fluitec
mixing + reaction solutions

Mixing / Heat Transfer

Unique mixer / heat exchanger combinations

Fluitec

www.fluitec.ch

It was back in 1993 when Fluitec launched its first static mixers in the market. Today, Fluitec is a reliable partner for high quality products whose know-how spans a wide range of mixing, heat transfer and reaction tasks in the chemical, petrochemical, pharmaceutical, environment and food industries.

View of the production shop – apparatus weighing up to 3.5 tons is manufactured in-house

The Fluitec management:
Daniel Altenburger (Managing Director), Silvano Andreoli (Manager Production), Alain Georg (Manager R&D), Tobias Vögeli (Manager Sales)

The Fluitec team

Contents

The Fluitec mixer/heat exchanger

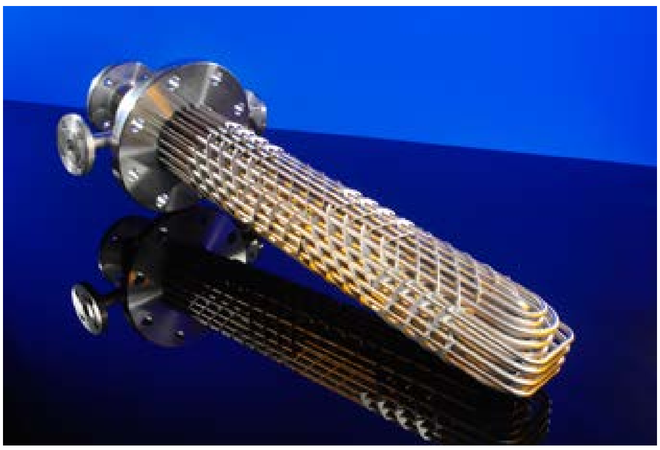
For more than 20 years now, the Fluitec mixer / heat exchanger has simplified heating and cooling of viscous media such as pastes, melts or emulsions. Thanks to its special mixing elements, the CSE-XR mixer / heat exchanger masters the fluid dynamics of both cross-mixing and surface renewal, so that the apparatus is suitable both for exothermic or endothermic chemical reactions and for temperature conditioning of highly viscous fluids (heating or cooling).

The CSE-XR technology is constantly evolving and meanwhile delivers optimal performance in a wide range of processes. The mixer / heat exchanger is a combination of a static mixer and a multitube heat exchanger in which a product on the shell side flows through the static mixer. The advantages of these two distinct systems are aggregated for use with slow-flowing media.

Applications
The CSE-XR mixer / heat exchanger can be used either as a heat exchanger or as a reactor.

Typical applications:

- Heating and cooling in the laminar flow regime
- Cooling and homogenising fluids with large viscosity differences
- Processing and manufacturing adhesives and hot melts
- Cooling and homogenising melts for the man-made fibre industry
- Temperature monitoring and homogenising of polymer melts and plastic foams
- Mixing and temperature conditioning of polyols with blowing agents and isocyanates
- Heating and cooling products in the food industry



The mixer bundle of a CSE-XR mixer / heat exchanger

- General plug flow and loop reactor in high-chem processes
- Reactor for mass polymerisations
- Reactions with heat effects on high-viscosity fluids, e.g. polymerisations
- Continuous reaction apparatus for strictly defined reaction times
- Isothermal residence time reactor for low and high-viscosity fluids
- Fast chemical reactions involving low-viscosity fluids with high heat effects and precise temperature control
- External cooling and mixing of stirred tank reactors
- Heating of viscous fluids with steam, also at high operating pressures
- Isothermal gasification reactor for gas-liquid systems

The Fluitec mixer / heat exchanger also works where conventional heat exchangers are doomed to failure due to pseudoplasticity (shear thinning), thixotropy or other significant viscosity changes (related to the product temperature).

From CSE-X mixer to CSE-XR mixer / heat exchanger

Straightforward static mixers like the CSE-X have a very high mixing efficiency. When used with viscous media, in other words in the laminar flow regime, the CSE-X mixing element produces a uniform plug flow with a uniform shear field over the entire cross-sectional area.

If mixing elements are mounted into the inner tube of a monotube heat exchanger, the heat transfer rate on the inside of the tube increases. However, there are also limitations on the use of CSE-X mixing elements in monotube heat exchangers, because with tube diameters larger than about DN 50 the heat transfer coefficient is inversely proportional to the diameter:

Equation 1 $\alpha_i = \frac{Nu \cdot \lambda}{D}$

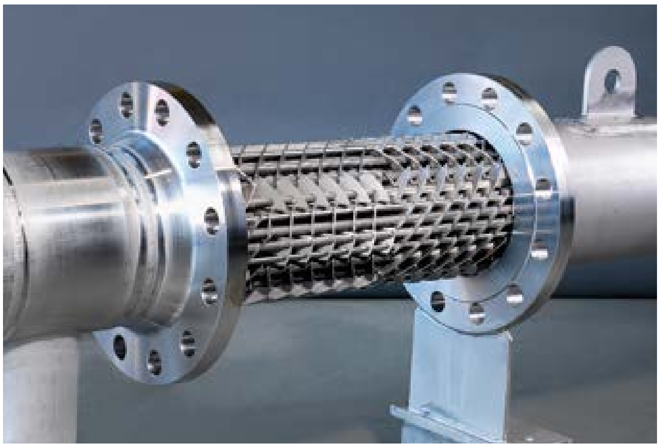
Since the heat transfer efficiency is lower in relation to the apparatus volume, it must be compensated by increasing the heat-exchanging area. If an additional tube bundle is inserted into a plug flow reactor with mixing elements, a larger inner heat-exchanging area is obtained without compromising mixing efficiency; this profits from the mixer / heat exchanger to the same extent as the outer heat-exchanging area of the plug flow reactor.

In other words, static mixers optimise the heat transfer on the tube wall owing to the forced radial convection.

High performance apparatus is fitted with internal multitubes. With both systems, the Nusselt number is independent of the tube length and can be calculated as follows:

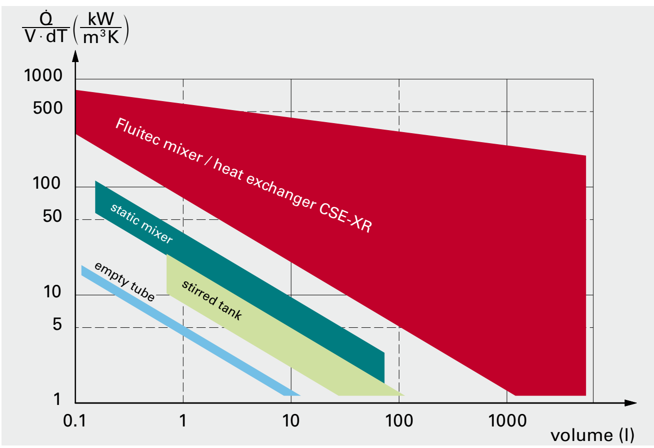
Equation 2 $$Nu = a \cdot Pe_D^b \cdot \left(\frac{Pr}{Pr_W}\right)^{0.14}$$

Values for the coefficient a and the exponent b can be found in the literature. The fact that both Newtonian and non-Newtonian flow behaviour can occur is an added difficulty with viscous media. Polymer melts and plastic solutions exhibit pseudoplastic, viscoelastic properties whereas pastes are dilatant (shear thickening) and viscoplastic. Time dependencies (rheopexy or thixotropy) and wall slip effects are also possible. All this can result in significant changes in the coefficient a and the exponent b, and hence huge differences in the design.



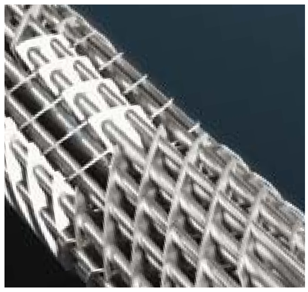
The inner heat exchanger tubes correspond to the inner heat-exchanging area

The very high Nusselt numbers achieved by the mixer / heat exchanger and the larger heat-exchanging area translate into an excellent, volume-specific heat transfer capacity.

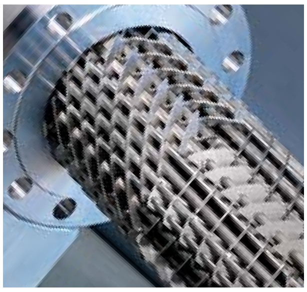


Specific heat transfer efficiency of different heat exchanger types

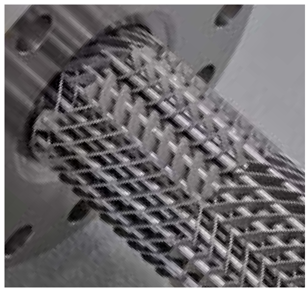
2nd generation



3rd generation



4th generation



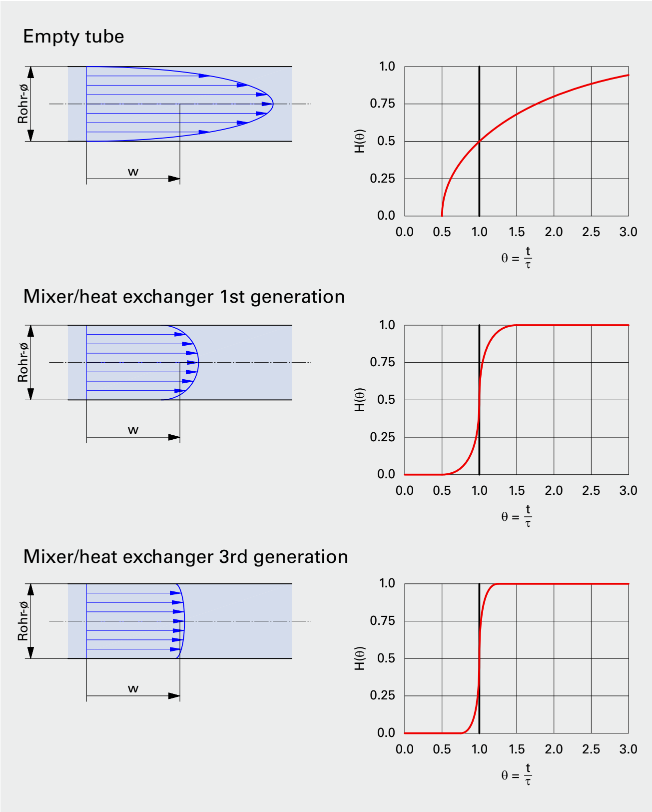
5th generation

Evolution of the mixer / heat exchanger

The CSE-XR® mixer / heat exchanger is constantly evolving. Following the successful launch of the mixer / heat exchanger in 1999, the installation of additional bars a few years later had a positive impact on both mixing efficiency and heat transfer. This basic concept has been regularly extended and optimised during the last few years, for example with an alternative tube arrangement and novel bar geometries.

Today, Fluitec CSE-XR mixer / heat exchangers can be supplied in many different versions and sizes and with different power and pressure ratings. Thanks to cutting-edge tools like 3D-CAD and computational fluid dynamics (CFD), new ideas can be developed and simulated much faster than was possible only a few years ago.

The newest generations of the CSE-XR® mixer / heat exchanger can not only be built shorter than before thanks to the optimised heat transfer; they also deliver even better performance in unit operations such as very intensive mixing with high heat or mass transfer rates. Alongside the evolutionary development and optimisation of the heat transfer efficiency, particular importance has traditionally been attached to reconciling optimal flow behaviour with excellent residence time distribution. These advances were achieved while maintaining, and often improving, the already outstanding flow and purging properties of the mixer / heat exchanger's basic geometry. The residence time range has been further optimised with each new version.



Velocity and residence time compared when mixer / heat exchangers are used in a laminar flow plug flow reactor (Re < 20)

Residence time distribution

The Fluitec CSE-XR® mixer / heat exchanger provides excellent residence time distribution. Practical experience has shown that, depending on the fluid, the mixer / heat exchanger is absolutely clean after purging with between 2 and 4 times its volume.

Design

Provided the customer is familiar with the flow behaviour, Fluitec can design the mixer / heat exchanger without any preliminary tests thanks to many years of intensive research and extensive experience.

With heating processes, the design is generally straightforward. Cooling can be more of a problem, however, especially if the temperature drops below the breakpoint. Preliminary tests are therefore recommended for complex, unknown cooling processes. If pilot-scale tests have already been performed using conventional, static mixers, e.g. helical shaped or X-type, these measurements can be taken for the scale-up to production level.

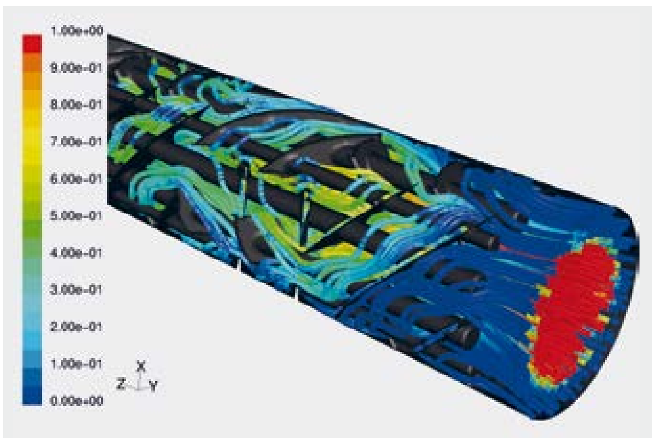
Breakpoint

This internal term describes an effect where further cooling is no longer possible after reducing the cooling water temperature. This effect can be explained with the aid of an example:

A polymer melt (viscosity @ 215°C = approx. 1500 Pas) must be cooled in a process from 215°C to 190°C at a throughput of 900 kg h^{-1}. Any coolant can be used. If we take a look at the heat transfer equation (equation 3), the heat transfer coefficient k and the area A are referred to the apparatus. By selecting the largest possible logarithmic temperature difference ΔT_L, a smaller apparatus can be used to achieve the necessary cooling in the heat exchanger.

Equation 3 $J_Q = k \cdot A \cdot \Delta T_L$

The desired final temperature is obtained by operating the polymer cooler at a coolant temperature of 150°C. If the coolant temperature is reduced to around 100°C, further cooling suddenly becomes impossible. This temperature is referred to as the breakpoint. The mixing efficiency is now no longer adequate to prevent the build-up of viscosity at the heat exchanger tubes. The pressure drop at the breakpoint will probably be larger while the Bodenstein number will be slightly lower. This represents the application limit of the CSE-XR mixer / heat exchanger. Unlike tube reactors with intersecting tubes and multitube heat exchangers, the mixer / heat exchanger also guarantees a good temperature profile at the breakpoint. The high mixing efficiency of the CSE-XR reduces the risk of maldistribution to a minimum. The breakpoint should generally be determined by means of preliminary tests on a small scale. This will ensure that the process can be operated with the largest possible logarithmic temperature difference ΔT_L.

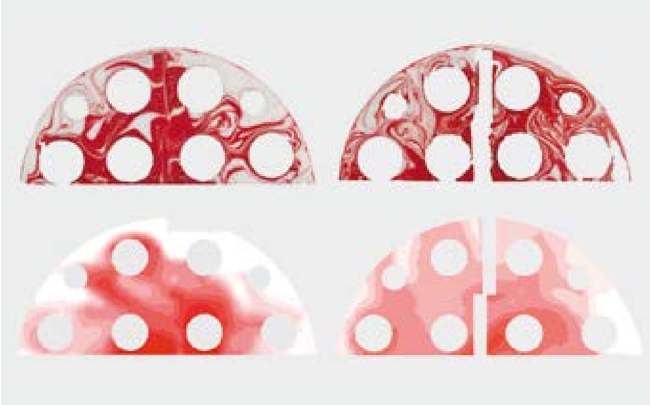


CFD simulation of a CSE-XR mixer / heat exchanger

Better-than-average cooling

The great advantage of the mixer / heat exchanger system lies in the many different combinations of mixing elements and tube arrangements. The breakpoint can be influenced by selecting the optimum geometry, in other words the range of applications for the heat exchanger can, under certain circumstances, be expanded by choosing high performance geometries.

It is then possible to mix strongly pseudoplastic (non-Newtonian) or thixotropic media over a wide temperature range and with a large difference between the viscosity at the inlet and outlet as well as the coolant temperature.



Epoxy section of a first-generation mixer / heat exchanger according to 2D and 4D (top: reality, bottom: CFD simulation)

Maldistribution

With conventional tube heat exchangers, that is without a static mixer, a laminar flow often leads to problems with the fluid layer on the tube wall, which in a tube with an axial flow only flows very slowly due to friction. If this empty tube is simultaneously cooled, the flow velocity on the tube wall may be further reduced because the viscosity of the cooler product increases, with the result that the surface layer rapidly comes to a standstill. The layer which then sometimes forms on the tube wall could subsequently thicken. If there is a parallel flow through the tubes (multitube heat exchanger), the formation of surface layers, viscosity differences due to different product temperatures and the influence of shear on the product can result in maldistribution, in which case the heat exchangers are characterised not only by poor performance but also by undefined residence time distribution.

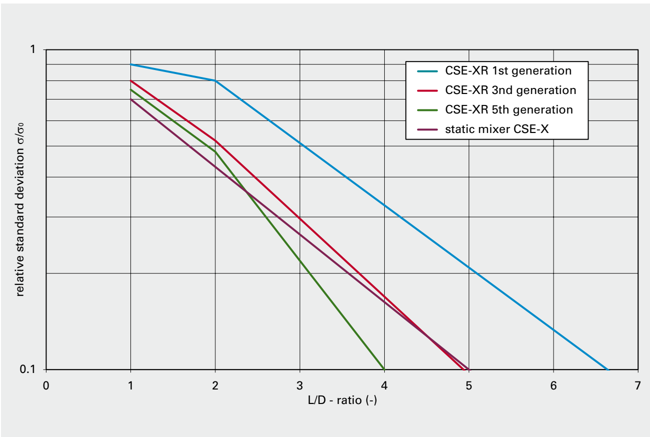
Assuming the CSE-XR mixer / heat exchanger used correctly, the risk of maldistribution effects can be ruled out. The above-mentioned weaknesses of conventional tube heat exchangers are avoided because there is a uniform product flow through a single mixer tube and the static mixer ensures that the shear field remains constant over the entire cross-sectional area. The defined, oblique inflow to the heat exchanger tubes means the medium on the tube wall is continuously and uniformly renewed (surface renewal). An oblique inflow to the multitubes significantly increases the heat transfer rate in the laminar flow regime compared to systems which are operated with a parallel flow (e.g. double shell tube).

Thanks to its plug flow, the static mixer ensures a narrow residence time range and a homogeneous product temperature over the entire cross-sectional area. Even media where the residence time is critical can thus be processed without any problems.

Mixing efficiency in the mixer/heat exchanger

The mixing quality was determined on the one hand using computational flow dynamics and on the other by means of practical measurements with Fluitec Image Processing (FIP).

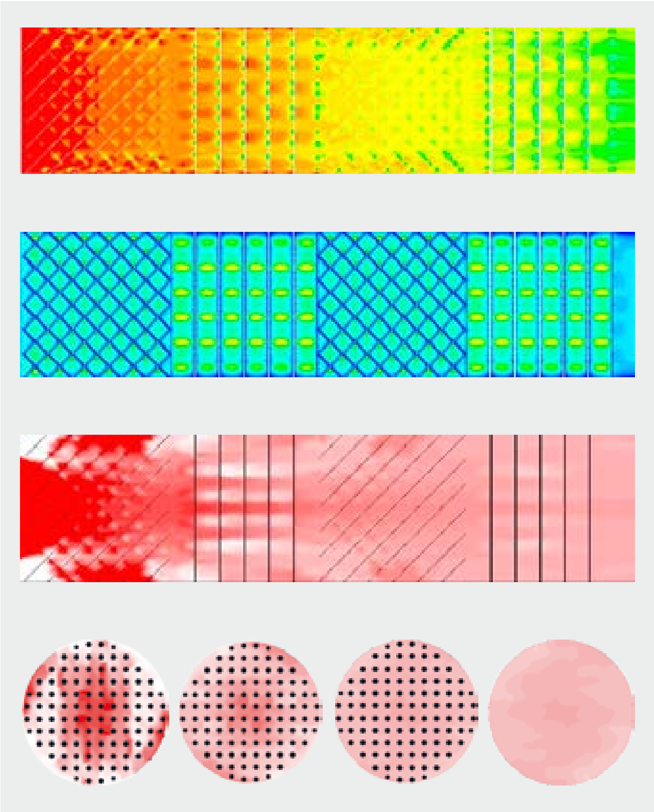
The mixer / heat exchanger provides excellent mixing efficiency. Studies have confirmed that, depending on the generation, the heat exchanger achieves mixing efficiencies to rival even the very best static mixers.



Mixing quality of static mixers and mixer / heat exchangers compared

Following extensive tests, it is also possible nowadays to calculate the temperature profile over the cross-sectional area after cooling processes with a very large temperature difference at the outlet. Warranty values of +/- 0.5°C to +/- 2°C are the norm.

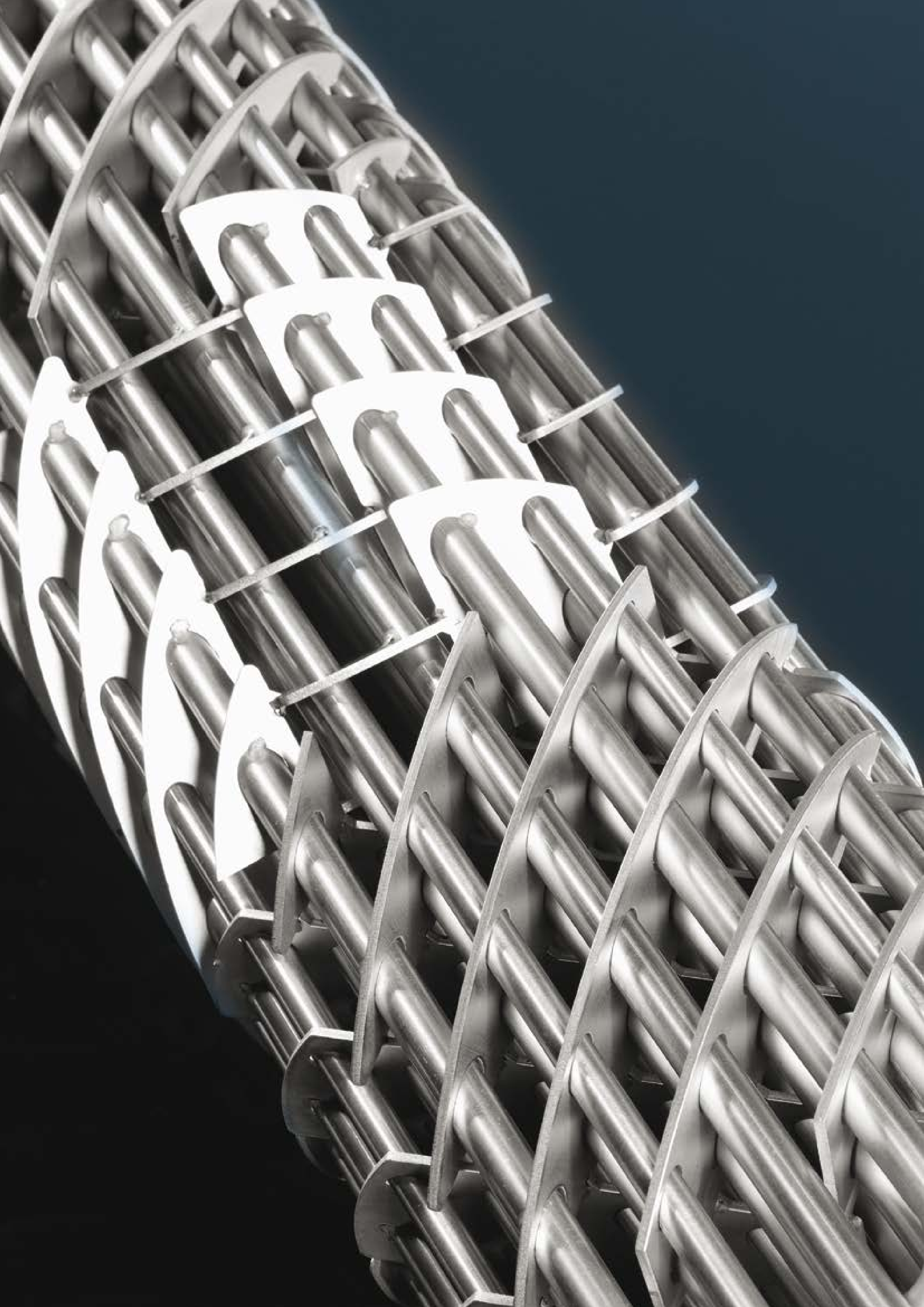
Example
A hot melt with a viscosity of around 2000 Pas had to be cooled from 140°C to 80°C in a coating plant. The cooling water temperature was 70°C. Warranty measurements were performed on the production plant at the outlet of



Temperature curve, shear and mixing in a mixer / heat exchanger

the CSE-XR mixer / heat exchanger. It was possible to adjust the temperature profile over the cross-sectional area to 80°C +/- 1.0°C during continuous production.

Even momentary temperature fluctuations of up to +/- 20°C upstream of the mixer / heat exchanger inlet can be compensated thanks to the exchanger's high mixing efficiency. However, this is conditional on a heat exchanger design that takes account of various additional criteria. Detailed calculation methods exist to facilitate temperature profile predictions in both the radial and the longitudinal directions of the CSE-XR mixer / heat exchanger.



Reactors based on mixer/heat exchangers

Reactors based on mixer-heat exchangers

Thanks to their special process properties, CSE-X mixers or CSE-XR mixer / heat exchangers are ideal for carrying out chemical reactions. They are mainly used as tube or loop reactors in continuous reaction processes.

In batch processes, Fluitec mixing systems are employed either as premixers or as additional, external loop reactors in stirred tanks. The properties of the fluids involved in a chemical reaction determine whether that reaction should be carried out as a continuous or a batch process; however, the choice of reaction process is also influenced by the general advantages and drawbacks of each process type.

Polymerisation reactor DN 250

Continuous reaction processes

In contrast to batch reaction processes, a flow of starting materials is constantly added to and removed from a continuous reactor. This steady-state reaction process is characterised by the consistency of the reaction parameters "concentration" and "temperature" over time. The advantages of continuous reaction processes can be summarised as follows:

- The defined mixing quality and narrow residence time range enable high product quality.
- The conversion rate in a tube reactor is higher than in a continuous, stirred tank reactor.
- The reactor requires practically no maintenance and its energy consumption is low.
- The reactor can be operated with a small reaction volume (improved control and safety).
- The high level of automation leads to low operating and investment costs.

Mixer / heat exchanger with a large specific heat-exchanging area. Ideal for process research or for developing in-line reactions

Conversion rate and reaction rate

The reaction rate RG is characterised using the conversion rate defined for the starting material i in a chemical reaction:

Equation 4 $$U_i = \frac{n_{i,0} - n_i}{n_{i,0}} = \frac{c_{i,0} \cdot V_0 - c_i \cdot V}{c_{i,0} \cdot V_0}$$

where $n_{i,o}$ is the amount of a starting material before the reaction (at the time t = 0) and n_i is the amount of this component at the time t. This definition based on the amounts of substances is always correct but is considered inconvenient by chemists, who prefer to calculate using concentrations; $V_0 = V$ can often be assumed for the sake of simplification.

One practical classification of the reaction rate is derived from the half life t_H. This is the time t_H after which half of the starting material has reacted, in other words when the conversion rate $U_i = 0.5$. Reactions are classified as follows:

	$t_H > 1$ min	= slow
1 s <	$t_H < 1$ min	= normal
1 ms <	$t_H < 1$ s	fast
	$t_H < 1$ ms	= very fast

Fluitec mixers and heat exchangers are used for slow, normal or fast reactions. If reactions where there is initially very high heat production have to be controlled isothermally, continuous loop reactors are preferred. A suitable residence time section can be installed downstream.

High mixing efficiency for reaction technology

The high mixing quality of the CSE-XR mixer / heat exchanger in the laminar flow regime is unique and enables different chemical processes to be combined.

A first-generation mixer / heat exchanger, for example, can be used to mix two highly viscous fluids. The required relative lengths, namely L/D = 12 to 20, enable a considerable quantity of heat to be simultaneously supplied and removed. More complex mixing tasks can be realised with more recent heat exchanger generations. A low-viscosity catalyst, for instance, can be added to a high-viscosity monomer using a third-generation Fluitec mixer / heat exchanger while simultaneously removing the reaction heat.

The CSE-XR mixer / heat exchanger is often chosen for chemical reactions such as esterifications and mass, emulsion or suspension polymerisations for this reason.

Bodenstein number

Another parameter which is of interest for a chemical reactor is the time for which the reaction partners are available for the reaction. The Bodenstein number Bo is frequently used for this purpose in real tube reactors. This is a measure of the residence time distribution width according to the dispersion model. In Fluitec reactors, the Bodenstein number is determined as follows:

Equation 5 $$Bo = \frac{u_z \cdot L}{D_{ax}}$$

Dispersion model

The dispersion model is only allowed to be used in case of minor deviations from the ideal displacement model, in other words high Bodenstein numbers and an almost axially symmetric material distribution are a must. Although the dispersion model can theoretically be extrapolated to Bo = 0, a value between Bo = 7 and 20 is specified as the residence time distribution limit between a tube flow and the stirred tank reactor, depending on the literature.

Residence time reaction section comprised of 6 Fluitec mixer / heat exchangers in line

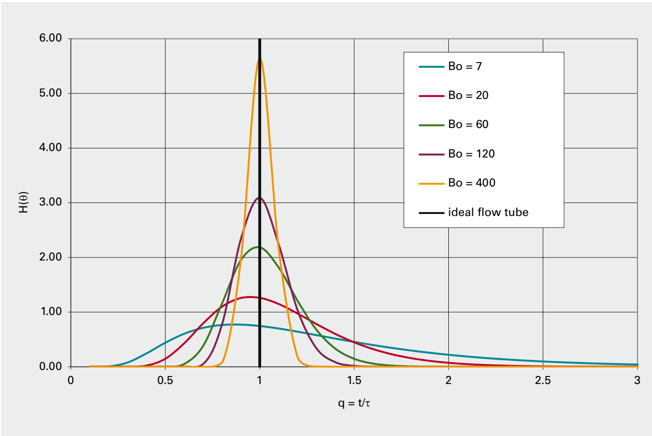
The reactor must be operated in a steady state in order to determine the residence time range. It is extremely important that the marker substance to be measured behaves like the reaction solution and remains chemically unmodified. The mean residence time t can be calculated according to equation 6 regardless of the reactor design:

Equation 6 $$\tau = \frac{V_R}{\dot{V}}$$

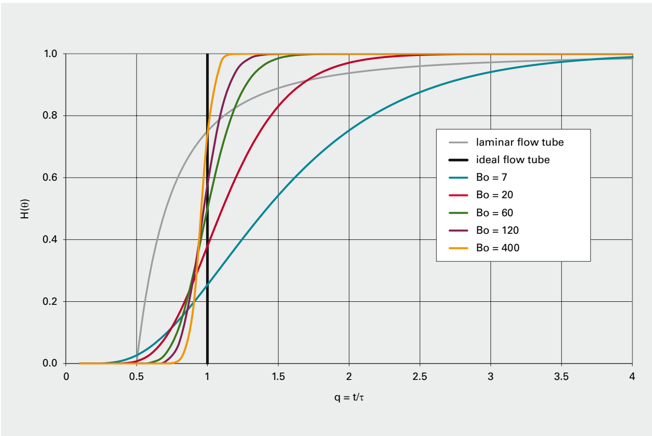
V_R = Reactor volume (L)
$\dot{V}$ = Reactor volume flow (L s^{-1})

The cumulative residence time curve is derived from the measured values in the residence time range, to enable the Bodenstein number in the reactor to be determined.

Depending on the length available for installation, Bodenstein numbers up to Bo = 400 can be achieved with Fluitec mixer / heat exchangers in reaction technology; this approximates an ideal plug regime.



Residence time range according to the 1-d model



Cumulative residence time curve

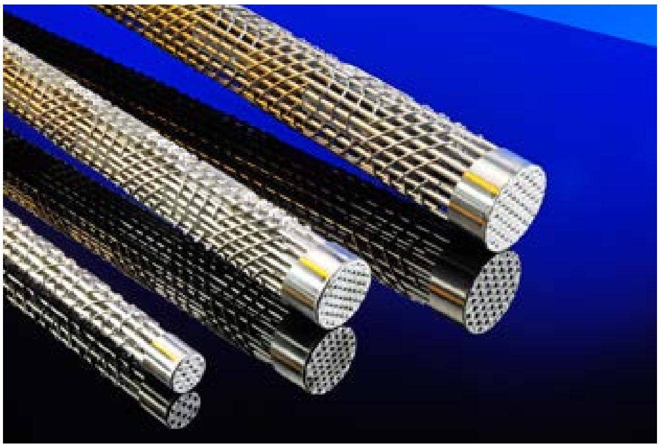
Scale-ups

The Fluitec scale-up system

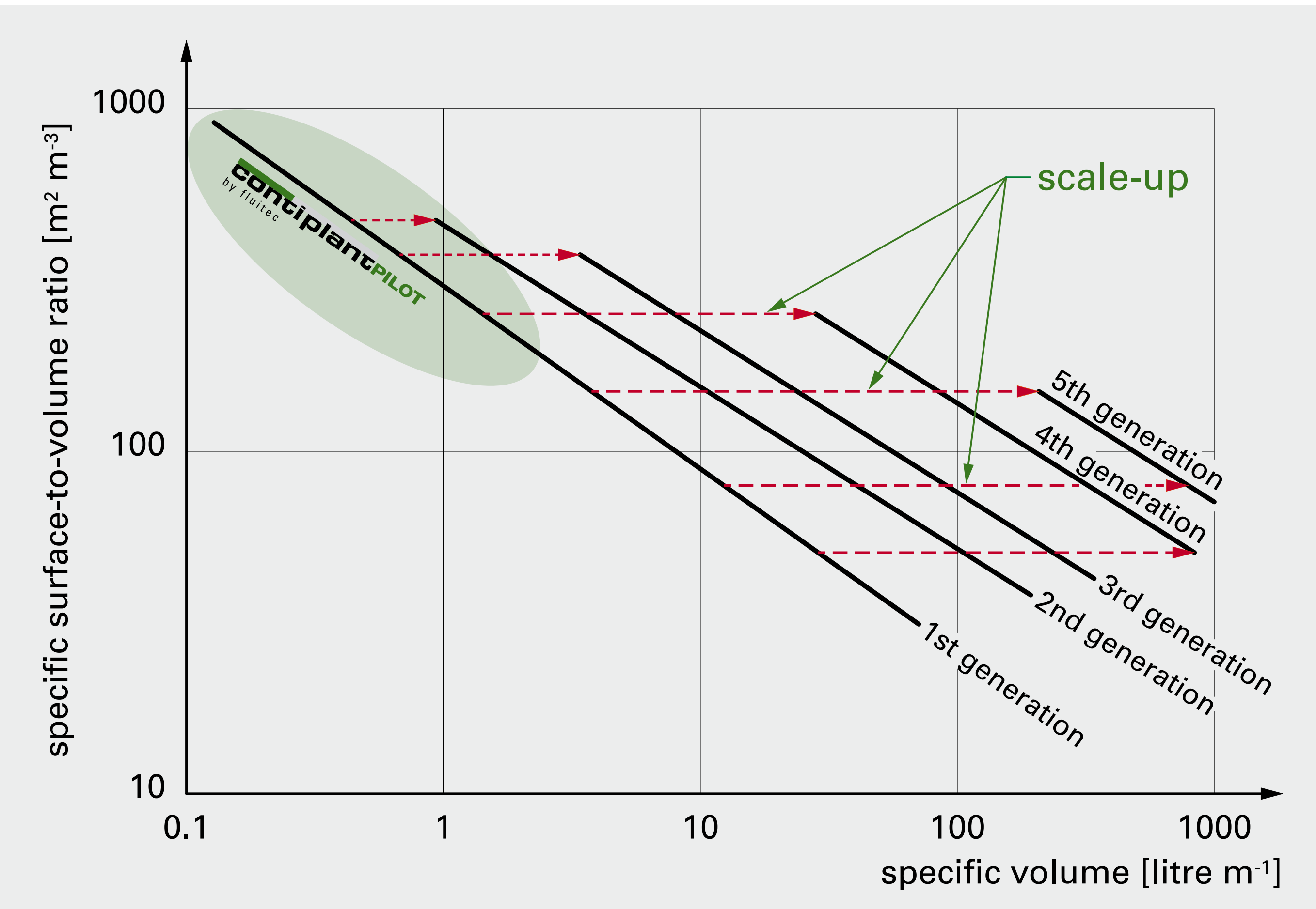
Our mixer / heat exchangers can be scaled up easily and accurately because a constant surface-to-volume ratio is maintained regardless of the size of the apparatus.

The design of the mixing elements is simultaneously adapted so that the local flow patterns – and hence the specific powers – also remain constant. This is possible thanks to the various, complex mixer / heat exchanger generations.

Apparatus of different sizes but with an identical surface-to-volume ratio are defined along the scale-up lines, so that precise scale-ups can be realised very simply.



Mixer / heat exchanger with a constant surface-to-volume ratio



The Fluitec scale-up concept

Typical applications

Mixer/heat exchanger for the food industry

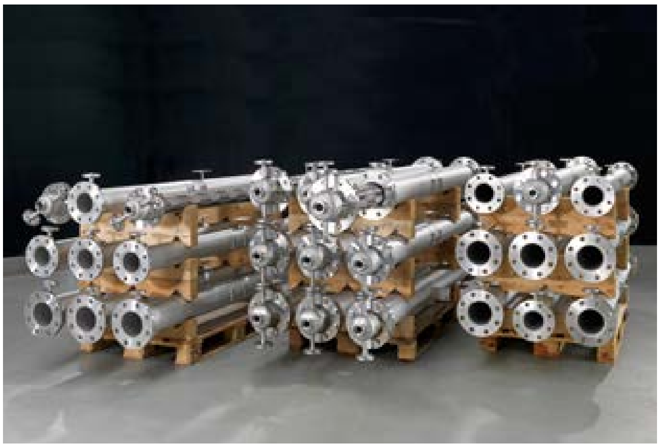
The Fluitec mixer / heat exchanger offers excellent in-line cleanability, making it suitable for processing high-viscosity products in the food industry. The large specific heat-exchanging area renders the CSE-XR® mixer / heat exchanger ideal for highly viscous fluids and temperature sensitive media.

The high heat transfer, which takes place without any local heat or high shear being produced, the narrow residence time distribution and the insensitivity to maldistribution are other major advantages. Wear and sealing problems, which often occur with other types of apparatus if parts of this apparatus rotate, are totally unknown.

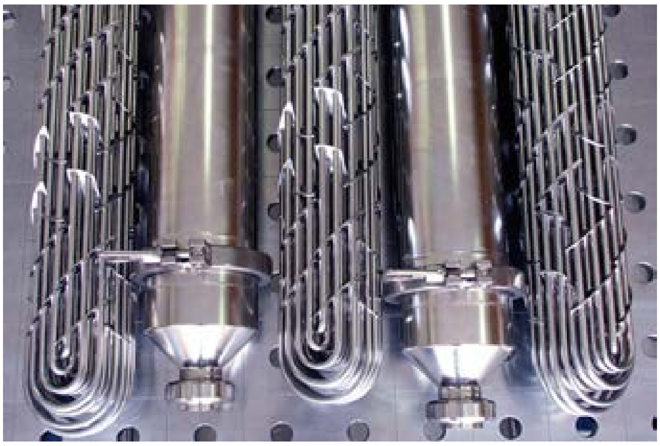
The bundle can be completely removed in a few simple steps for inspection purposes. The entire surface can be cleaned and sterilised in a controlled way.

The Fluitec CSE-XR® mixer / heat exchanger is used, for example, in the following applications:

- Temperature conditioning of pasty foods
- Cooling cocoa mass and cocoa butter
- After-cooling downstream of agitator bead mills
- Manufacturing creams
- Processing caramel or liquorice
- Manufacturing and processing chocolate and chocolate coatings
- "Boiling" sweets
- Processing fats

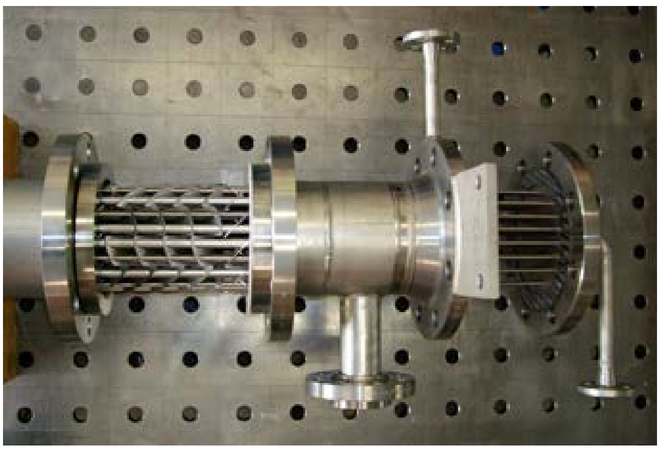


Mixer / heat exchanger for food applications



CSE-XR mixer / heat exchanger in the food version

Inspection by a client after CIP cleaning



Heat exchanger for heating food products by steam

Cooler for coating adhesive films and tapes

Uniformly distributed layers of adhesive are a vital precondition of premium quality adhesive films and tapes. The viscosity, and hence the thickness of the applied layers, can be reliably controlled thanks to the constant temperature control and the homogeneous temperature profile (± 1 to ± 2°C) during the manufacturing process.

Cooling polymers in extrusion processes

CSE-XR mixer / heat exchangers are used in extrusion processes to modify the temperature of the melt (adjust the viscosity) and establish optimal conditions for processing.

Filling process for adhesives

Resins and adhesives often have to be cooled and remixed after the production process before being filled into containers Unwanted reactions of hot resins and adhesives are thereby inhibited and the subsequent evaporation of solvents prevented. In addition, the precipitation of particular ingredients and components is reduced and product quality improved.

Cooling man-made fibres

During the manufacture of polyester (PET) fibres, for example, the optimum temperature in the finisher – the last section of a polymerisation reactor – is even higher than in the spinnerets. The melt is therefore cooled between the polycondensation unit and the spinneret, and a homogeneous temperature is established. That improves the product quality, increases the maximum throughput and / or allows the use of longer piping with longer residence times.

Extrusion of foam

A homogeneous, uniform cooling must be ensured when extruding foams, because there is a risk of maldistribution if the viscosity increases abruptly (clogging of the individual tubes of a multitube heat exchanger). Due to its special design, the CSE-XR mixer / heat exchanger is able to cope with any differences between the viscosity at the inlet and outlet. The apparatus operates gently, is self-cleaning and allows quick product changes.

Continuous reactors based on mixer / heat exchangers

Fluitec mixer / heat exchangers can be used as continuous tube reactors, for example for the following reactions: polymer preparation, esterifications, nitrations, diazotisations, rearrangements, alkylations, halogenations, hydrations, oxidations, polymerisations, neutralisations, etc.

Plug flow and loop reactor for polymerisations

Typical applications

- Radical polymerisations (in emulsion, in substance, in solution)
- Ionic polymerisation (anionic, cationic)
- Ring-opening polymerisation (cationic)
- Polycondensation

Heating viscous media with a high heat output

Mixer / heat exchangers can also be operated in parallel during heating processes if there is no risk of maldistribution. With high heat outputs, for instance, they can be arranged in turret form. In this case, the product to be heated flows through several mixer / heat exchanger bundles in parallel. The picture shows a detail of a heat exchanger turret with a heat output of 3 MW.

Multitube heat exchangers with static mixers

Multitube heat exchangers with mixing elements in the multitubes are ideal for product viscosities between 50 and approximately 500 mPas.

Various static mixing elements can be installed in the multitubes depending on the heat transfer application. These elements increase the heat transfer from the product to the tube wall, so that smaller sizes can be realised than if the multitube heat exchanger has no mixing elements.

Multitube heat exchangers are not suitable for processes where the residence time is critical or for cooling tasks where the viscosity increases significantly (risk of maldistribution). The Fluitec CSE-XR® mixer / heat exchanger is recommended as an alternative for these applications.

Multitube heat exchanger with mixing elements in the tubes to improve heat transfer

Sterile heat exchangers

Sterile multitube heat exchanger

Fluitec's sterile multitube heat exchangers are the perfect solution whenever a heat exchanger has to meet the requirements for FDA components.

Due to its special design, Fluitec's sterile apparatus ensures the greatest possible separation between the primary and secondary media, with total drainage on the product side. Fluitec sterile multitube exchangers are therefore ideally suited to CIP or SIP plants.

The special surface treatment technique, plus seamless tubes with electropolished interiors, results in surface roughness as low 0.4 µm on the product side.

The thermal stresses in the heat exchanger are always checked by us, to guarantee a long service life. If excessive stresses are determined, we fit the apparatus with an expansion joint. Fluitec sterile multitube heat exchangers are thermally optimised and adapted to each customer's needs using advanced software. Fluitec's specialists support you at the project stage with batch calculations for sanitisation, sterilisation, cooling and other processes.

Thanks to the work of these highly qualified specialists and the use of standardised components, we can offer our sterile apparatus in top quality and at competitive prices, even if it is custom-built and thermally optimised.

Product features

- Double tubesheet
- No dead spots on the product side
- O-ring seal with FDA certification
- Max. surface roughness of wetted parts: Ra 0.4 µm
- Sterile connections on the product side
- Insulation with stainless steel shell (welded gas-tight as an option)
- Optional expansion joint
- Single and multiple-flow versions
- Horizontal or vertical installation
- Materials: 1.4571, 1.4404, 1.4435, 1.4435 BN2 or other high-alloy qualities

Fluitec sterile heat exchanger with a double tubesheet

Inquiry data sheet Fluitec Mixer / heat exchanger

Contact:

Company:		Phone:	
Name:		Fax:	
Street:		E-Mail:	
ZIP/Town:		Country:	

Inquiry:

Project / Inquiry-Nr:

Inquiry requested until:

Only budget quotation: ☐ Yes ☐ No

Process Data:

	Unit:	Product stream		Heating / cooling stream (HTM)	
Name fluid:	[-]				
Flow minimal:	[$m^3 h^{-1}$]				
Flow normal:	[$m^3 h^{-1}$]				
Flow maximal:	[$m^3 h^{-1}$]				
Max allowed pressure drop:	[bar]				
		Inlet	Outlet	Inlet	Outlet
Density:	[$kg\ m^{-3}$]				
Viscosity:	[Pas]				
Specific heat capacity:	[$J\ kg^{-1}\ K^{-1}$]				
Thermal conductivity:	[$W\ m^{-1}\ K^{-1}$]				
Temperature:	[°C]				
Classification fluid: (acc. 2014/68/EU)	[-]	☐ gaseous ☐ hazardous	☐ liquid ☐ not hazardous	☐ gaseous ☐ hazardous	☐ liquid ☐ not hazardous

Viscosity of the product at the inlet temperature of the heating / cooling stream (wall viscosity): Pas

Rheologie product: ☐ Newtonian ☐ Shear thinning ➔ **Please add a shear rate / viscosity diagram**

Mechanical Data:

Notice: ■ Standard configuration

Mixing bundle:	☐ Not removable	☐ Removable		
Design code:	■ AD2000	☐ ASME	☐	
Connections product-room:	■ Flange EN1092	☐ Flange ANSI	☐ Free tube end	☐
Connections HTM-room:	■ Flange EN1092	☐ Flange ANSI	☐ Free tube end	☐
Planned nominal diameter of connections:	Product-room DN		HTM-room DN	
Material product contacting parts:	■ 316 L / 316 Ti	☐ 304 / 304 L	☐ Duplex 2205	☐
Material not product contacting parts:	☐ 316 L / 316 Ti	■ 304 / 304 L	☐ Duplex 2205	☐
Product-room:	Max. allowed pressure:	bar	Max. allowed temperature:	°C
HTM-room:	Max. allowed pressure:	bar	Max. allowed temperature:	°C
Maximal installation length / oriantation:	☐ No ☐ Yes ➔	mm /	☐ Vertical	☐ Horizontal

Remarks:

Documentation: (if required)

■ Drawing / Parts list ☐ List of material certificates

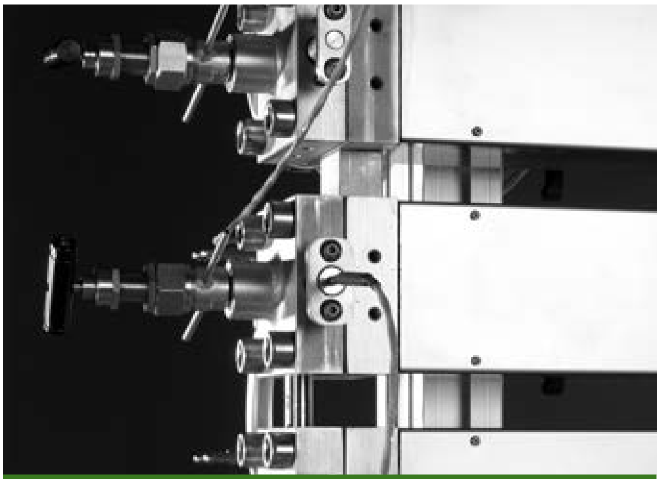
☐ Welding specifications ☐ Fabrication control plan

☐ ☐

Other Fluitec products

Static Mixing

Advanced mixing technology



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