**Description**

SPIRAX-SARCO “plates & shell” Heat Exchangers PSHE series are the new generation Heat Exchangers. They combine the best properties of the Plate and Frame units and Shell and Tubes Heat Exchangers.

The heart of these new units consists of a fully welded pack of circular plates without any gasket. This pack is housed within a shell, which is a pressure vessel. The strong tubular shell ensure maximum safety and resistance to very hard conditions in terms of Temperature (-150°C / +600°C), pressures (full vacuum / up to 100bar), cyclic working conditions (T and p) and Pressure (60 bar) or Temperature (280°C) differentials.

The product family is composed by three type of Heat Exchanger:
- **PSHE**: this version is completely welded and the shell is not openable.
- **PSHE Openable**: in the openable version, the shell is provided with a flange to be coupled with the end cover. This type of Heat Exchanger can be open for inspection, maintenance or substitution of the plate pack.
- **PSHE Compact**: in this version all the connections are on one side, on the end cover, to reduce the necessary space.

The construction provides for several material alternatives, from the stainless steel on the plate side and from carbon steel on the shell side. It permits to satisfy each requirement, in particular way regarding the corrosion resistance. The exchange surface is made by the circular plates those, due to the high turbulence created by the complex geometry of each plate passage, lead to very high heat transfer co-efficient. The corrugation of the plates helps to set the flow through the Heat Exchanger into turbulent conditions.

Connections can be flanged (DIN or ANSI) or to weld. In special situations, connections plate side can be doubled to reduce the pressure drop and velocities at the inlet side of the Heat Exchanger.

The inherent characteristics of these units permit the maximization of the thermal performances; this means not only that the Heat Exchanger is more compact, but also that it is cost effective as less material is used in its manufacture. Design and manufacturing are according to the PED 97/23/CE European “Pressure Equipment Directive”; the Heat Exchangers are CE marked when it is necessary. The categorization can be made considering both fluids from group 2 (non dangerous fluids) and from group 1 (dangerous fluids), according to section 3.1 of the directive 97/23/CE.

**Design conditions and operating limits**

**TMA - Maximum allowable Temperature:**
- Minimum Temperature (for both sides): -80°C
- Maximum Temperature (for both sides): 400°C

**PMA - Maximum allowable Pressure:**
- Standard pressure values: 16 bar 25 bar 40 bar 60 bar
- Higher pressures (up to 100bar) on request.

Local regulations may restrict the use of this product to below the conditions quoted. In the interest of development and improvement of the product, we reserve the right to change the specification.
Quality system
All production of the Plate & Shell family of products is based on Sophisticated & highly automated production technology throughout the manufacturing process including use of robot production lines. This ensures consistent quality and repeatability in the manufactured Heat Exchangers. Manufacturing is carried out according to EN 729 Quality Control and general tolerances are according to SFS-EN ISO 13920. Welding procedures are in accordance with EN288-3 or ASME IX. The manufacturer Quality System is conform to the Standard ISO 9001:2000 and is in compliance with requirements of the PED Directive module B+D.

Models
“Plates & Shell” Heat Exchangers can be manufactured under an infinity of combinations thanks to the possibility of choosing the construction materials, the design conditions, the diameter, the number of plates, the type, the dimension and the number of nozzles, the number of passes and other, less evident but equally important, details. As a consequence, the units are not univocally defined by the name of the model, but it is always necessary to refer to the technical data sheet and, in general, to the whole documentation that is part of the quotation. The name of the model is only to indicate the type of Heat Exchanger, the diameter, type and number of plates, the number of passes.

<table>
<thead>
<tr>
<th>Model</th>
<th>Area / plate [m²]</th>
<th>Connections Plate Side, DN</th>
<th>Connections Shell Side, 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>0.8</td>
<td>200</td>
<td>25-700</td>
</tr>
<tr>
<td>PSHE 14</td>
<td>1.55</td>
<td>300</td>
<td>25-1000</td>
</tr>
</tbody>
</table>
Installation, operation and maintenance

Installation, operation and maintenance manual is supplied with the unit (into the boxing). It is complete of all the necessary technical documentation in order to have a complete understanding of the product (chapter 3.4 of the attachment 1 of the PED directive); the customer can have all the information regarding the risks due to not correct operations or not foreseen by the product characteristics (chapter 2.2.3 and 3.4 of the PED directive). It is possible to remind that:

- The installation must absolutely avoid that any force by static or dynamic loads, vibrations, or thermal dilatations is transmitted to the heat exchanger.
- The heat exchanger has to work under previously specified conditions (pressure and temperature) and with fluids whose performances and chemical compatibility were verified.
- When working conditions are different from the calculation ones, the heat exchanger performances are different too; it also possible to create dangerous situations or damages to the unit.
- Pressures and flow rates have to be lower than the design limits in order to avoid any possible breakages on the more stressed parts by the dynamic action of the fluids.
- In case of steam to water heat exchange, it is better to have water pressure higher or, at least, equal to the steam one, in order to avoid micro-evaporation and scaling on the exchange surface.
- Good practice suggests to never stop water circulation when steam (or any other high temperature fluid) is into the heat exchanger.
- Piping, if with different diameter compared to the nozzle, has to be correctly fitted.
- Air venting has to be continuously checked during start up and working time too.
- Insulation is always suggested and it is absolutely necessary if the shell temperature is much higher than the ambient one. To avoid damage during the shipping, it is better to apply it directly on site.
- Cleaning inside and outside tubes can be chemical (by anti-scaling products); openable units permit the extraction of the plate pack.

For any further information see the manual or contact Spirax Sarco.