Refrigeration
Heat Exchangers

INDIVIDUAL SOLUTIONS - LEADING TECHNOLOGIES
Fluid Dynamics’ Plate & Shell Heat Exchangers (PSHE) are the leader in heat exchanger technology.

Compact and manufactured to a high standard of quality, they have at their heart a fully welded pack of circular plates in a strong, unique shell construction.

Fluid Dynamics’ PSHE combine the best features of both plate and shell & tube heat exchangers and can withstand high pressures and temperatures.

**Compact size**
This heat exchanger requires only 25% of the surface compared to shell & tube heat exchangers yet it can be constructed with up to 2000 m² of heat transfer area. The compact size minimizes installation, operating and maintenance costs saving energy and the environment.

**Robust and gasket-free construction**
The gasket-free construction is durable enough for the harshest conditions, prevents maintenance issues and leakages in very high / low pressures and temperatures.

**High thermal efficiency**
Its construction creates high turbulence between the plates which provides very high thermal efficiency. This allows full advantage of a compact heat transfer solution in extreme temperatures and pressure, not possible in traditional compact heat exchangers.

**Openable version**
An openable version offers increased flexibility of use by allowing the fully welded plate pack to be completely withdrawn from the shell for inspection or cleaning.

**Applications**
- **PSHE Fully welded and openable version**
  - Condensers
  - Evaporators
  - Cascades (evaporator-condenser –model)
  - Gas / liquid
- **PSHE compact**
  - Liquid / liquid
  - Condensers
  - End-use areas with minimum space such as portable cooling and steam units
  - Replacing plate or shell & tube heat exchangers
Main Applications

**Evaporators**
The versatility of Fluid Dynamics’ PSHE is demonstrated particularly in evaporator applications. PSHE can be used as highly efficient Flooded, or Direct Expansion (DX) evaporators, due to low pressure drop and high heat transfer. Fully welded circular plates and a protective outer shell, guarantee safety for the end user and ensures high integrity and durability.

**Flooded Evaporators**
- Refrigerants: NH3, CO2, R404, R134a, propane, methane, etc.
- Capacity Range: 5 - 20 000 kW
- Compact Size & Small Refrigerant Charge
- Low Evaporative Side Pressure Drop
- Flexible Construction
- High Efficiency
- Safe Operation

**Direct Expansion (DX) Evaporators**
- Capacity Range: 5 – 1500 kW
- Can Be Used For All Refrigerants
- Compact Size
- Safe Operation

**Cascades**
Cascade heat exchangers are used to transfer heat between two refrigerants. They are used especially with CO2. A cascade unit combines both condenser and evaporator (flooded or DX). Fluid Dynamics’ PSHE are ideal for cascade operations, based on their high thermal efficiency. They can provide minimum temperature difference between the evaporative and condensing media with low running costs. Using Fluid Dynamics’ fully welded construction ensures there is no leakage or cross-contamination.

- Refrigerants: NH3, CO2, R404, R134a, propane, methane, etc.
- Capacity Range: 5 – 10 000 kW
- High Heat Transfer
- Low Pressure Drop
- Many Materials Available
- Easy to Install and Insulate
**Fluid Dynamics’ Systems, Flooded Evaporators + Droplet Separators**
- Capacity Range: 100 – 5,000 kW
- Compact Size & Small Refrigerant Charge
- Possibility for Internal and External Circulation Systems
- Flexible and Customised Construction
- Safe Operation
- Ready to be Installed

**Combined Systems**
Combined Systems is a new, extremely compact solution for flooded evaporators and flooded cascades. The evaporator, or cascade, and surge drum are all in one shell. Combined Systems is especially suitable for limited spaces, such as marine applications or production facilities with very limited height. In addition to the compact size, it creates cost savings with insulation, piping and the amount of refrigerant needed.
- Flooded Evaporators + Separator
- Flooded Cascade + Separator
- Multi Pass Droplet Separation
- 50 – 2000 kW
- Small Refrigerant Charge
- Round Plate

**Condensers**
The construction of Vahterus PSHE is ideal for condensing applications. Key benefits include high thermal efficiency, small/reduced refrigerant charge, and low pressure drop. PSHE are suitable for all refrigerants over a wide temperature and capacity range.
- Refrigerants: NH3, CO2, R404, R134a, propane, methane, etc.
- Capacity Range: 5 – 10,000 kW
- Compact Size & Small Refrigerant Charge
- High Heat Transfer
- Low Pressure Drop
- Many Materials Available
- Easy to Install and Insulate

**Other Applications**
- Desuperheaters
- Oil Coolers
- Ammonia Absorption Plant
Compact & Effective
Vahterus PSHE combines the benefits of Plate & Frame and Shell & Tube heat exchangers. PSHE can either be described as a fully welded, high integrity plate heat exchanger, with no gaskets; or a generic alternative to Shell & Tube, approx. 25% of the footprint, displaying both space and weight benefits.

Benefits of PSHE
- No Gaskets or Brazing
- High Integrity / Total Containment
- Strong and Safe Construction
- Unique Protection and Resistance to Thermal and Pressure Cycling
- Thermally Efficient
- Compact and Low Weight
- Flexible Construction
- Proven, Reliable Technology
- Low Fouling
- Minimal Maintenance Requirement
- Close Approach Temperatures

Technical Specification
Maximum Heat Transfer Area
- 2000 m²/exchanger

Mechanical Design
- Full vacuum to 200 bar possible
- -200 to +900°C

<table>
<thead>
<tr>
<th></th>
<th>Area / Plate m²</th>
<th>Plate side nozzles DN</th>
<th>Shell side nozzles DN</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSHE 2</td>
<td>0.032</td>
<td>25</td>
<td>20-80</td>
</tr>
<tr>
<td>PSHE 3</td>
<td>0.076</td>
<td>50</td>
<td>25-250</td>
</tr>
<tr>
<td>PSHE 4</td>
<td>0.15</td>
<td>80</td>
<td>25-300</td>
</tr>
<tr>
<td>PSHE 5</td>
<td>0.26</td>
<td>100</td>
<td>25-350</td>
</tr>
<tr>
<td>PSHE 7</td>
<td>0.46</td>
<td>150</td>
<td>25-500</td>
</tr>
<tr>
<td>PSHE 9</td>
<td>0.80</td>
<td>200</td>
<td>25-700</td>
</tr>
<tr>
<td>PSHE 12</td>
<td>1.00</td>
<td>200</td>
<td>25-1000</td>
</tr>
<tr>
<td>PSHE 14</td>
<td>1.55</td>
<td>300</td>
<td>25-1000</td>
</tr>
</tbody>
</table>
Fluid Dynamics' Semi-Welded plate heat exchangers are ideal for solution chilling in refrigeration applications. The plate packs are manufactured using welded cassettes (two plates welded together). The refrigerant side is contained within the welded portion of the cassette to include welding of the solution port.

Gaskets are used to seal the secondary side which makes the plate pack easy to disassemble and clean.

The welded cassettes are designed for optimum gasket sealing. Higher pressure improves the sealing of the gaskets.

Contact Fluid Dynamics for your next refrigeration application.

Specifications

<table>
<thead>
<tr>
<th>Frame</th>
<th>Carbon Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nozzles</td>
<td>Rubber Lined Carbon Steel</td>
</tr>
<tr>
<td></td>
<td>Metal Lined: Stainless Steel 304 or 316 Titanium</td>
</tr>
<tr>
<td>Plates</td>
<td>0.6 mm AISI Stainless Steel 304 or 316 Titanium</td>
</tr>
<tr>
<td>Design Pressure</td>
<td>11.35 to 25.14 Barg</td>
</tr>
<tr>
<td>Gaskets</td>
<td>Nitrile; EPDM; Viton; Neoprene; Chloroprene</td>
</tr>
<tr>
<td>Connections</td>
<td>Studded Port Slip-on or weld neck flange Sanitary ferule Stub end</td>
</tr>
</tbody>
</table>
Fluid Dynamics’ FD Brazed Plate Heat Exchangers consist of corrugated chevron plates with various brazing materials available for different working conditions. The high quality of FD Brazed Plate heat exchangers ensures that they are capable of working in high pressure and high temperature environments subject to model selection. FD Brazed Plate heat exchangers come in a wide range of sizes and brazing materials to ensure the right solution for your needs no matter what the application.

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>FD-K</td>
<td>Standard</td>
<td>FD-K Series has the largest range of sizes and is widely used in many applications. Versatile and robust they are ideal for use in HVAC, Heat Pumps, Chillers, Oil Coolers, Process Cooling and Heating. FD-K: rated to a maximum working pressure of 45 bar. FD-K 215: dual circuit with 6 connections.</td>
</tr>
<tr>
<td>FD-Z</td>
<td>Large Diagonal Flow</td>
<td>The newly innovative FD-Z Series is designed with a diagonal flow pattern which provides higher efficiency and is a worthy replacement of shell &amp; tube, double tube and multi-tube heat exchangers in various applications. The advantage of the FD-Z Series dual circuit is it provides the best performance in both full load and part load conditions. The FD-Z Series single circuit is specially designed for large volume and high heat transfer efficiency. FD-Z 400/401/2600 - 4 connections. FD-Z 415 / 416 Dual Circuit - 6 connections.</td>
</tr>
<tr>
<td>FD-C</td>
<td>Super High Pressure</td>
<td>The FD-C Series is specially designed for evaporators, condensers, economisers and oil coolers in R744 (CO2) heat pumps and refrigeration systems. Different designs with maximum working pressure of 70 bar, 100 bar and 140 bar are available for a variety of duties and performance specifications. Compact size, outstanding heat transfer performance and low pressure drop are the three key features. The quality and durability of the FD-C Series is proved by achieving burst test pressures up to 650 bar and testing over 100,000 cycles.</td>
</tr>
<tr>
<td>FD-R</td>
<td>High Heat Transfer</td>
<td>FD-R Series represents the upgrade version of the FD-K Standard Series. It is specially designed for R410A systems with heat transfer efficiency of 10% more than the FD-K Standard Series. The FD-R Series is perfectly suited to those applications where pressure drop is not the main concern. Fluid Dynamics’ FD-R Series is ideal for Heat Pumps and HVAC applications. The FD-KR Series is rated to a maximum working pressure of 45 bar.</td>
</tr>
</tbody>
</table>
Fluid Dynamics Shell & Tube Evaporators & Condensers combine European quality which satisfy the requirements of the European pressure vessel codes and can also be supplied with AS1210 compliance. Manufactured to the highest standards these units come in a variety of materials including copper tubes, brass or carbon steel baffles, asbestos free gaskets and alloy steel bolts with other metals on request.

### Shell & Tube Evaporators

<table>
<thead>
<tr>
<th>Model</th>
<th>Main applications</th>
<th>Refrigerant</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>FD-LSE</td>
<td>Water chilling in air-conditioning plants; Liquid or brine solutions cooling in refrigeration plants; Water heating in heat pump systems;</td>
<td>Most common refrigerants</td>
<td>1670 kW to 1600 kW up to 4 refrigerant circuits</td>
</tr>
<tr>
<td>FD-LPE</td>
<td></td>
<td>R143a</td>
<td>Up to 1150 kW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 to 4 refrigerant circuits</td>
</tr>
<tr>
<td>FD-HPE</td>
<td>Dry-expansion Heat Exchangers</td>
<td>HCFCS, HFCS etc. compatible with materials</td>
<td>40 kW to 750 kW up to 2 refrigerant circuits</td>
</tr>
<tr>
<td>FD-MPE</td>
<td></td>
<td>HCFCS, HFCS etc. compatible with materials</td>
<td>15 kW to 1400 kW up to 4 refrigerant circuits</td>
</tr>
</tbody>
</table>

### Shell & Tube Condensers

<table>
<thead>
<tr>
<th>Model</th>
<th>Main applications</th>
<th>Refrigerant</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>FD-CT</td>
<td>Condensation of refrigerant gas in air-conditioning &amp; refrigeration plants and heat recovery</td>
<td>HCFCS, HFCS, NH3 etc. compatible with materials</td>
<td>10 kW to 2000 kW up to 2 refrigerant circuits</td>
</tr>
<tr>
<td>FD-M&amp;SM</td>
<td>Condensation of refrigerant gas in air-conditioning &amp; refrigeration plants using seawater as medium</td>
<td>HCFCS, HFCS etc. compatible with materials</td>
<td>35 kW to 750 kW at Eurovent rating conditions</td>
</tr>
<tr>
<td>FD-HC</td>
<td>Condensation of refrigerant gas in air-conditioning &amp; refrigeration plants</td>
<td>HCFCS, HFCS etc. compatible with materials</td>
<td>2.6 kW to 50 kW in standard conditions</td>
</tr>
</tbody>
</table>
Ceiling Mounted Evaporators - FD-CA & FD-CF
Options include: Cleanable (shown); Defrost; Casing; Fans; Variable fin spacing
Features include:
- Capacities from 5 kW to 250 kW at 10K TD
- Copper tubes for freons;
- Fin spacing: 2 to 6 fpi (8mm to 4mm).

Floor Mounted Evaporators - FD-VA; FD-VF; FD-WA; FD-WF
Options include: Cleanable; Defrost; Casing; Fans; Variable fin spacing
Features include:
- Capacities from 20 kW to 200 kW at 10K TD
- Fin spacing: 4 & 6 fpi (6mm to 4mm);
- Standard fans with 125Pa external pressure

Dual Discharge Evaporators - FD-DAS; FD-DAQ
Options include: Cleanable; Defrost; Casing; Fans; Variable fin spacing
Features include:
- Capacities from 5.6 kW to 142 kW at 10K TD
- Fin spacing: 4 & 6 fpi (6mm to 4mm);
- Standard & quiet fans (low velocity, low noise)

Dry Air Evaporators - FD-FC (Industrial); FD-GD (Compact)
Options include: High Legs; Silencers; Speed Controller; Ecomesh
Features include:
- Capacities from 27 kW to 1118 kW at 15K TD
- Copper or Stainless Steel tubes
- Multiple noise variation (6, 8, 10, 12, 16 pole variations
- Grey Plastisol coating

Air-Cooled Condensers - FD-DD (Industrial); FD-BSC (Compact)
Options include: High legs; Silencers; Speed controller; Ecomesh
Features include:
- Capacities from 27 kW to 1118 kW at 15K TD
- Fin spacing: 4 & 6 fpi (6mm to 4mm);
- Standard & quiet fans (low velocity, low noise)
- Multiple noise variations (6, 8, 10, 12, 16 pole)
- Plastisol casing
- Flatbed (shown) V-bank or vertical
- Ecomesh adiabatic cooling
- Eurovent certified performance
Ammonia Products - FD-CE Evaporators & Special Condensers

Fluid Dynamics recognises the renewed interest in ammonia refrigerant and can now offer a new generation of evaporators and condensers incorporating stainless steel tubes and aluminium fins. These units have been developed after extensive consultation with British Steel Laboratories and incorporate an innovative, new assembly process and welding technique providing highly efficient and reliable products.

Features:
- 16 mm (5/8") Stainless Steel tubes
- Innovative welding technique
- Advantage over galvanised steel coolers:
  - Significant weight savings
  - Better performance
  - Improvements in defrost time
  - Improvements in air temperature recovery
Fluid Dynamics can assist you with all your heat exchanger needs:

- Shell & Tube
  - FluidEX®
  - Marine
  - Fail Safe™
  - Hybrid
  - Custom Build
  - Corrugated
    - Multitube Industrial
    - Multitube Hygienic
    - Annular Space
    - Tube in Tube
    - Exhaust Gas
- Scraped Surface Heat Exchangers
- Special Projects
- FD-Plate™
  - Gasket
  - Gasket - Fail Safe™
  - Brazed
  - Brazed - Fail Safe™
  - Fully Welded
- Fin Tube
- Coil Condensers
- Dry Air Coolers
- Adiabatic Coolers
- Air Cooled Condensers & Evaporators
- FluidAIR® Bar & Plate
- FT Range™ On Road / Off Road
- Ultrasonic Cleaning
- Aftermarket & Re-engineered
- Heat Pumps
- Piston Pumps