ZPJE

Creating Value for Our Customers

Zhenhai Petrochemical Jianan Engineering Co.,Ltd.
镇海石化建安工程股份有限公司

Spiral Plate Heat Exchanger

The Spiral Plate Heat Exchanger (SPHE) is the preferred equipment for demanding duties involving solids-containing,highly viscous, easily coking and fouling-prone media. It is widely applied in oil refining, chemicals, environmental protection and mining.
Zhenhai Petrochemical Jianan Engineering Co., Ltd. (ZPJE) has focused on high-efficiency heat transfer for decades, developing proprietary technology for SPHEs across thermal calculation, flow simulation and mechanical modelling. As a leading Chinese designer and manufacturer of such units, ZPJE supplies equipment for high-temperature, high-pressure and complex heat exchange duties. Continuous investment in R&D has built a full portfolio of domestic and international patents and software copyrights, which guarantee the high performance and reliable operation of every ZPJE product.

Design

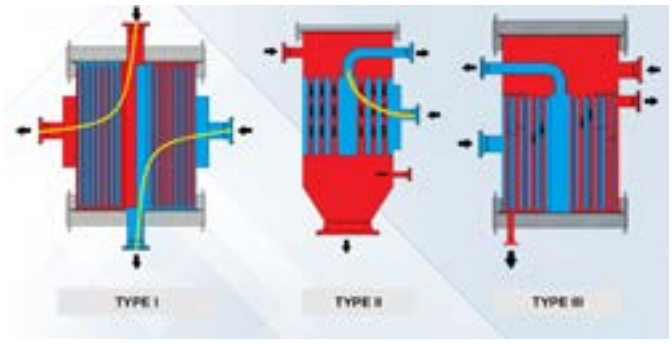
The core heat transfer unit of the SPHE consists of two (or four) parallel metal plates rolled axially around a center pipe, forming two or four independent concentric spiral channels enclosed within a cylindrical pressure vessel. Hot and cold fluids flow through their respective channels in one of two arrangements: counter-current mode, for high-efficiency heat transfer with full counterflow, or crossflow mode, where a low pressure drop is required. The joint between the center pipe and the heat transfer plates is 100% radiographic testing (RT), so the unit withstand complex and demanding operating conditions.

Spiral Flow Channel :
Precisely arranged spacer studs inside the channels continuously disturb the fluids and reduce the critical Reynolds number. Intense turbulence therefore forms even at low flow velocities, increasing the wall heat transfer coefficient rises considerably. The single continuous spiral channel eliminates stagnant flow zones, where fouling deposits begin to build up, the reduced flow crosssection automatically raises the fluid velocity, and the resulting shear force washes the deposits away. This self-cleaning effect keeps fouling to a minimum and cuts long-term operation and maintenance costs.

Cross Flow Channel :
Fluid flows axially through the channels between the spiral plates. Flow resistance is low, so high throughput is achieved at minimal pressure drop. This arrangement suits two-phase flow conditions such as evaporation and condensation, and reduce the pumping energy consumption of the system.



Cut-away view of the ZPJE Spiral Plate Heat Exchanger



Typical SPHE types : Type I (single phase or two phases), Type II (vaporizer or condenser), Type III (condenser).

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Reliability

Spiral Plate Heat Exchangers are formed by rolling continuous plates. ZPJE's fully automatic, high-precision production line covers spacer stud welding, spiral plate rolling and plate edge bending & welding. The result is an outstanding structural strength and a wide adaptability across operating conditions. For special services, the surface roughness of the heat transfer plates and welded spacer studs can reach Ra 0.2.

High Precision Manufacturing :

- Spacer stud position after welding : ±0.5 mm
- Spacer stud height after welding : ±0.1 mm
- Plate edge clearance after bending : ±0.5 mm
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Certifications :

- PED 4.3 qualified by E.U.
- A1 & A2 pressure vessel licenses (China)
- ASME authorization certificates of U,U2 & R
- ISO 9001:2015
- ISO 14001:2015
- ISO 45001:2018

Manufacturing

Spiral plate materials :

- CS, SS (304, 304L, 316, 316L, 321), SMO254, Duplex SS (2205), Nickel Alloy.

Manufacturing capabilities :

- Maximum channel width : 2,440 mm
- Maximum spiral bundle diameter : 3,600 mm
- Maximum design pressure : 6.0 MPa
- Maximum design temperature : 550 °C
- Maximum plate thickness : 7 mm
- Channel spacing : 5 – 32 mm



Fully welded spiral bundle of a large-diameter SPHE.

Performance

The robust fully welded design, combined with anti-fouling and anti-clogging features, minimises the long-term maintenance cost of the SPHE. On severe services involving solids-containing, highly viscous, easily coking and fouling media, the ZPJE SPHE is the most cost-effective solution once total capital and operating costs are taken together.

- High heat transfer efficiency and low hot approach temperature : more heat recovered, lower CO2 emissions.
- Compact structure : significant savings in plot area.
- Self-cleaning spiral channel : suited to high-viscosity and solids-containing services, with longer intervals between cleanings.
- Fully welded design and easy cleaning : reduced downtime and maintenance costs.



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