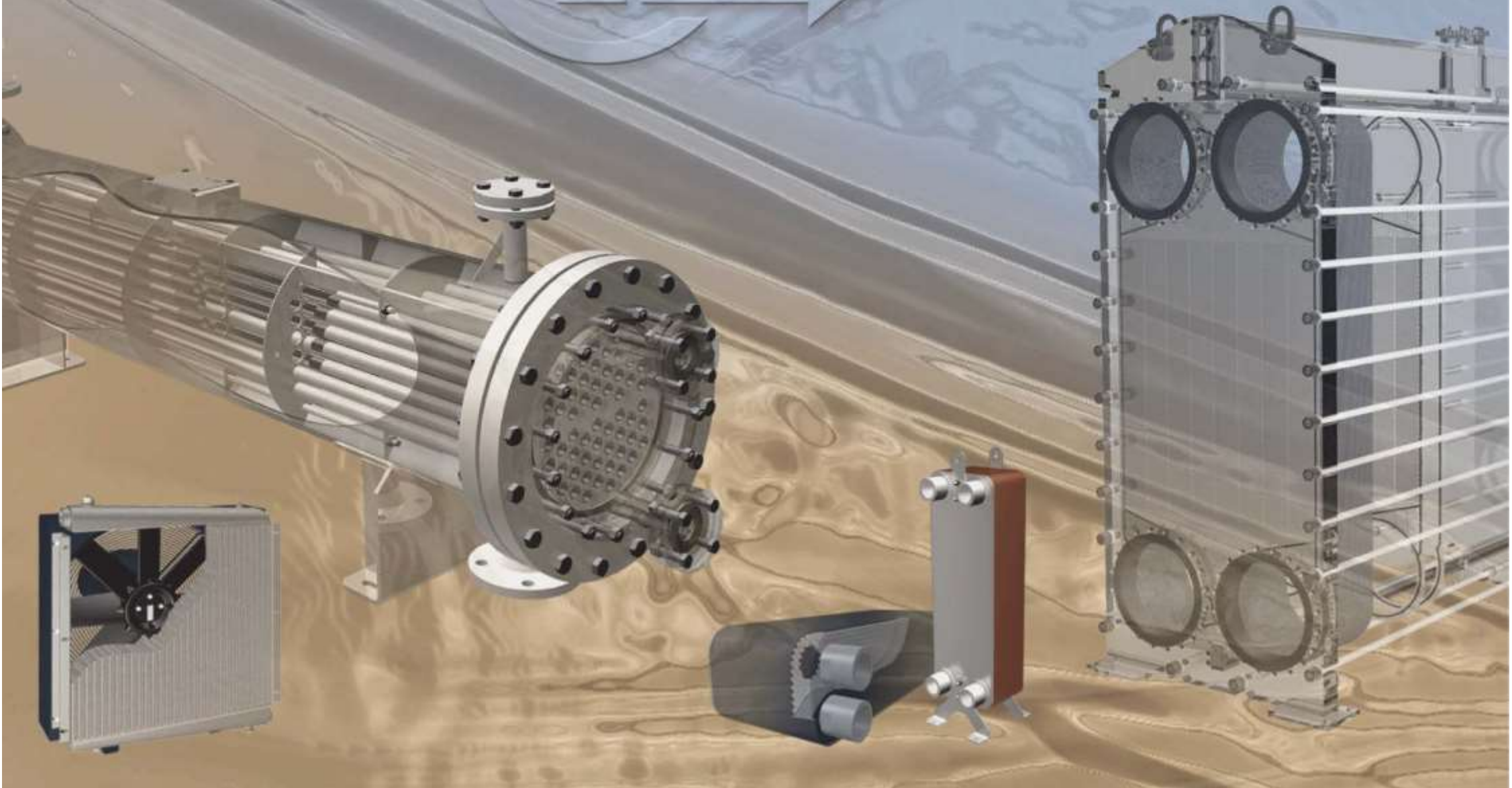


**FUNKE** 

Quality Heat Exchangers





# **Introduction *Who we are***

**FUNKE is your specialist for the development and fabrication of heat exchangers with a heat transfer area from 0,04 m<sup>2</sup> of up to 2500 m<sup>2</sup>.**

**FUNKE heat-exchangers are used in various industries and offer a wide range of applications.**

**FUNKE calculates, designs and fabricates the most common types of heat exchangers and as such offers superior expertise in a variety of solutions.**

## Activities *Growth in numbers*

The quality and reliability of our products and performance  
result in a continuous growth

	1999	2015
<b>FUNKE Headquarters in Germany</b>		
<b>Employees</b>	<b>125</b>	<b>280</b>
<b>Group Turnover (Mio. €)</b>	<b>14</b>	<b>60</b>
<b>Subsidiaries</b>	<b>0</b>	<b>7</b>
<b>with employees</b>	<b>0</b>	<b>210</b>
<b>International Sales &amp; Service Partners</b>	<b>12</b>	<b>30</b>
<b><i>Employees in the Group</i></b>	<b><i>ca. 140</i></b>	<b><i>ca. 500</i></b>





# Introduction *Growing of Headquarters in Gronau/Leine*

1974

1990

2006

2008

2013





## Activities *The FUNKE Group until now*

**FUNKE Wärmeaustauscher  
Apparatebau GmbH. Germany**

FUNKE échangeurs  
*France*

FUNKE Heat Exchanger Systems  
*P.R. China*

FUNKE Heat Exchangers USA, Inc.  
*USA*

FUNKE RUS OOO  
*Russia*

T.T.T. Total Transfer Technology s.r.l./FUNKE  
*Italy*

FUNKE Ukraine Ltd.  
*Ukraine*

TOO FUNKE Kazakhstan  
*Republic of Kazakhstan*



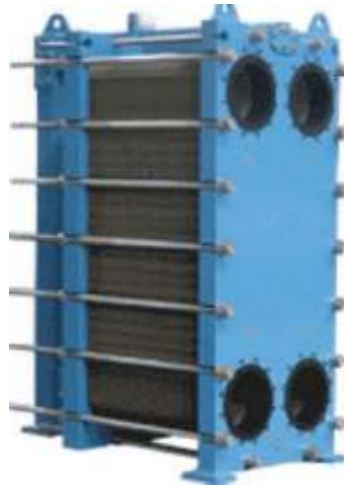
*Supported by a global net  
of ca. 30 sales and  
service partners!*





# Introduction *Range of products*

Bolted Plate Heat Exchangers  
(gasketed & semiwelded)



Brazed  
Plate Heat Exchangers



Oil / Air Cooling Units



Shell-and-Tube  
Heat Exchangers





# Introduction

*Our products apply to*

HEATING

COOLING



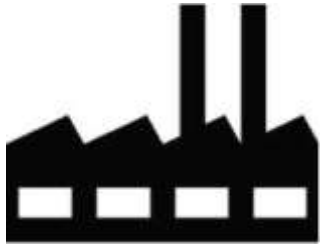
VAPORIZING

CONDENSING

*of liquids and gases*



## Introduction *Fields of Application*



**Mechanical engineering**

**Compressors**

**Chemistry**

**Food/Pharmaceutics**

**Petrochemistry**

**Paper Industry**

**Hydraulic systems**

**Lubricating oil systems**

**Shipbuilding**

**Heating/Ventilation/Air-conditioning**

**Power Plants**







# Introduction *Application examples I*



Double Oil-Cooler



Oil cooling



Double Oil-Cooler for  
Brazilian Oil-Rig



Methanol Cooler

Double  
Oil-Cooler





## Introduction *Application examples II*



Power Plant of 5x12 MW

Process Water Cooling



Double oil cooler





# Introduction *Application examples III*



Hydraulic  
oil cooling in  
power plant



Condensation  
of bioethanol



Cooling of hydraulic  
oil for high pressure  
air compressors  
in oil exploration

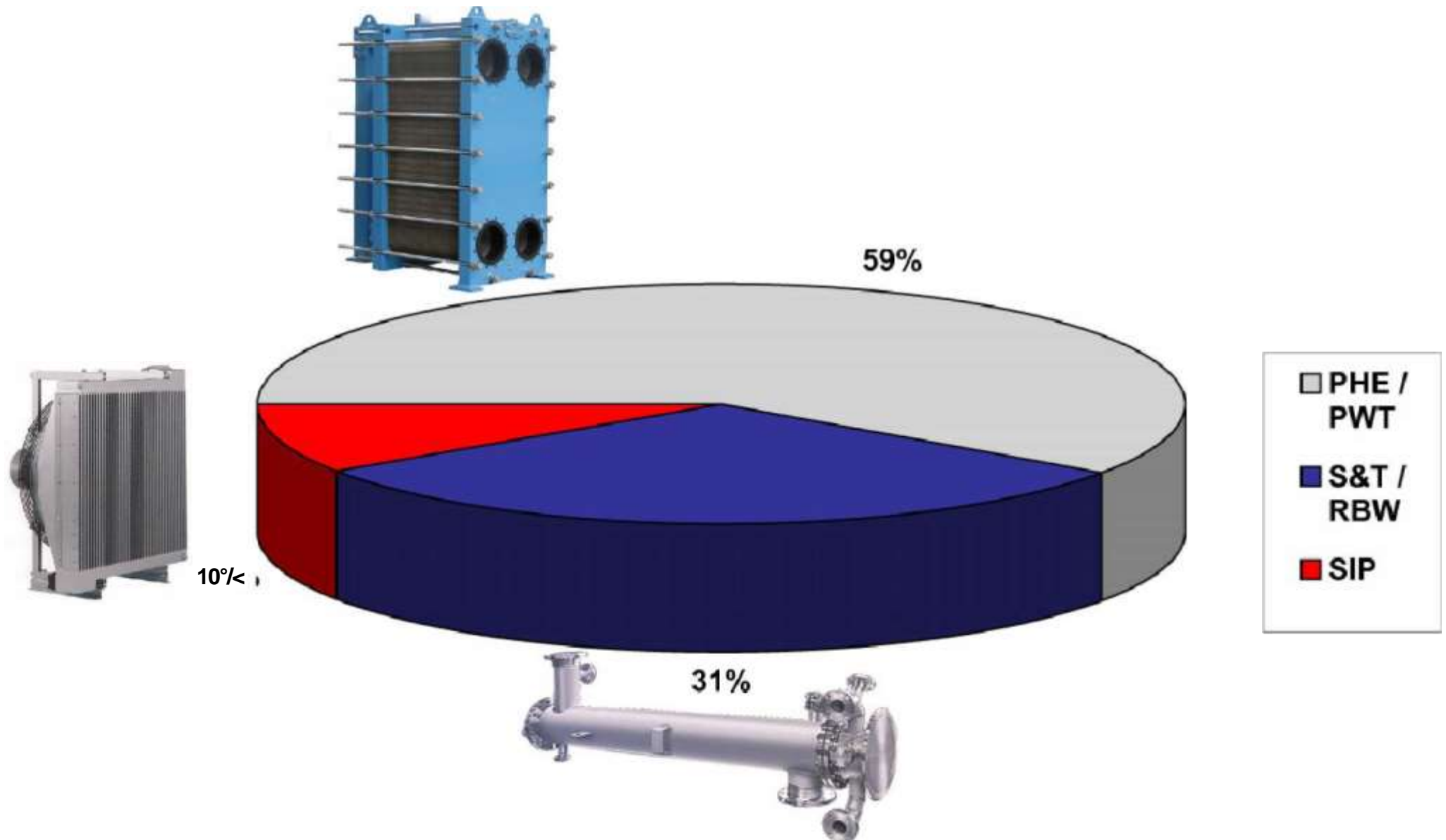


Cooling of lubricating  
oil for extruding presses





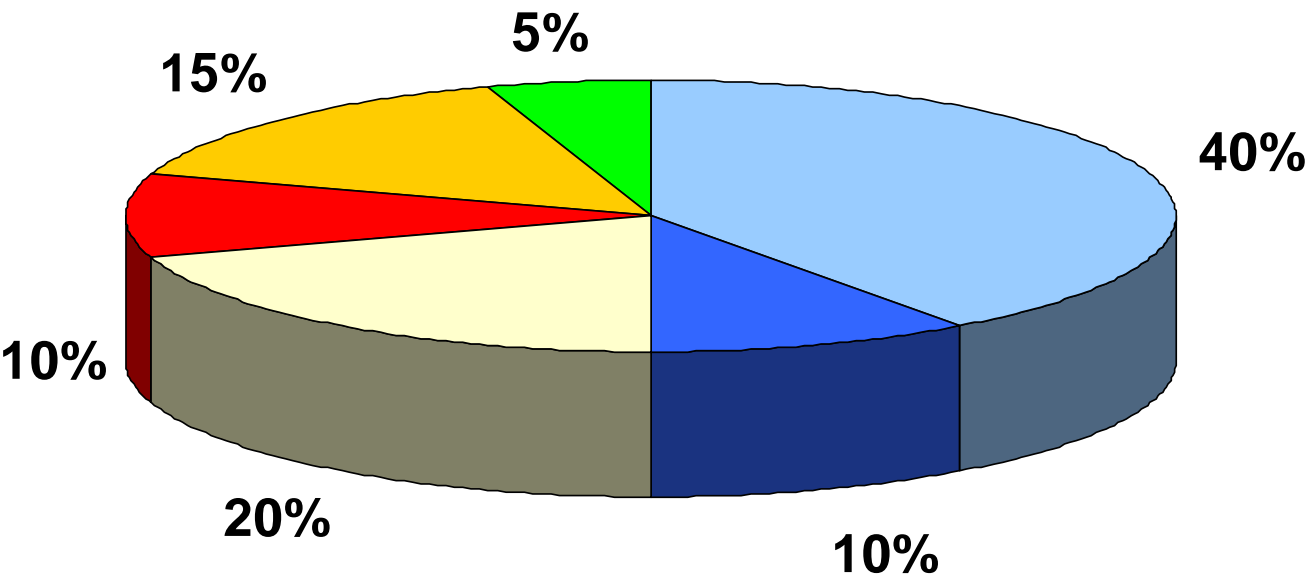
## Introduction *Turnover by product lines*





# Introduction

## *Turnover by industry segments*



- Mechanical engineering (OEM)
- Food / Pharmacy
- Heating/Ventilation/Air conditioning
- Chemistry
- Petrochemistry
- Trade etc.



# Introduction      *References*

## Some of our customers

Hyundai	Uhde	GAMA	Atlas Copco
Coperion	Technip	Hitachi	Burckhardt Compression
Andritz	LMF	Linde Group	Evonik Industries
GE Energy	Voith	Samsung	Daelim Industrial
Bayer	Fuji	Zeppelin	NNE pharmaplan
BASF	MAN	Howden	Dresser-Rand
Liebherr	Daewoo	Hydac	Gardner Denver
Siemens	Alstom	Lanxess	Bosch-Rexroth

... and many more





# Introduction *Core Competencies*

## World-wide standards / design codes

EU-97/23/EG (Pressure vessels)

AD-data sheet (D)

TEMA (International)

ASME, U-Stamp (USA)

API (American Petr.Industry (USA)

British Standard (GB)

DIN EN 13445

ABS (USA)

USSR-Register of Shipping

GOST R and B

Lloyd's Register

Det Norske Veritas

... and others



# Introduction

# *Core Competencies*

**We have supplied in accordance with the following customer specific specifications**

## Engineering companies

## Oil companies

Badger	R.M. Parsson
C.J.Brown	Petronas
Fluor-Daniel	Davy Powergas
Edeleanu	SNAM Progetti
Fluor	Technimont
Linde	Technip
Lummus	Uhde
Lurgi	Foster Wheeler

Agip  
BP  
Esso  
Exxon  
Shell  
Statoil



# Introduction *Certified Competence*

TEMA-Standard •

DIN EN ISO 9001:2008 •

ASME U-Stamp •

Germanischer Lloyd

Bureau Veritas

Det Norske Veritas

HP0 in connection with DIN EN 729-2

and others

ATEX

AD-2000

NACE-Standard







# Introduction *Core Competencies*

## Calculation with HTRI-Software





# **Introduction *Manufacturing equipment in Gronau***

## **Machinery and Plants**

laser-plasma cutting equipment  
machine tools CNC and conventional  
large automatic presses (max.15.000 tons)  
vacuum soldering installation  
shot blasting equipment  
pickling bath  
paint shop  
rolling equipment for tubesheets

## **Testing procedures**

equipment for hydraulic tests  
with automatic pressurising up to 200 bar  
manual pressurising up to 600 bar  
radiographic test  
magnetic particle test  
ultrasonic test  
spectroscopic analysis  
high tension test  
penetration test  
helium test  
layer thickness test



# Shell-and-Tube Heat Exchangers





# Shell-and-Tube Heat Exchangers

## Technical Key-Data (depending on design)

Performance	1 kW - 30 MW
Transfer Surface	0.11 m <sup>2</sup> - 2000 m <sup>2</sup>
Shell Diameter	60 mm - 2000 mm
Operating Temperature	-20°C - 500°C
Operating Pressure	max. 600 bar

## Maximum Product Dimensions

max. diameter	2000 mm
max. weight	20 t
max. length	10 m

These factors are interdependent, i.e. a much lighter heat exchanger may be 10 m or longer.





# Shell-and-Tube Heat Exchangers

## *Material*

According to the pertinent rules regulations and media used, different materials are applied, mainly:

- Carbon Steels
- Stainless Steels
- Non-ferrous Metals

Additionally, the use of special materials such as titanium as well as platings and coatings is possible.



# Shell-and-Tube Heat Exchangers Design

## Shell-and-Tube Heat Exchangers

Standard units

TDW, BCF, CCF, SSCF, CCFA

Preselected geometries allow for:

- Short delivery times
- Attractive price performance ratio
- Guaranty of years of approved series

Customized solutions

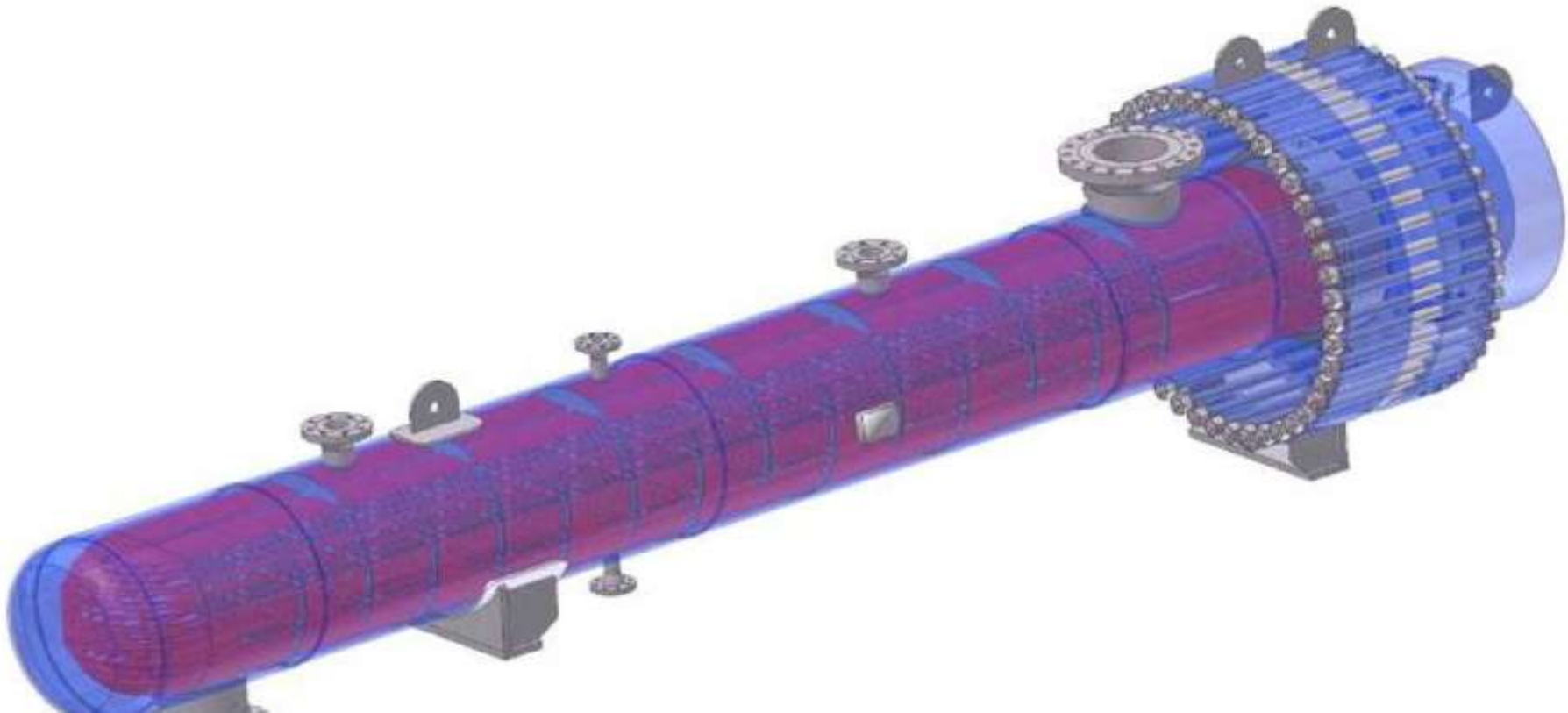
CP, A 100, C 100...C 500, WRA 200

Strict implementation of customers requirements:

- Company specifications
- Standards of engineering companies
- International design standards

# Shell-and-Tube Heat Exchangers

**Customer Specific - C300 with 300 bar Working Pressure**







# Shell-and-Tube Heat Exchangers

**Customer Specific - C300 with 300 bar Working Pressure**





# Shell-and-Tube Heat Exchangers

A Glance in production



Quality Heat Exchangers



# Shell-and-Tube Heat Exchangers

Impressions of ability







# Shell-and-Tube Heat Exchangers

Impressions of ability





# Plate and Frame Heat Exchangers



# Plate and Frame Heat Exchangers

*General*

FUNKE heat transfer plates were developed to create high heat transfer coefficients.

This results in a superior economical and technical adaption to the respective application requirements.

Single-pass and multi-pass plate heat exchangers

- heat exchange surface/plate 0.04 - 3.00 m<sup>2</sup>
- max. design pressure 25 bar
- max. design temperature 195° C

Also available as safety plate heat exchangers (in double-wall-design)







# Plate and Frame Heat Exchangers

***Material***

## Plate material

### Standard

- 1.4404/AISI 316 L
- 1.4401/AISI 316
- 1.4301/AISI 304
- 1.4547/254 SMO
- Titanium ASTM B 256 Grade 1

### Optional

- 1.4539/AISI 904L
- Alloy C276
- Titanium-Palladium  
ASTM B 256 Grade 11
- 2.4066/2.4068  
(Nickel 200 / Nickel 201)
- 2.4602 (Alloy C-22)
- 2.4605 (Alloy 59)
- Tantal

Thickness: 0,5-0,7 mm





# Plate and Frame Heat Exchangers

## *Material*

### Gasket materials

NBR (nitrile-rubber)

EPDM (ethylene-propylene-rubber)

Viton (fluorine-rubber)

all in varied quantities

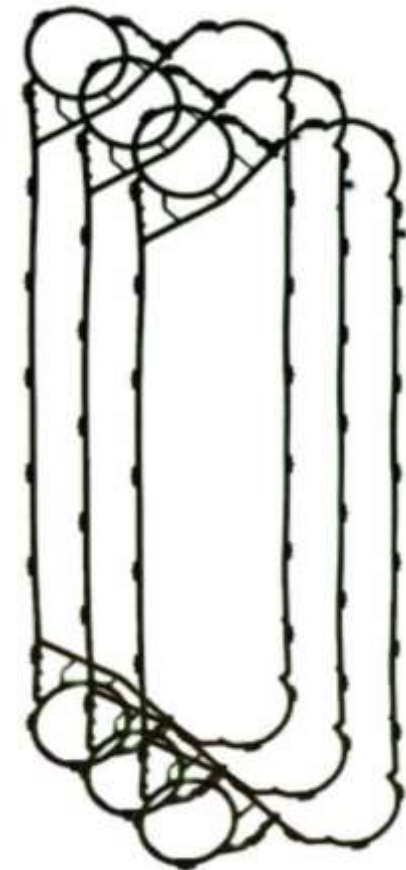
### Optional

Chloroprene

HNBR

Butyl

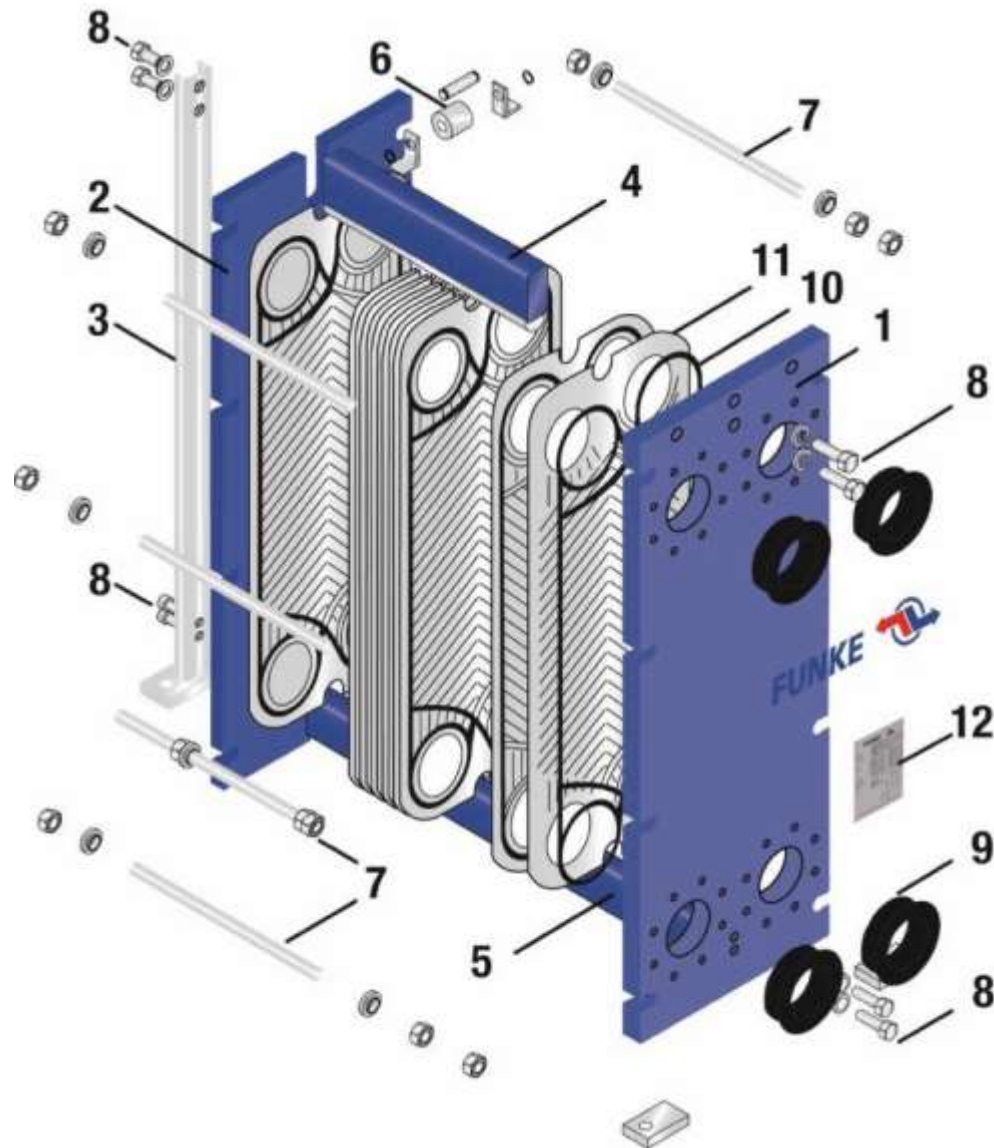
others



# Plate and Frame Heat Exchangers

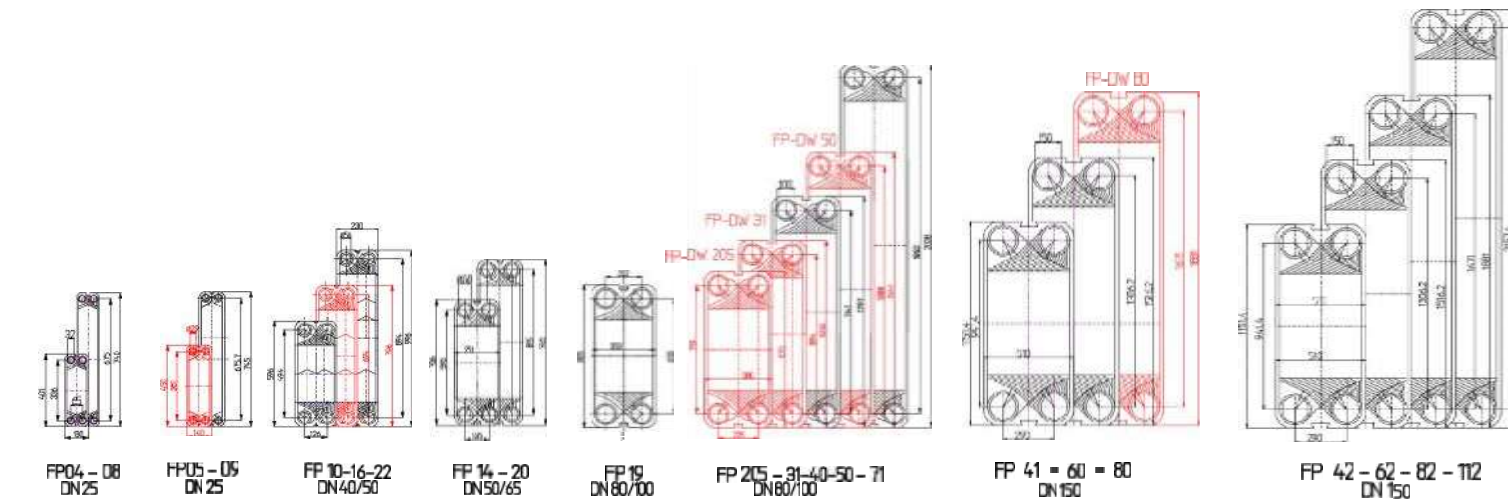
## *Design*

1. Fixed plate
2. Movable plate
3. Support column
4. Carrying bar
5. Lower plate guiding bar
6. Carrier roller
7. Tightening bolt and nuts
8. Fixing bolts
9. Rubber liner
10. Gaskets
11. Heat transfer plates
12. Name plate



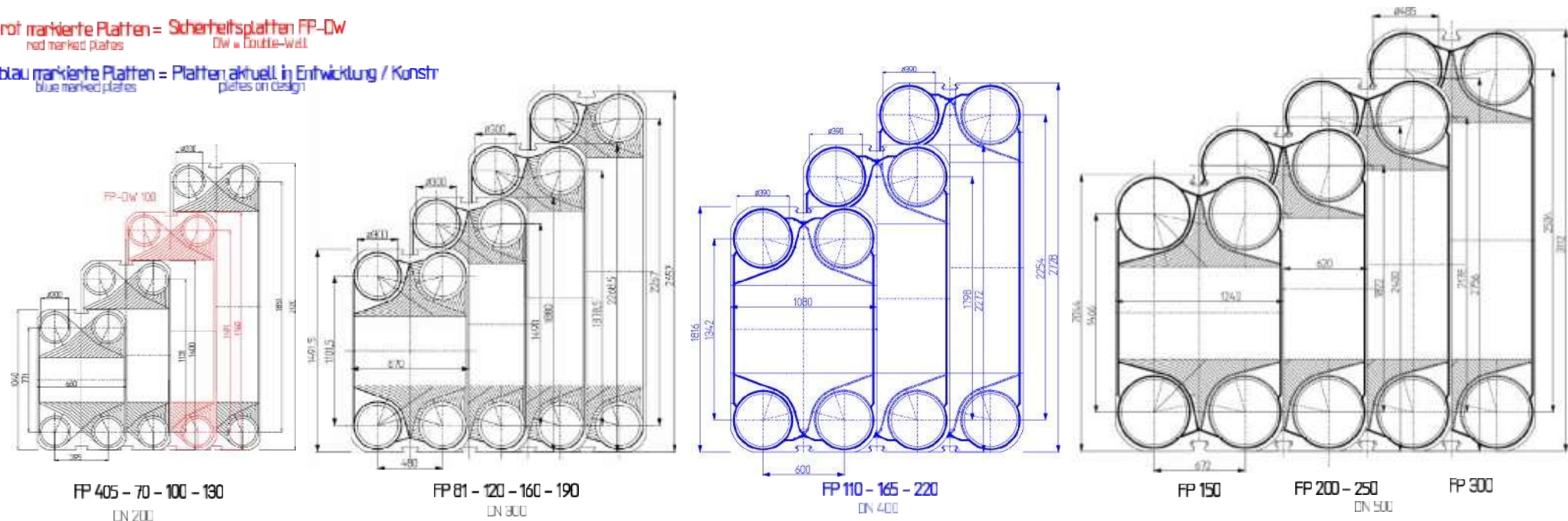


# Plate and Frame Heat Exchangers



rot markierte Platten = Sicherheitsplatten FP-Dw  
red marked plates = safety plates FP-Dw

blau markierte Platten = Platten aktuell in Entwicklung / Konstr.  
blue marked plates = plates currently in development / construction





# Plate and Frame Heat Exchangers

*Production*

## Embossing of quality plates

1,500 tons  
embossing force



2,200 tons  
embossing force



4,000 tons  
embossing force



6,000 tons  
embossing force







# Plate and Frame Heat Exchangers

## *Production*

**Fully Automated Press Line with 15,000 tons Embossing Force**







# Plate and Frame Heat Exchangers

## *Production*







# Plate and Frame Heat Exchangers

*Production*

## Final Assembly Hall



Plate Heat Exchangers for  
power industry applications



# Plate and Frame Heat Exchangers *Production*

Large and Small







# Plate and Frame Heat Exchangers

## *Application*



Double Oil Cooler

Application in mechanical engineering: Luboil cooling for gas and steam turbines



Application in Power Plant



# **Safety Plate Heat Exchangers with double wall design - FPDW**



# Development Plate and Frame Heat Exchangers

## Safety Plates FPDW

Alternatively to the yet existing plate material 1.4404 (AISI 316L) we embossed first samples made of titanium. These plates will also consist of 2 single plates with the thickness 0,3 5mm per blank.

The max. allowable pressure is 10 bar.



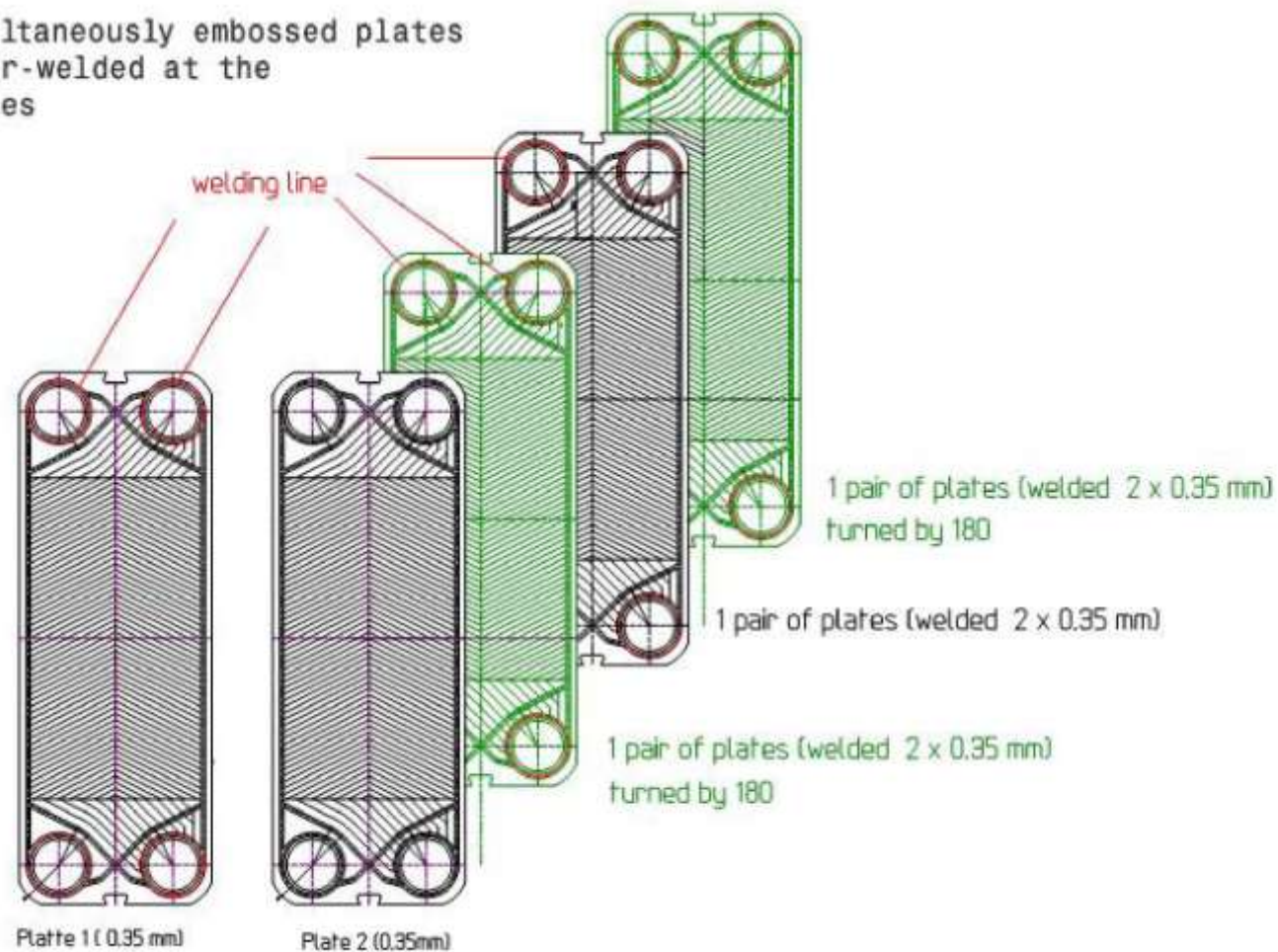


# Plate and Frame Heat Exchangers

*Technology*

## Safety Plate Heat Exchangers with double wall design - FPDW

two simultaneously embossed plates  
are laser-welded at the  
port holes





# Brazed Plate Heat Exchangers



## Brazed Plate Heat Exchangers *Types GPL/GPLK*







# BPHE Types GPL/GPLK

## *Applications*

### Application conditions

#### Operating pressure and operating temperature

- The BPHE GPL/GPLK is designed for a working pressure up to 30 bar / 435 psi at max. 200°C / 392 °F.
- In special designs, GPL/GPLK can work with up to 45 bar / 653 psi at 150°C / 302°F.
- The NPL (nickel brazed) can be operated at 16 bar / 232 psi at 200°C / 392°F.
- In special designs, NPL can be operated at up to 27 bar / 391 psi at 200°C / 392°F.

**Material:** For the plates stainless steel  
                  ANSI 316 / 1.4401 is used.

**Performance:** 2.0 to 6 000 kW / 6824 Btu to 20.5 MBtu





# BPHE Types GPL/GPLK

## *Applications*

### Media

Copper brazed plate heat exchangers GPL/GPLK are mainly used for media such as

- Oil and oil containing fluids
- Glycol mixtures
- Alcohols
- Refrigerants
- Gas/Air
- Water
- many more (according to media properties and its viscosity)





## BPHE Types GPL/GPLK

## *Application examples*



Hydraulic oil cooling





# Brazed Plate Heat Exchangers GPLB





## BPHE Types GPLB

## *Technical data*

### Technical Data

- 100% stainless steel
- Operating pressures max.:  
25 bar / 30 bar (standard), higher pressures available on request
- Operating temperatures max.:  
-200°C to +350°C (standard)
- CE-certified



## BPHE Types GPLB

## *Application examples*

### HVACR

- Tap water
- Heat pumps
- Solar technology
- Distant heating
- Combined heating and power stations
- Chemical plants
- Refrigeration engineering





# Brazed Plate Heat Exchangers TPL





# BPHE Type TPL

## *Applications*

With special turbo-plates in the flow gaps, TPL were especially developed for the requirements in plant and mechanical engineering



Brazed plate heat exchangers TPL are mainly used for

- Hydraulic- and Motor-Oil-Cooling
- Air cooling
- universal applications with diverse media

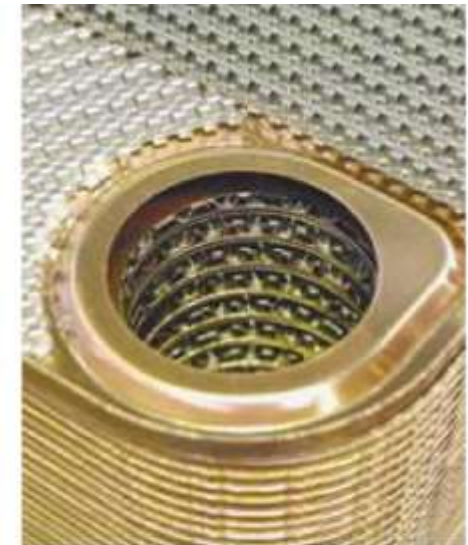


# BPHE Type TPL

## Technical

### Technical Data

heat transfer surface / plate	0,035-0,286 m <sup>2</sup>
max. operating pressure	30 bar
max. operating temperature	-100 °C/-148 °F up to +200 °C/392°F



### Material

Plates	1.4404 / 1.4401
Solder	copper 99,9 %

Due to the efficient performance of the FUNKE TPL for media with higher viscosities the unit can be of a much smaller size compared to conventional plate heat exchangers!





## BPHE Type TPL

## *Application examples*



Oil cooling in cooling device



Compressed air aftercooler





## Brazed Plate Heat Exchangers *Production*



Vacuum braze oven



# Brazed Plate Heat Exchangers TPLB



# BPHE Type TPLB

## *Applications*

Brazed Plate Heat Exchangers 100% Stainless  
Steel - Cu-free brazed - Series TPLB

Typical applications for brazed plate heat exchangers type  
TPLB

- HVACR
- Tap water
- Heat pumps
- Solar technology
- Distant heating
- Combined heating and power stations
- Chemical plants
- Refrigeration engineering







# BPHE Type TPLB

## *Technical*

### Technical Data

- 100% stainless steel
- max. operating pressure 14 bar (standard),  
higher pressure available on request
- max. operating temperatures -196°C to +200°C (standard)
- CE-certified



# Welded Plate Heat Exchangers FunkeBlock



# Welded PHE FunkeBlock

## *Design*

Pressure Plate -

Plate pack -

Column -

Panel -

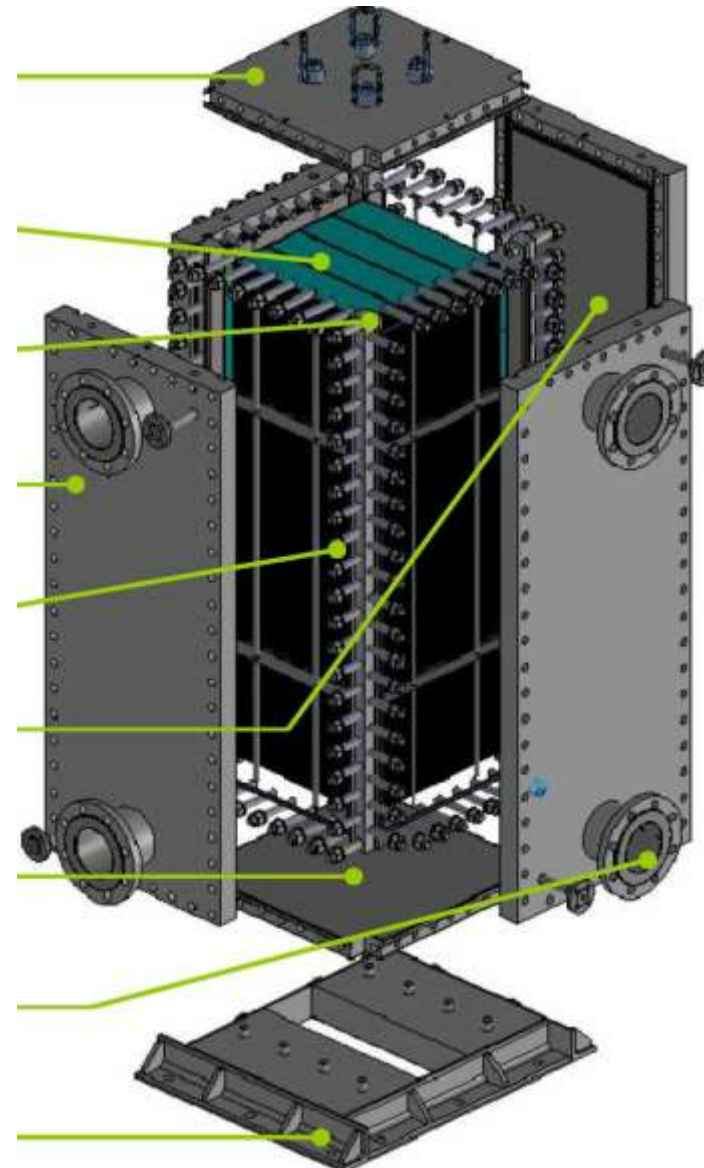
Panel bolts -

Panel lining

Pressure plate lining -

Connection -

Foot -







## Welded PHE FPB

## *Design*

The FunkeBlock comes in different models, types and with different plate geometries, to match the requirements of the heat transfer duty.

FunkeBlock is designed to be servicable, cleanable and can be fully internally inspected.

In addition, the FunkeBlock can be executed to be fully drainable.





## Welded PHE FunkeBlock

FunkeBlock is designed for operation in

- Chemical industry
- Petrochemical industry
- Oil & Gas
- Refinery

Typical application types are

- Heat recovery
- Process heating and cooling
- Condensing in processes
- Evaporation

## *Applications*





# Welded PHE FunkeBlock

## *Technical*

Mechanical design in accordance with the common standards like EN13445 and ASME VIII Div 1.

Temperature working range: -40°C up to 350°C.

Design pressure up to 35 barg and fully vacuum.

Plate materials: SS304, SS316L, 904L, 254SMO, Ti Gr 1, and different Ni alloys.





# Welded PHE FunkeBlock

## *Technical*

completely automatic  
 $O_2\% < 0,01$   
Plate-Comb 100% automatic ->  
only Funke does that!

100% robot welded  
Plate-comb joint



100% Robot welded  
Plate-Plate joint





# Heat Exchangers in Hygienic Design



## Hygienic Design

***Genera!***

FUNKE delivers quality heat exchangers which are designed and built in accordance with hygiene requirements.







## Practised segregation of carbon / stainless steel production areas

The segregation of carbon / stainless steel production areas makes FUNKE the ideal supplier for

- Chemical and Pharmaceutical Industries
- Fine Chemical Industries
- Classical Pharmaceutical Industry
- Food- and Beverage Industry  
(beer, milk, wine, etc.)





# Hygienic Design

# *Advantages*

## Decisive advantages of FUNKE HD-heat exchangers

- highest safety standards
- first class surface finish of materials used
- 100%-drainability possible
- gaskets according to hygienic design
- high temperature resistance (e.g. for steam sterilization)
- low delta ferrite content
- very suitable for CIP- and SIP
- durable and easy to maintain





## Hygienic Design

HD-shell-and-tube heat exchangers are available with removable U-tube bundle or fixed straight tube bundle.



As a standard, in case of leakage at the tube-to-tube sheet joint double tube sheets prevent intermixing of the two media involved in the heat exchange.

## General







# Hygienic Design

# *Material/*

## Materials

Only stainless steels are used.

On the product side only stainless steels with a very low carbon content as e.g. 1.4404 or 1.4435 are used.

The adequate selection of material and a corresponding manufacturing technology guarantee for low delta ferrite contents of parts in contact with the product.





# **SIP - Standard Industry Products**

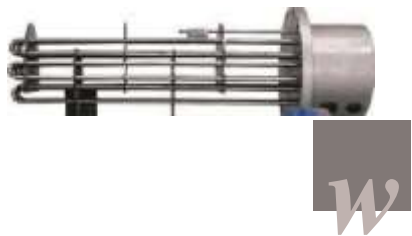


# SIP - Standard Industry Products

Oil/Air Cooling Units



Electrical  
Oil Pre-heaters







# Oil/Air Cooling Units

**OKANII**

17 sizes with cooling capacity up to 6,2 kw/K

## Technical Data

frontal area of core	0,05- 1,44 m <sup>2</sup>
max. operating pressure	26 bar possible
max. operating temperatures oil/emulsion	120 / 90°C

## Fan drive

- three-phase motor
- direct-current motor
- hydraulic motor



Model with hydraulic motor





# Oil/Air Cooling Units

# Applications

Cooling unit  
turbo-coupling, Voith



Putzmeister, concrete mix  
facility

Raster  
Zeulenroda,  
producer of  
presses



Liebherr,  
concrete mixer





# Oil/Air Cooling Units

# *Applications*

Applications for mechanical engineering and mobile hydraulics





**Thank you for your attention!**