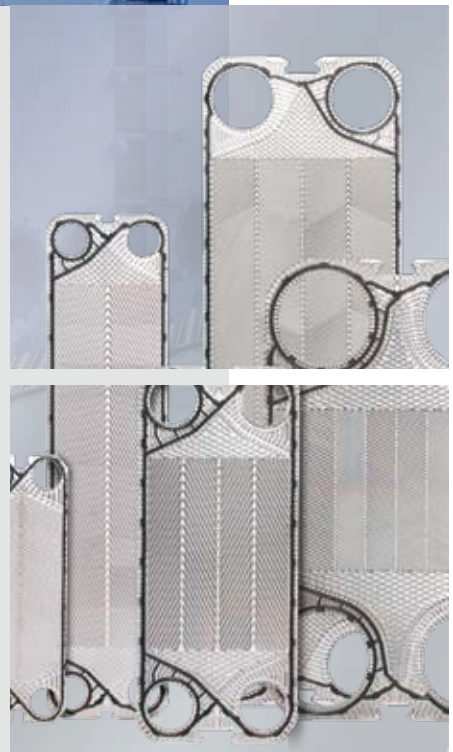
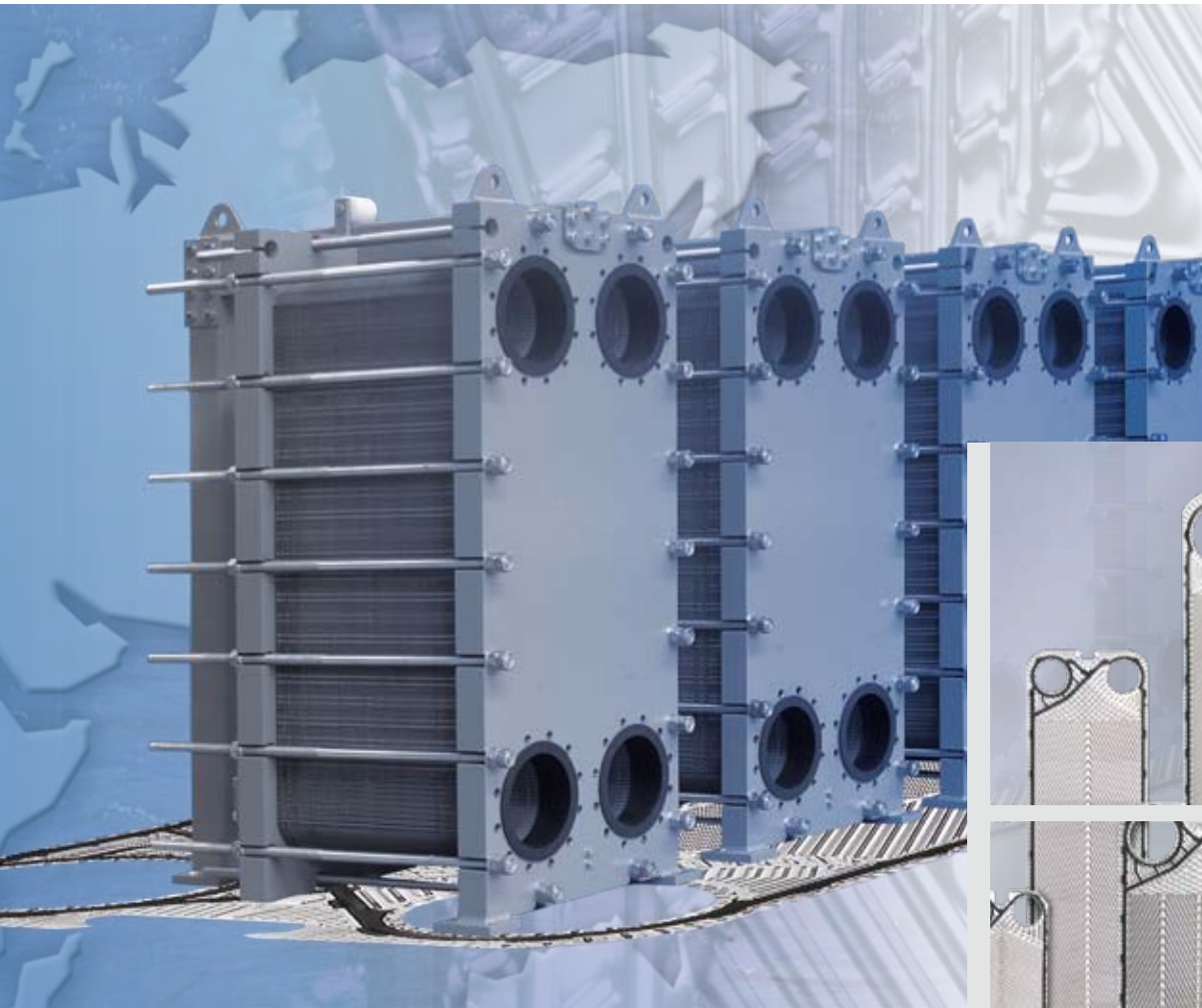


Quality Heat Exchangers



Represented by: **FORTIS LLC**

Contact: David Downey (617) 600-4178 * Fax (617) 600-4179

Email: daviddowney@fortisepe.com

Plate Heat Exchangers

Series FP, FP-DW, FP-SW



With partnership into the future

FUNKE is a leader in the development and production of quality heat exchangers with a heat transfer area of up to 2,600 ft². The range of products includes shell-and-tube heat exchangers, plate heat exchangers in bolted, brazed and welded execution, oil/air cooling units, electrical oil pre-heaters. Thus, as one of the few producers worldwide, FUNKE offers solutions with optimum thermodynamic designs for different industries and virtually all applications.

FUNKE focuses on customer orientation, highest quality standards, flexibility and advisory skills – important benefits a company of just the right size is able to offer.



Your specialist for heat exchangers

Satisfied and regular customers are evidence for the reliability and quality FUNKE guarantees.

FUNKE's broad product range comprises

- Plate Heat Exchangers (bolted, brazed, welded)
- Shell-and-Tube Heat Exchangers
- Oil / Air Cooling Units
- Electrical Oil Pre-heaters

FUNKE offers a wide range of plate heat exchangers (PHE) to meet almost any requirement in machine and plant engineering with regard to heat transfer.

Benefits of FUNKE plate heat exchangers (PHE)

- low investment, operation and maintenance costs
- highly efficient heat transfer (U-value on average 3-5 times higher compared to bare-tube heat exchangers)
- for economic solutions asymmetrical flow gaps are available
- exploitation of even smallest temperature differences $\leq 1 \text{ K}$
- up to 75% less space required
- self-cleaning effect due to highly turbulent flow behaviour
- future additional capacity is possible by fitting extra heat transfer plates
- high safety measures avoid media mixing
- easy to open/clean
- low operating weight/low liquid content

Technical key data (depending on design)

Capacity	3400 BTU/hr	-	100 MMBTU/h
Volume flow	50 GPM	-	20,000 GPM
Surface / plate	0.4 ft²	-	32 ft²
Connection size	1"	-	20"
Operating temperature	0 F	-	380 F
Working pressure			max. 300 psi

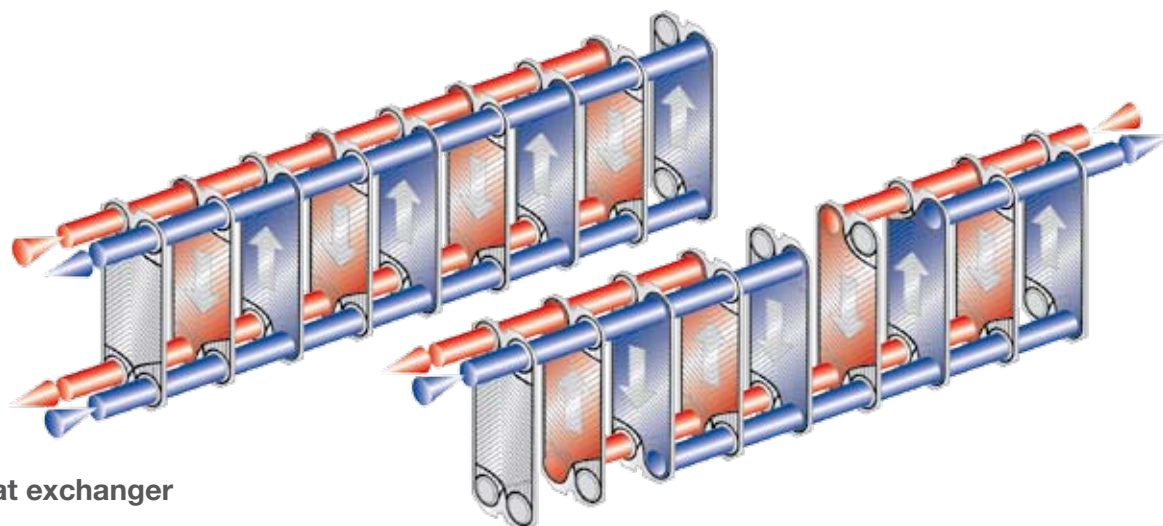
Series

FP	gasketed / bolted PHE (standard design)
FP-DW	safety PHE (double-wall plate design)
FP-SW	semi welded PHE (welded cassettes)

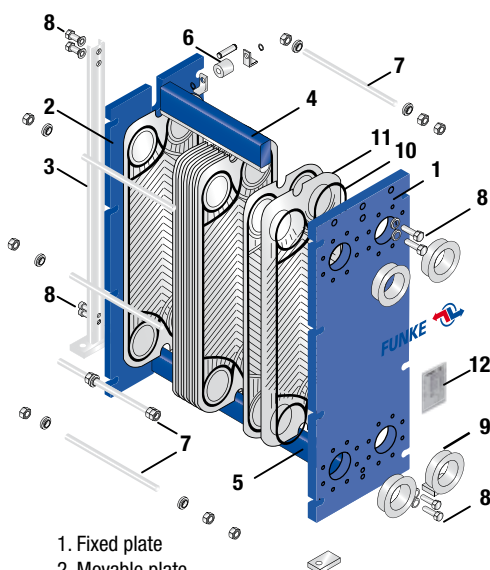
Design and function of FUNKE PHE

The heart of a PHE is a pack of embossed plates with channels. The plates are assembled in a 180° angle to each other, resulting in flow gaps on each side. Each plate is provided with a gasket, which securely seals the flow gaps from the atmosphere and separates the two media used in the heat exchange.

The gasketed plate pack is mounted in a rack and is compressed with tightening bolts between the fixed plate and the movable plate. To guarantee maximum heat transfer, warm and cold media are normally led through the PHE in one-pass or multi-pass counterflow. Connections are on the fixed plate, but can also be on the movable plate for multi-pass flow (see principle sketches below).

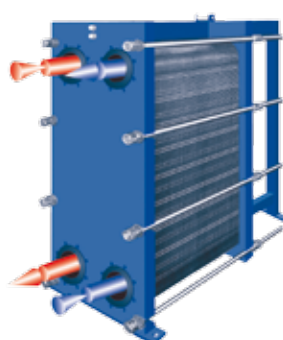


Design of a plate heat exchanger



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. Metal / rubber liners
10. Gaskets
11. Heat transfer plates
12. Name plate

Connection positions



single-pass



two-pass



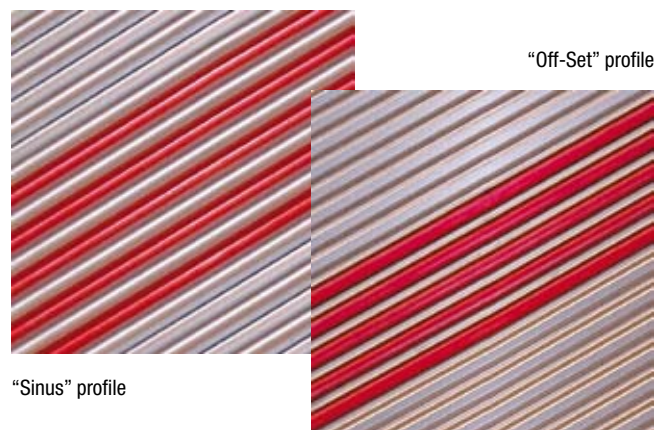
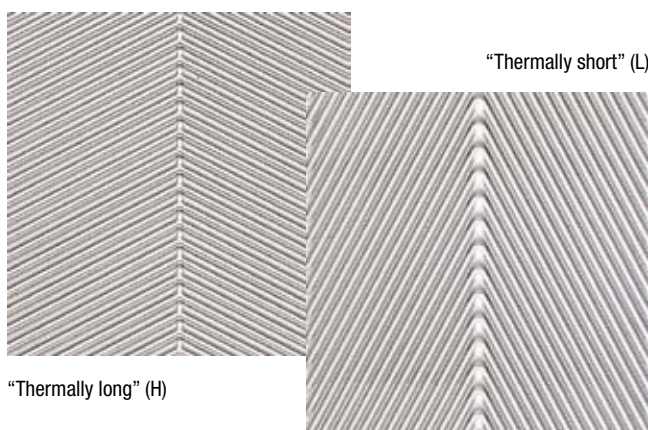
three-pass

Funke Plate Innovations

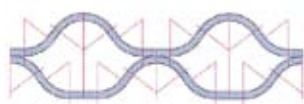
“Off-Set”- embossing for highest efficiency

All plate heat exchangers look very similar at first glance. But the difference and the secret of efficient heat transfer cannot be seen from the outside – it is the wave pattern. Its performance depends on many factors, including size and number of plates. Altogether, these factors determine the size of the plate heat exchangers and the operating costs. A crucial factor e.g. is that plates with different plate corrugation angles (in relation to the flow direction) can be combined. Obtuse corrugation angles result in longer thermal paths (H) and higher heat transfer rates but also lead to higher pressure drops. Acute corrugation (L) angles are chosen if the pressure drop must be kept low.

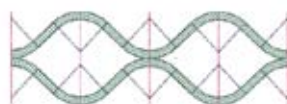
FUNKE plate heat exchangers offer more advantages by combining different plate corrugations- with the unique “Off-Set” profile even asymmetrical flow gaps can be formed. Therefore, the cross-sectional areas of the warm and the cold side of the PHE can approximately be one third larger or smaller (see pictures and graphics below).



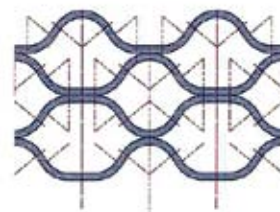
With the sophisticated “ Off-Set” profile our customers benefit from an additional tool for providing cost-effective PHE solutions. An oil cooler, for example, is significantly smaller and cheaper if the volume flow on the cooling water side can be much larger. Therefore, up to 17 per cent less exchange surface is required compared to conventional symmetrical plates. The configuration of the plate pack is always calculated using state-of-the-art design software, whether symmetrical or asymmetrical. So, FUNKE always aims to find the most efficient and cost effective solution for the customer.



“Off-Set” profile



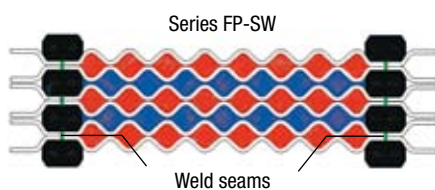
Standard-“Sinus”-wave



Varieties of flow gaps

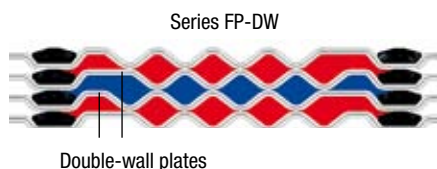
Welded cassettes

In this design special media, such as ammonia in cooling applications, flows through welded plate pairs. On the water side between the cassettes, specially designed gaskets are used.



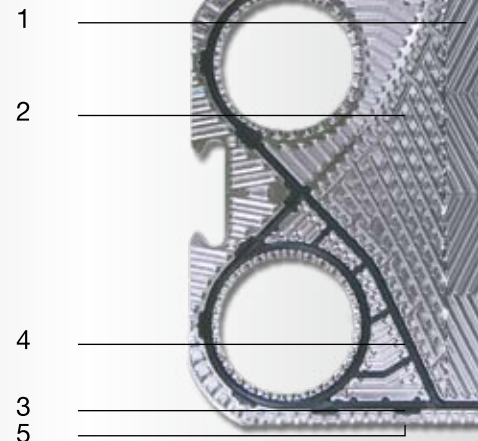
Double-wall plates

These plates provide maximum protection against the mixing of media used in the heat exchange process. Two simultaneously embossed plates are laser-welded at the port holes. If there is a leak, fluids can escape at the edges of the plate pair.



Short overview of plate and gasket:

- very high heat transfer rates due to thermodynamically optimized design
- corrugation fields with "Off-Set" embossing allow for symmetrical and asymmetrical flow gaps (1)
- specially embossed entry fields for an optimum distribution of media (2)
- gaskets fastened by "Clip-system" for easy maintenance
- gaskets have a special ribbed surface, enabling more exact centring and stabilization of the entire plate pack (3)
- double gasket with leakage groove between two media, preventing mixing of the media (4)
- special plate profile at the edges, reinforcing the plate pack and ensuring high pressure resistance of the gasket during operation (5)



1
2
4
3
5

1
2
4
3
5

Technical data

Plate material

As standard, FUNKE heat transfer plates are produced in 1.4404 / AISI 316L. Due to the high content in molybdenum, this material is generally more corrosion-resistant and more resistant to chloride damage than 1.4301 / AISI 304.

Optionally, the following additional materials may be used:

- 1.4301 / AISI 304 (cost-effective for use with uncritical media)
- 1.4539 / AISI 904L (with high nickel content to avoid stress corrosion cracking; good price/performance ratio when media with a low acid and chloride content are applied)
- 1.4547 / 254 SMO (higher chloride and acid-resistance than 1.4404 / AISI 316L)
- Alloy C276 (highly resistant against acids and chlorides; e.g. for concentrated sulphuric acid)
- Titanium ASTM B 265 Grade 1
- Titanium-Palladium ASTM B265 Grade 11 (highest material quality; appropriate e.g. for chlorides at higher temperatures)

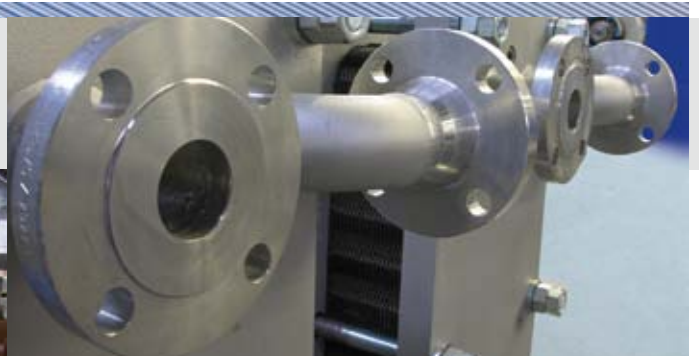
Accessories

Optionally, we equip your plate heat exchanger with the following accessories:

- insulations (e.g. mineral insulation material cladded with galvanised sheet; other claddings optional)
- inline-filters
- special painting (e.g. sea air resistant paint)
- shroud / drip tray
- earthing lugs
- CIP cleaning system

Special equipment

- frames made of stainless steel or with stainless steel cladding
- PHE as double cooler with switch-over valve and thermostat



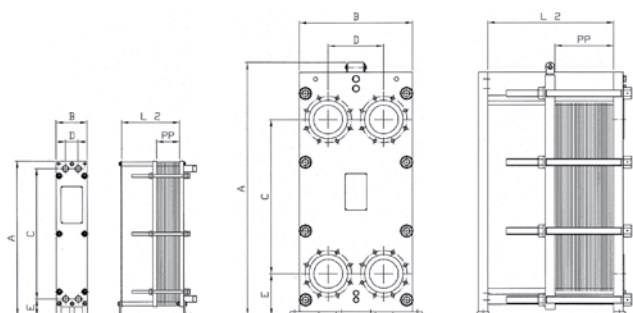
Connections

FUNKE plate heat exchangers can be supplied with all common connections (threaded or flange connection, connection with loose flange, moulded rubber part or metal lining; others on request) for any application (industry, building services, chemicals, food). Of course, all common materials as well as welded designs are available.

Gasketing

Depending on the design and the type, adhesive or non-adhesive (Clip-system) gaskets may be used. As gasket materials, well-known, proven and tested materials are used, such as:

- NBR (nitrile-rubber): universally applicable for aqueous and oily fluids e.g. water / oil-applications
- EPDM (ethylene-propylene-rubber): wide range of applications for many chemical compounds which do not contain mineral oil and grease; also for water and steam applications
- Fluororubber (Viton): extremely resistant to chemicals and organic solvents, also to sulphuric acid and vegetable oils at high temperatures
- other materials on request



Dimensions



Frame		max. Pressure, psi	max. number of plates	surface / plate ft²	A	B	C	D	E	L2	PP	Connections	max. surface ft²
					in	in	in	in	in	in	in	in	
FP	5	300	150	0,40	18,5	7,3	15,0	2,8	1,8	10 - 40	pcs. x 0.106	1	65
FP	9	300	150	0,90	30,1	7,3	26,6	2,8	1,8	10 - 40	pcs. x 0.106	1	130
FPDW	5	150	150	0,40	18,5	7,3	15,0	2,8	1,8	10 - 40	pcs. x 0.114	1	65
FP	10	300	200	1,10	28,9	12,2	19,4	5,0	5,0	10 - 40	pcs. x 0.114	2	215
FP	16	300	200	1,70	36,7	12,2	27,3	5,0	5,0	10 - 40	pcs. x 0.114	2	320
FP	22	300	200	2,30	46,5	12,2	35,2	5,0	5,0	10 - 40	pcs. x 0.114	2	480
FPDW	16	150	200	1,70	36,7	12,2	27,3	5,0	5,0	10 - 40	pcs. x 0.122	2	320
FP	205	300	500	2,30	45,7	18,9	28,3	8,9	8,0	20 - 98	pcs. x 0.122	4	1130
FP	31	300	500	3,20	52,4	18,9	35,2	8,9	8,0	20 - 118	pcs. x 0.122	4	1620
FP	40	300	500	4,30	62,2	18,9	44,9	8,9	8,0	20 - 118	pcs. x 0.122	4	2150
FP	50	300	500	5,40	71,9	18,9	54,6	8,9	8,0	20 - 118	pcs. x 0.122	4	2690
FP	71	300	500	7,50	91,3	18,9	74,1	8,9	8,0	20 - 118	pcs. x 0.122	4	3770
FPDW	205	150	500	2,30	45,7	18,9	28,3	8,9	8,0	20 - 118	pcs. x 0.13	4	1130
FPDW	31	150	500	3,20	52,4	18,9	35,2	8,9	8,0	20 - 118	pcs. x 0.13	4	2150
FPDW	50	150	500	5,40	71,9	18,9	54,6	8,9	8,0	20 - 118	pcs. x 0.13	4	2690
FPG	31	300	500	3,20	52,4	18,9	35,2	8,9	8,0	20 - 118	pcs. x 0.122	4	2150
FP	42	300	750	4,30	57,9	24,4	37,0	11,4	8,9	20 - 160	pcs. x 0.122	6	3390
FP	62	300	750	6,50	72,2	24,4	51,4	11,4	8,9	20 - 160	pcs. x 0.122	6	4840
FP	82	300	750	8,60	86,6	24,4	65,8	11,4	8,9	20 - 160	pcs. x 0.122	6	6460
FP	112	300	750	12,40	105,8	24,4	84,9	11,4	8,9	20 - 160	pcs. x 0.122	6	9040
FP	405	300	700	4,40	54,3	29,9	30,3	15,6	11,2	20 - 160	pcs. x 0.122	8	3230
FP	70	300	700	7,50	68,5	29,9	44,5	15,6	11,2	20 - 160	pcs. x 0.122	8	3820
FP	100	300	700	10,80	82,7	29,9	58,7	15,6	11,2	20 - 160	pcs. x 0.122	8	7530
FP	130	300	700	14,00	96,9	29,9	72,8	15,6	11,2	20 - 160	pcs. x 0.122	8	9800
FPDW	100	150	700	10,80	82,7	29,9	58,7	15,6	11,2	20 - 160	pcs. x 0.13	8	7540
FP	81	300	800	8,60	76,0	38,6	43,3	18,9	14,4	70 - 207	pcs. x 0.15	12	6890
FP	120	300	800	12,90	91,3	38,6	58,7	18,9	14,4	70 - 207	pcs. x 0.15	12	10330
FP	160	300	800	17,20	106,7	38,6	74,0	18,9	14,4	70 - 207	pcs. x 0.15	12	13780
FP	190	300	800	20,50	122,0	38,6	89,3	18,9	14,4	70 - 207	pcs. x 0.15	12	16360
FP	150	300	800	16,20	98,4	53,9	57,7	26,5	18,9	78 - 235	pcs. x 0.161	20	17220
FP	200	300	800	21,50	112,4	53,9	71,7	26,5	18,9	78 - 235	pcs. x 0.161	20	17220
FP	250	300	800	26,90	126,4	53,9	85,7	26,5	18,9	78 - 235	pcs. x 0.161	20	21530
FP	300	300	800	32,30	140,4	53,9	99,8	26,5	18,9	78 - 235	pcs. x 0.161	20	25830

FP gasketed / bolted PHE (standard design) · FP-DW safety PHE (double-wall plate design) · FP-SW semi welded PHE (welded cassettes)
More types and sizes on request · Technical changes reserved · pcs. = number of plates



Hydraulic
oil cooling in
power plant.

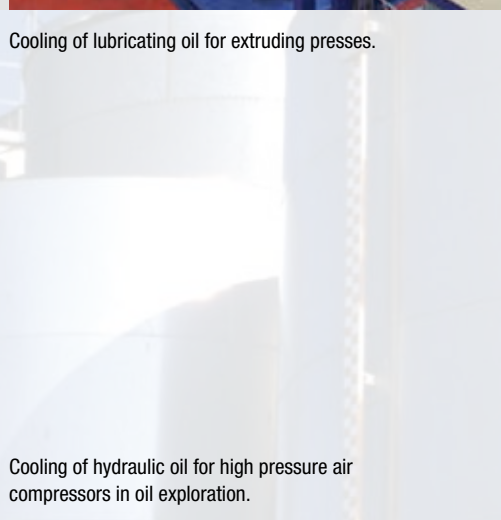


Cooling of lubricating oil for extruding presses.

FUNKE customers value reliability



Condensation
of bioethanol.



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



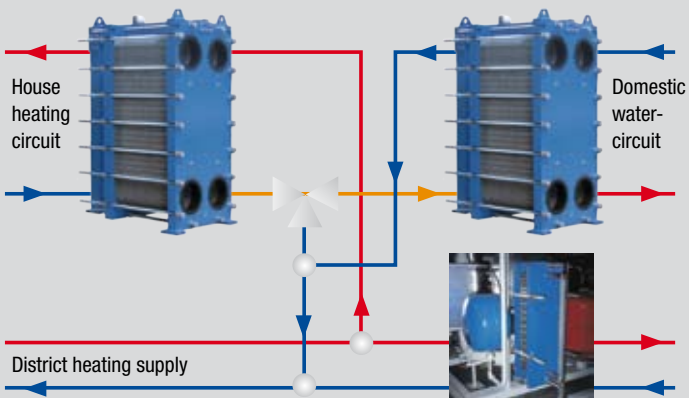
Cooling of
laser welding
plants in
automotive
production.



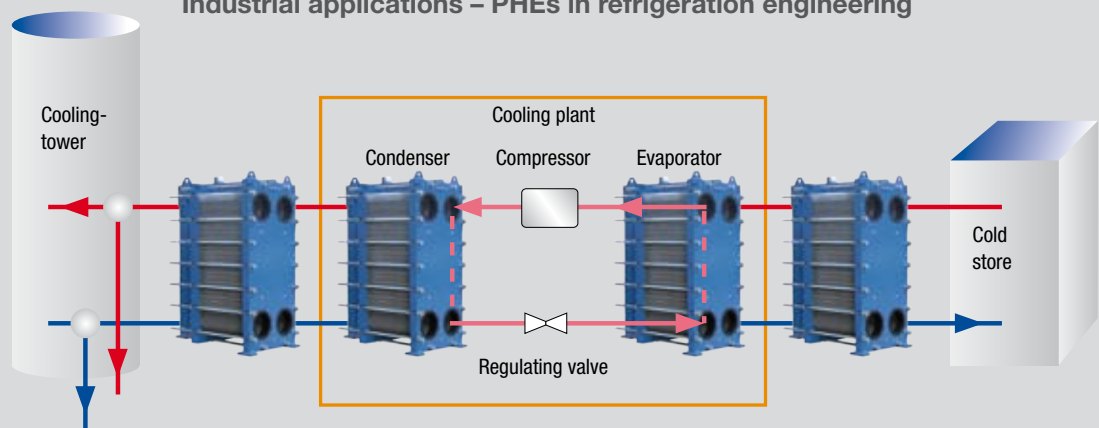
Plate heat exchangers as double oil cooler with transflow valves and temperature control.



Industrial applications – PHEs in heating, ventilation, air condition (Example: district heating system)



Industrial applications – PHEs in refrigeration engineering



Quality production at FUNKE



Lifetime partnership – our service for your PHE

The design and the high quality standards of FUNKE plate heat exchangers aim to keep maintenance work to a minimum, provided that the conditions of use the PHE has been designed for are adhered to. However, during service life, the gaskets of a PHE are subject to a normal fatigue process. Depending on the conditions of use, the plate pack can be tightened several times until the lower limit 'PP-min.' is reached, at this time gaskets need replacement. Normally, maintenance and servicing can be carried out by adequately trained personnel of the operator. If you need help, contact our local service technicians or service partners who will provide the services as follows:

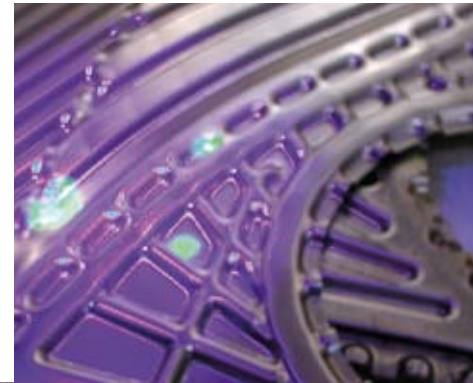
Our service proposal for your PHE

- cleaning service: CIP (Cleaning in Place) or mechanical cleaning on site or chemical cleaning (immersion bath) at the factory
- on request, complete CIP systems (incl. the required cleaning chemicals) can be provided by FUNKE
- replacing gaskets: this always includes cleaning of plates; crack test is optional
- spare parts service: supply of original parts throughout the world
- overhaul of complete unit
- future supplementary performance optimization: extension of plate pack/change in plate configuration

Required data for the best PHE design

The desired performance of the PHE can be achieved by very different configurations. With precise knowledge of all process conditions we can offer our customers the most efficient and cost-effective PHE.

Required data can be found on our quotation questionnaire at our website. If you require assistance, please do not hesitate to contact us. We will be pleased to assist you.



Quality means safety. Each unit built by FUNKE is design and pressure tested. Additional approvals are also available in accordance with quality authorities such as:

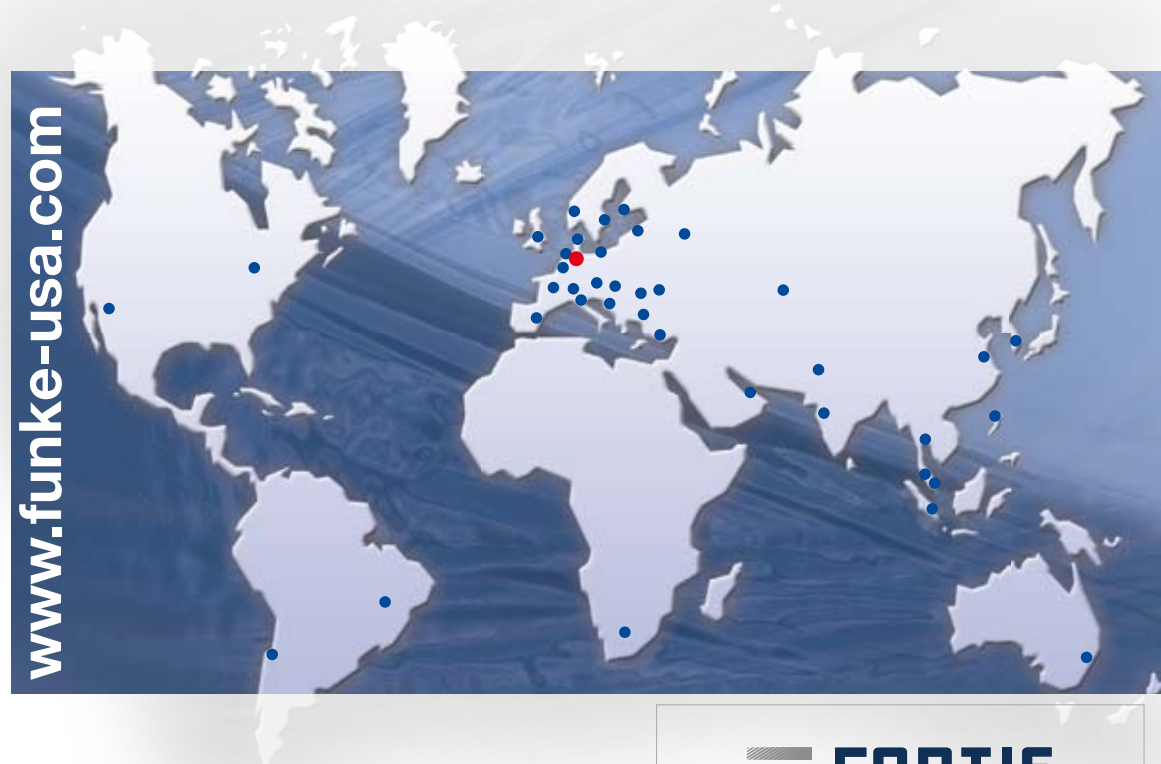
- American Bureau of Shipping (ABS)
- Bureau Veritas (BV)
- Det Norske Veritas (DNV)
- Germanischer Lloyd (GL)
- Lloyds Register of Shipping (LRS)
- Schweizerischer Verein für technische Inspektionen (SVTI)
- Technischer Überwachungsverein (TÜV)

as well as customers' test and inspection regulations.



FUNKE has been certified according to DIN EN ISO 9001:2008 and is an approved manufacturer according to:

- EU Pressure Equipment Directive 97/23/EC (PED), Module H/H1
- HP0 in connection with DIN EN 729-2
- ASME U-Stamp
- GOST R (incl. RTN & hygiene certificate)
- China Certificate



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