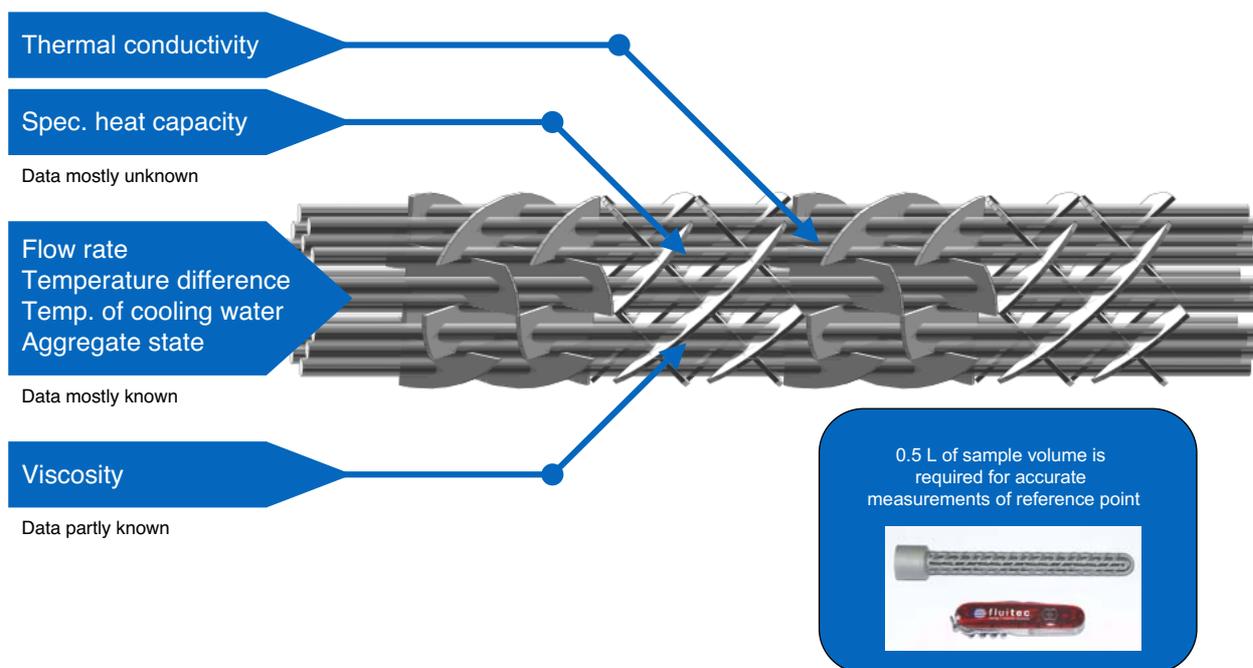


Fluitec Documentation No. 11.148 Rev. 1

Fluitec Mixer/Heat-Exchanger Capable for CIP-cleaning CSE-XR® for Food Processing

The Fluitec CSE-XR® type mixer/heat exchanger is specially designed for heat exchange in laminar flow conditions. It is used as a standard device for processing sweets and chocolate as well as in the dairy Industry. In addition to the very high heat transfer performance when processing high-viscosity liquids, its success is founded on the lack of any dead spots and its reliability for CIP cleaning (Cleaning In Place). Products in the food industry mostly have a very complex composition, so that theoretical assumptions of the physical properties tend to be inadequate. The analytical test facilities at Fluitec allow fast, precise and economical determination of physical data such as viscosity, density, specific heat capacity and thermal conductivity. For accurate analytics, about 0.2 to 0.5 l of a sample volume are required. These values ensure a precise design and sizing of the laminar heat exchanger and therefore safe operation.



The technology

The Fluitec CSE-XR® type mixer/heat exchanger was explicitly developed for cooling or heating products with a high viscosity under laminar flow conditions. It basically consists of a combination of static mixing elements and a bundle of heat transfer tubes. The product flows through the mixing elements outside the tubes, while the heating or cooling liquid is pumped through these tubes. The product is thereby permanently directed to the hot or cold tubes, thus leading to very high heat transfer rates and a plug flow regime.

The main characteristics of this unique design are

its compact dimensions, its CIP capability and its ability to mix the product intensively without requiring any moving parts. The combination of mixing and heat transfer results in a general improvement in product quality. The CSE-XR® combines the advantages of plate and scratch heat exchangers, while eliminating the disadvantages of both. It has a large specific interfacial area, creates high k -values and has no dead spots. In-line cleaning can be performed without any dismantling.

To simplify inspections, however, the complete bundle of mixing elements and internal tubes can be removed very easily as a single package.

Products are treated gently due to the low and uniformly distributed shear rates and the absence of any local hot spots. The fact that there are no moving parts means negligible wear and maintenance costs, and sealing problems are totally unknown. Products that could crystallise, precipitate or freeze are cooled in a special CSE-XR® model, which is continuously self-cleaned during operation by moving the bundle of mixing elements in the axial direction.

The Fluitec CSE-XR® mixer/heat exchanger is used for the following processes:

- Tempering viscous food
- Cooling cocoa butter and chocolate
- Aftercooling downstream of ball mills
- Processing creams
- Processing caramel and liquorice
- Tempering chocolate coatings
- “Boiling” sweets and candies
- Processing oil and fat

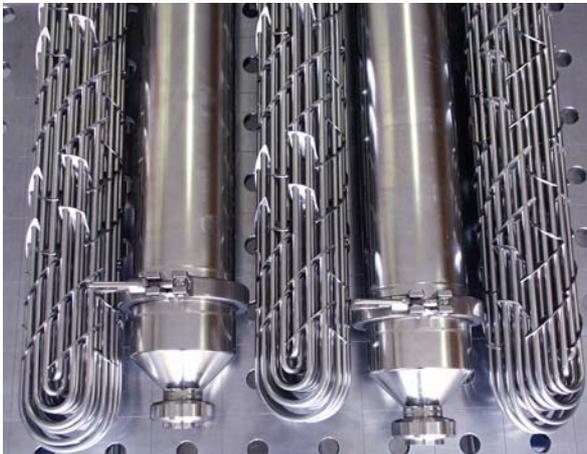


Fig 2: CSE-XR® mixer/heat exchanger

Design features

The most important design features are as follows:

- The mixing and heat exchanging internals are removable as a single, compact package
- All surfaces can be reliably cleaned and sterilised in-situ
- Maldistribution is reduced to a minimum, thus leading to a very narrow residence time distribution
- Due to the very high specific heat transfer performance, this design is ideal for processing highly viscous and temperature sensitive media

Determination of the physical data of the product
The availability of physical data for complex and highly viscous products is often severely restricted. Values from literature, especially those for pure components, must be treated as very approximate information only, since even minute traces of other components can change the physical properties dramatically, especially the thermal conductivity. Practical preliminary tests with the original products are the best way to

design a successful heat exchanger. Only 0.2 – 0.5 liter of a sample volume are required to obtain all the necessary data.

These analytical measurements are performed by Fluitec free of charge as the basis for a reliable and fair offer to its clients.



Fig 3: Inspection of the CSE-XR® by a client after CIP cleaning

Excellent plug flow

The plug flow-like regime of the Fluitec mixer/heat exchanger leads to a very narrow residence time distribution. Bodenstein numbers up to $Bo = 400$ are common, indicating almost perfect plug flow. Practical experience shows that the CSE-XR® is completely clean after flushing with 2 – 4 volumes of cleaning liquid, although this value naturally depends on the type of liquid.

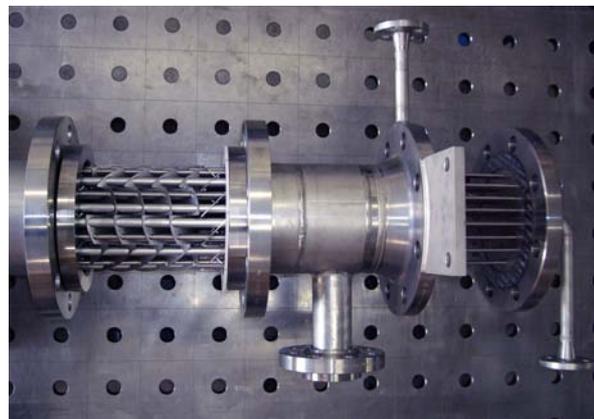


Fig 4: The third generation of the Fluitec mixer/heat exchanger to be heated with steam