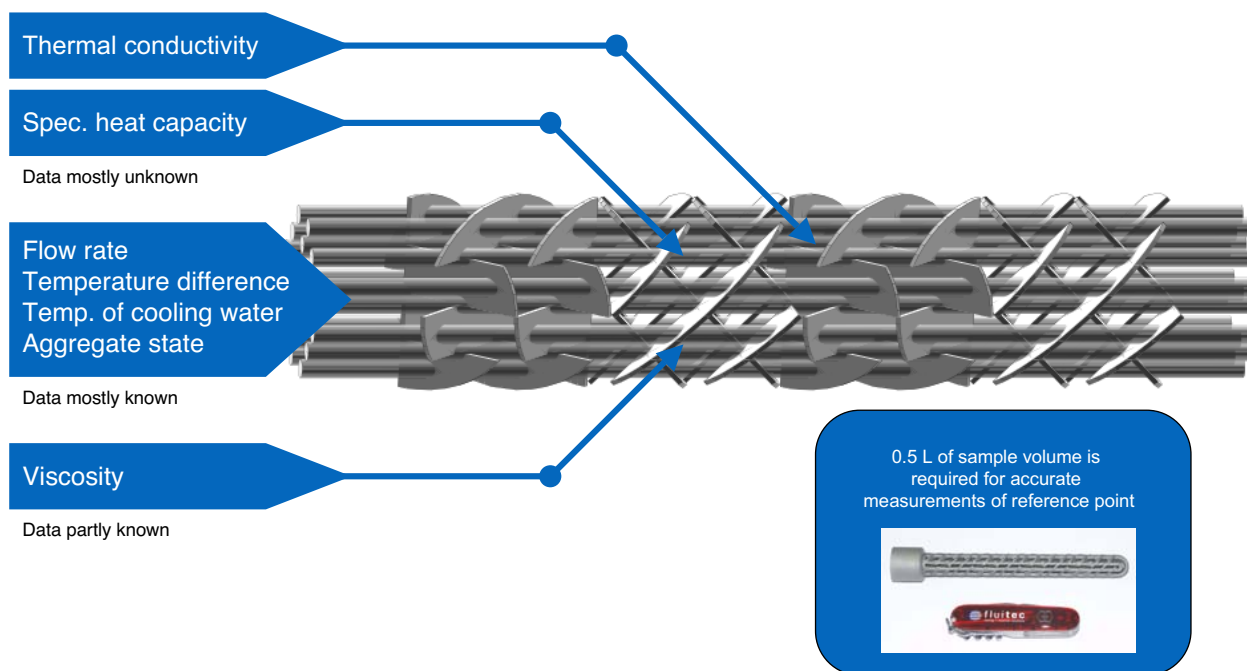


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Fluitec Mixer/Heat-Exchanger capable for CIP-cleaning CSE-XR® for Food Processing

The Fluitec Mixer/Heat-Exchanger type CSE-XR® is consequently designed for the heat exchange at laminar flow conditions. It is used as a standard device for processing of sweets, of chocolate or in the dairy Industry. Beside of the very high heat transfer performance if processing liquids of higher viscosities, its success is based on the lack of any dead spots and its reliability for CIP-cleaning (Cleaning In Place). Products in the food industry are mostly of very complex composition, thus making theoretical assumptions of the physical properties very doubtful. The analytical test facilities at Fluitec allow the fast, precise and economic determination of physical data such as the viscosity, the density, the specific heat capacity and the thermal conductivity. For accurate analytics, about 0.2 to 0.5 L of a sample volume is required. These values ensure the precise design and dimensioning of the laminar heat exchanger and thereby safe operating.



The Technology

The Fluitec Mixer/Heat-Exchanger type CSE-XR® is especially created to cool or to heat products of higher viscosities under laminar flow conditions. It consists basically of the 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 plug flow regime.

Main characteristics of this unique design are the compact design, the CIP-capability and the

ability to mix the product intensively without any moving parts required. The combination of mixing and heat transfer leads to a better products quality in general. The CSE-XR® combines the advantages of plate heat exchangers 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 necessary.

For inspection reasons, however, the complete bundle of mixing elements and internal tubes can be removed as one single package in a very easy way.

Products are treated gently due to the low and uniformly distributed shear rates and due to the absence of any local hot spots. The lack of any moving parts leads to negligible wear and maintenance costs, and also sealing problems are unknown. Products which may crystallize, precipitate or freeze are cooled in a special model of the CSE-XR®, which is permanently self-cleaned during operation, by moving the bundle of mixing elements in axial direction.

The Fluitec Mixer/Heat-Exchanger CSE-XR® is used for the following processes:

- tempering of viscous food
- cooling of cocoa butter and chocolate
- as a cooler after ball mills
- processing of creams
- processing of caramel and liquorice
- tempering of couverture
- to “boil” sweets and candies
- for the processing of oil and fat.

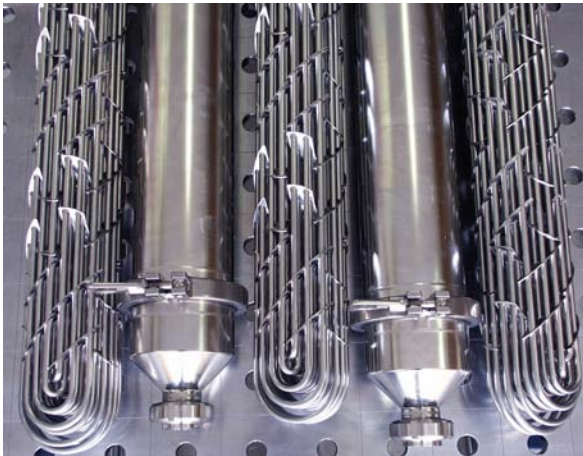


Fig 2: Mixer/Heat-Exchanger CSE-XR®

Characteristics of the Design

Constructive characteristics of the design are such as:

- the mixing and heat exchanging internals are removable as one 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 dedicated to process highly viscous and temperature sensitive media.

Determination of the Physical Data of the Product

The availability of the physical data of complex and highly viscous products is often strongly restricted. Values from literature, especially if using values of pure components, must be treated as very rough information only, since already traces of other components can change the physical properties dramatically, especially the thermal heat conductivity. Practical preliminary tests using the original products are the best way to succeed in designing and

operating heat exchangers. Fluitec requires only 0.2 – 0.5 L of a sample volume to get all necessary data. Fluitec performs these analytical measurements for free in order to make a reliable and fair offer to its clients.



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

Excellent Plug-Flow

The plug-flow like flow regime of the Fluitec Mixer/Heat-Exchanger leads to a very narrow residence time distribution. Values of *Bodenstein*-numbers of up to $Bo = 400$ are common, indicating an almost perfect plug-flow regime. Practical experience shows that cleaning of the CSE-XR® is finished after flushing with 2 – 4 volumes of cleaning liquid. Of course, this value is depending on the type of liquids.

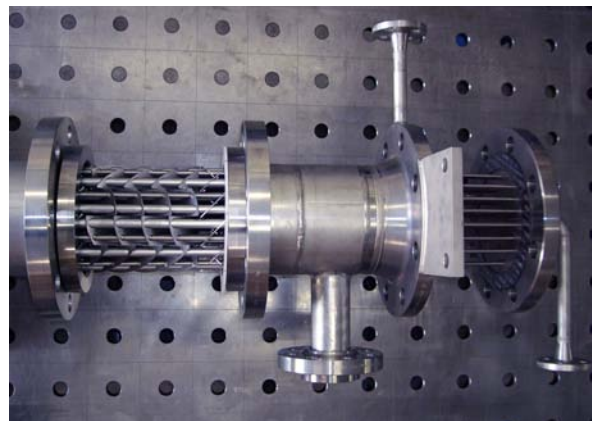


Fig 4: Fluitec Mixer/Heat-Exchanger of the 3th generation to be heated with steam.