Spiralex’ Heat Exchangers for Sludge to Sludge Applications

Spiralex® corrugated tubular heat exchanger
The corrugated tubular heat exchangers of Spiralex BV are very recommendable for the processing of high viscosity and particulate products, where the use of any other kind of heat exchangers, like plates, is not suitable since their performance is not correct due to pressure limitations, particles, running times or CIP. The Spiralex® heat exchanger is designed according the principle of counter current flow.

Spiralex® heat exchangers are manufactured in any austenitic steel, like stainless steel AISI 304, AISI 316, 254 SMO, Duplex 2205, Duplex 2507 and many more. Spiralex® heat exchangers are standard manufactured in accordance with the new PED/CE regulation. We design the Spiralex® heat exchanger under international codes, like AD Merkblätter, ASME VIII, TÜV, Stoomwezen, BS5500 (British Standard) as well as a number of other codes. Our manufacturing facilities are certified according to ISO9001 and TÜV. Moreover, destructive and non-destructive tests on the Spiralex® heat exchangers can be executed, as well as witness from recognised companies like Bureau Veritas, TÜV, Lloyd’s Register, Der Norske Veritas, SGS, and many others.

Spiralex BV provides its technology to countries like U.S.A., Japan, Western and Central Europe and Australia (see for an international reference list on www.redenko.nl). For more than 20 years of experience, the Spiralex® heat exchangers have been manufactured for a wide variety of service throughout the world. There are numerous installations in service where cleaning and sterility are prior requirements.

Working Principle
The way the fluid flows through a pipe depends on several parameters like the velocity of flow, equivalent diameter of the channel, density and viscosity of the fluid. This combination determines a dimensional function named Reynolds Number. A laminar flow occurs when the flow lines move along the direction of flow (axial), so there’s no mixing of molecules associated to different lines of flow, as there is no transversal displacement. On the other hand, a turbulent flow induces mixing since transversal displacement takes place.

Regarding the heat transfer system that we are considering, heat is transmitted by conduction and convection. We refer as the transmission of energy produced when molecules vibrate (there’s no displacement). With convection, molecules collide and exchange energy (displacement takes place). Convection can be natural or forced. Forced convection is what is achieved with a heat exchanger whilst providing the mixing between cold and hot parts of fluid, for example when we stir a cup of coffee to cool it. Natural connection would mean to leave it cool itself by means of natural currents taking place within the fluid.
Our heat exchangers are based on corrugated tubes, which is made by a mechanical deformation of the wall of a smooth tube, or a plate, which produces an increase of turbulence when fluids go through. The advantages of a turbulent flow regarding the transmission of heat are mainly:

- The heat transfer is carried out faster because we increase the mixing of hot and cold parts of the fluids.
- The product does not burn inside the exchanger because of the stirring and mixing, as product is not allowed to stick on the wall while it is kept in continuous agitation.
- While the flow is turbulent, deep agitation is induced, so the heat exchanger can be easily cleaned since the product does not stick. Fouling deposition rates are reduced.
- The channels are easily accessible for inspection or manual cleaning. It is also possible to dismantle the unit for cleaning (a not welded TFM-version).

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**Advantage of the Corrugated tubular heat exchanger**

1. **High turbulence and self-cleaning effect**
   Due to the corrugated tubes, which produces an increase of turbulence when fluids go through, the heat transfer is carried out faster because we increase the mixing of hot and cold parts of the fluids and the sludge does not burn and stick inside the heat exchanger because of the stirring and mixing (continuous agitation and therefore a short residence time).

2. **Short payback time**
   The payback time of the corrugated heat exchanger resulting from energy-savings is 30-40% shorter than other types of heat exchangers (i.e. smooth tube or spiral) due to the cheaper purchase price, longer running times, shorter maintenance time and less spare parts.

3. **Easy access**
   By removing the flanges of the corrugated heat exchanger, the entire length of the heat exchanger is accessible for inspection or mechanical cleaning if necessary and no heavy cover has to be removed. Moreover, due to the single pass on each side, the corrugated heat exchanger is rapidly cleaned and has very good results with cleaning solutions without opening the unit (C.I.P. & S.I.P.).

4. **No dead ends**
   Due to the excellent design of the corrugated heat exchanger, there are no dead areas. Therefore, the chance of problems like bacteria growth (sludges and digestate!), corrosion problems (standing flow) and sticking will be much lesser.

5. **No internal leakage**
   Media cannot mix; the tubes are fully welded in the tube sheet on each side of the heat exchanger.
Other big advantages of the Spiralex® heat exchangers for sludge solutions are:

- Homogeneous heat treatment, without distribution problems or preferential flows.
- Low fouling rate.
- Top quality in heat treatment because of velocity, short heating time, homogeneous distribution and possibility to work at high pressure.
- Modular unit: its capacity can be increased at any moment.
- Low maintenance costs (few spare parts, easy CIP, etc).
- Heat recovery up to 70%
- Cooled digested sludge reduces environmental pollution due to reduction of vapours and odours.
- Cooled digested sludge provides improved thickening and dewatering of the sludge.
- Fully drainable

Spiralex is a main supplier for thermal solutions in the pharmaceutical, food and chemical industries. Its thorough and project-oriented approach, its service and quick response makes Spiralex a reliable and major partner to many leading companies.

When you need additional information or advice, please contact Spiralex BV.