

INDUSTRIES PTY LTD

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Quality Heat Exchangers





Plate Heat Exchangers Series FP, FPDW

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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 2 400 m². The range of products comprises shell-and-tube heat exchangers, bolted and brazed plate heat exchangers as well as oil/air cooling units and 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.

FUNKEs broad product range comprises

- Plate Heat Exchangers (bolted and brazed)
- 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 (K-values 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 $\mbox{</= 1 K}$
- 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	1 KW	-	30 MW						
Volume flow	5 m³/h	-	4500 m³/h						
Surface / plate	0,04 m ²	-	3,0 m ²						
Nominal connection diameter	DN 25	-	DN 500						
Operating temperature	-20°C	-	+195°C						
Working pressure			max. 25 bar						

Series						
FP	gasketed/bolted PHE (standard design)					
FPDW	safety PHE (double-wall plate design)					

Design and function of FUNKE PHE

The heart of a PHE is a pack of embossed plates with apertures. 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 multipass flow (see principle sketches below).







Always the right plate for your requirements

"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

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

mmin

- 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)



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 nonadhesive (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 pressu	/ re	max. pressure	max. number	surface/ plate	А	В	С	D	E	L2	PP	connections	max. surface
rating]	range bar	of plates	m²	mm	mm	mm	mm	mm	mm	mm		m²
FP FP FP FP	04 08 14 20	16 16 16 16	125 150 200 200	0,04 0,08 0,14 0,20	460 800 837 1066	160 160 310 310	336 675 590 819	65 65 135 135	85 85 132 132	150-600 150-600 250-1000 250-1000	pcs. x 2,4 pcs. x 2,4 pcs. x 2,4 pcs. x 2,4	1" 1" 2" 2"	5 12 28 40
FP FP FPDW	05 09 05	25 25 16	150 150 150	0,04 0,08 0,04	532 827 532	200 200 200	381 676 381	70 70 70	45 45 45	250-1000 250-1000 250-1000	pcs. x 2,7 pcs. x 2,7 pcs. x 2,9	1" 1" 1"	6 12 6
FP FP FP FPDW	10 16 22 16	25 25 25 25	200 200 200 200	0,10 0,16 0,21 0,16	733 933 1182 933	310 310 310 310 310	494 694 894 694	126 126 126 126	128 128 128 128	250-1000 250-1000 250-1000 250-1000	pcs. x 2,9 pcs. x 2,9 pcs. x 2,9 pcs. x 3,1	2" 2" 2" 2"	20 30 45 30
FP FPDW	19 19	16 16	500 500	0,19 0,19	1080 1080	440 440	650 650	202 202	200 200	500-2500 500-2500	pcs. x 3,1 pcs. x 3,1	DN 80 DN 80	100 100
FP 2 FP FP FP FP	205 31 40 50 71	25 25 25 25 25 25	500 500 500 500 500	0,21 0,30 0,40 0,50 0,70	1160 1332 1579 1826 2320	480 480 480 480 480	719 894 1141 1388 1882	225 225 225 225 225 225	204 204 204 204 204 204	500-2500 500-3000 500-3000 500-3000 500-3000	pcs. x 3,1 pcs. x 3,1 pcs. x 3,1 pcs. x 3,1 pcs. x 3,1	DN 100 DN 100 DN 100 DN 100 DN 100	105 150 200 250 350
FPDW 2 FPDW FPDW	205 31 50	16 16 16	500 500 500	0,21 0,30 0,50	1160 1332 1826	480 480 480	719 894 1388	225 225 225	204 204 204	500-3000 500-3000 500-3000	pcs. x 3,3 pcs. x 3,3 pcs. x 3,3	DN 100 DN 100 DN 100	105 200 250
FP FP FP FPDW	41 60 80 80	25 25 25 16	700 700 700 700	0,40 0,60 0,80 0,80	1470 1835 2200 2200	620 620 620 620	941 1306 1671 1671	290 290 290 290	225 225 225 225 225	500-4000 500-4000 500-4000 500-4000	pcs. x 3,5 pcs. x 3,5 pcs. x 3,5 pcs. x 3,7	DN 150 DN 150 DN 150 DN 150 DN 150	280 420 560 560
FP FP FP FP 1	42 62 82 112	25 25 25 25	750 750 750 750	0,40 0,60 0,80 1,15	1470 1835 2200 2687	620 620 620 620	941 1306 1671 2157	290 290 290 290	225 225 225 225 225	500-4000 500-4000 500-4000 500-4000	pcs. x 3,1 pcs. x 3,1 pcs. x 3,1 pcs. x 3,1	DN 150 DN 150 DN 150 DN 150 DN 150	315 450 600 840
FP 4 FP FP 1 FP 1 FPDW 1	405 70 100 130 100	25 25 25 25 25 16	700 700 700 700 700 700	0,41 0,70 1,00 1,30 1,00	1380 1740 2100 2460 2100	760 760 760 760 760	770 1130 1490 1850 1490	395 395 395 395 395	285 285 285 285 285 285	500-4000 500-4000 500-4000 500-4000 500-4000	pcs. x 3,1 pcs. x 3,1 pcs. x 3,1 pcs. x 3,1 pcs. x 3,3	DN 200 DN 200 DN 200 DN 200 DN 200	300 355 700 910 700
FP 1 FP 1 FP 1 FP 1	81 120 160 190	25 25 25 25	800 800 800 800	0,80 1,20 1,60 1,90	1930 2320 2710 3100	980 980 980 980	1100 1490 1879 2267	480 480 480 480	365 365 365 365	1780-5280 1780-5280 1780-5280 1780-5280	pcs. x 3,8 pcs. x 3,8 pcs. x 3,8 pcs. x 3,8	DN 300 DN 300 DN 300 DN 300 DN 300	640 960 1280 1520
FP 1 FP 2 FP 2 FP 3	150 200 250 300	25 25 25 25	800 800 800 800	1,50 2,00 2,50 3,00	2500 2855 3211 3567	1370 1370 1370 1370	1466 1822 2178 2534	672 672 672 672	480 480 480 480	1980-5980 1980-5980 1980-5980 1980-5980	pcs. x 4,1 pcs. x 4,1 pcs. x 4,1 pcs. x 4,1	DN 500 DN 500 DN 500 DN 500	1600 1600 2000 2400

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



Hydraulic oil cooling in power plant.





Condensation of bioethanol.



Cooling of lubricating oil for extruding presses.





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 Heat Exchangers

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)
- Technischer Überwachungsverein (TÜV)

as well as customers' test and inspection regulations.



FUNKE has been certified according to DIN EN ISO 9001:2008, DIN EN ISO 14001:2004 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 incl. ASME R-Stamp
- Custom Union (TRTS 032/2013)
- China Certificate





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