



Static Mixing

Advanced mixing technology

Mixing / Heat Transfer

Unique mixer/heat exchanger combinations

In-line Reaction Technology

Modular reaction systems from milli to maxi

Systems

DeNOx systems, mixing and dosing systems

It was back in 1993 when Fluitec launched its first static mixers in the market back. 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)



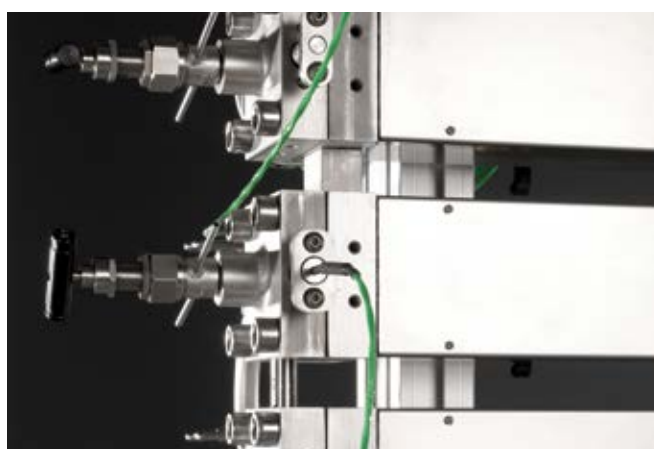
The Fluitec team



Static Mixing

Solutions for static mixing

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Reaction Technology

Solutions for In-line reactions

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Mixing / Heat Transfer

Solutions for mixing/heat transfer

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Systems

Solutions for flue gas, mixing and dosing

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Static mixers made by Fluitec are modern, economical and efficient – and proven energy savers. Innovative new and optimised solutions developed by Fluitec engineers regularly set new benchmarks in static mixing technology.

Laminar static mixers

Laminar mixing processes are based on the repeated separation of the flow into layers, followed by redistribution and recombination parallel to the flow direction. The number of layers, and hence the homogeneity, increases with each additional mixing element. The design and length of the mixer vary according to the mixing task. The challenge confronting manufacturers is to offer an efficient, energy saving mixer for every mixing application.

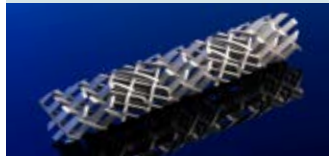
Fluitec CSE-X®, the newest generation of laminar mixers, has openings in the wall area. This innovative feature reduces the pressure drop for even the most complex mixing tasks by up to 50% compared to conventional mixer geometries – without compromising the mixing quality. The Fluitec portfolio includes numerous optimised special-purpose mixers for extreme mixing tasks or specific residence time distribution requirements.

New CSE-X



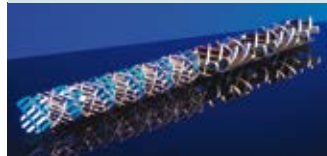
The new CSE-X is a more advanced version of the CSE-X/8. It reduces the pressure drop by up to 50% without compromising mixing efficiency and can also mix high or low-viscosity fluids without any problems. This new mixer model has a narrower residence time distribution than the CSE-X/8.

CSE-X/8



The CSE-X/8 was the number one universal mixer for many years. In the meantime, it has been largely superseded by the new CSE-X owing to its relatively high energy consumption. However, its geometry sometimes has advantages and it therefore remains the system of choice in certain applications.

mikromakro

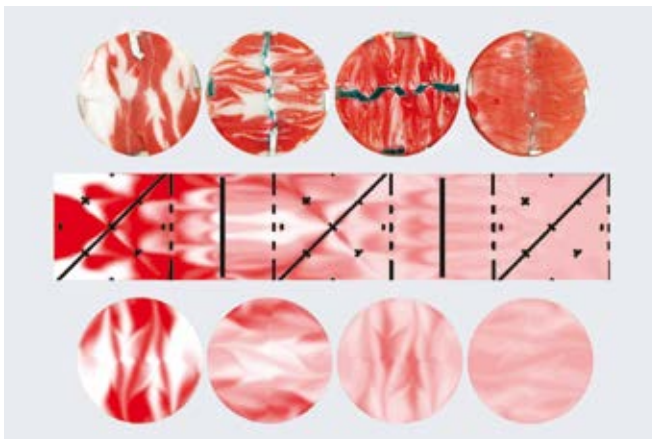


“mikromakro® mixing” involves making selective use of static mixers with different geometries and diameters. Good pre-distribution must normally be achieved in the macro mixer in preparation for fine distribution in the micro mixer.

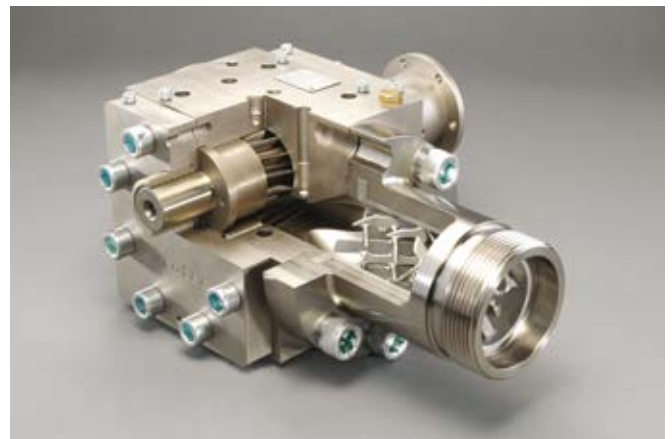
High performance mixer



A high performance mixer is an X-mixer with additional bars. These improve the mixing efficiency, residence time distribution and variable concentration range, though at the expense of higher energy consumption. This mixer type is therefore only used to meet special requirements.



Section of the new CSE-X mixer (CFD simulation compared to reality)



The new CSE-X at the output of a melt pump

Dosing

The use of static mixers in the laminar flow regime makes great demands on the additive dosing technique. The fluid must be guaranteed to exit in a controlled way without pulsation, taking account of the specific properties of the mixer, and clogging must be reliably prevented.

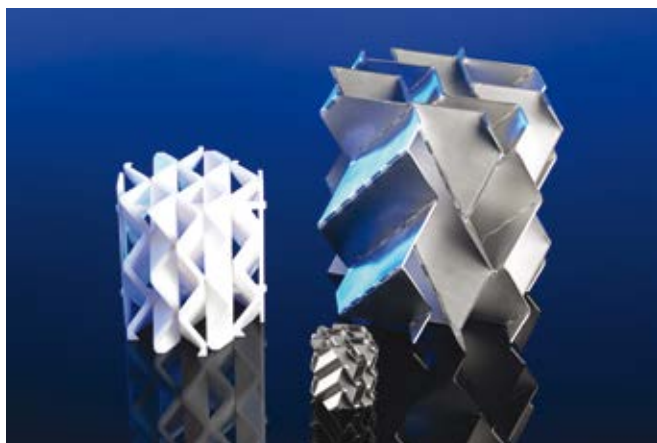


Fluitec injection point for polymer melts

Static mixers for dispersion, emulsion and mass transfer

Insoluble media can be easily dispersed or contacted with the help of static mixers.

Static mixers are ideal for washing, reaction and mass transfer processes. They can be designed and built for both laminar and turbulent flows such that the droplet size, mass transfer surfaces and extraction and emulsion processes can be fine-tuned to the requirements of the process.

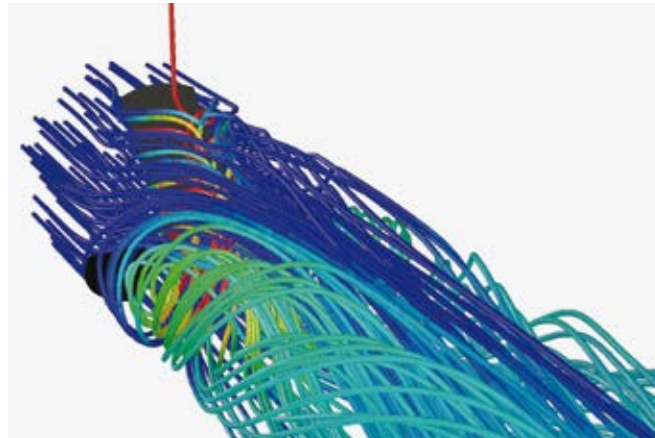


CSE-V mixing element for dispersion (various materials)

Turbulent static mixers

Static mixers can significantly reduce the time required for mixing processes if the flow in the tube is turbulent. Special mixing elements are used here to form the vortex. Mixing and homogenisation take place in the downstream mixer tube.

Two mixer designs have proved particularly successful in the last few years: the Aquamix slide-in mixer for installation in existing tubes and the Vortex housing-type mixer, which can be supplied in several different designs and materials (metal or plastic).



CFD calculation of a Vortex turbulent mixer



Aquamix for food applications

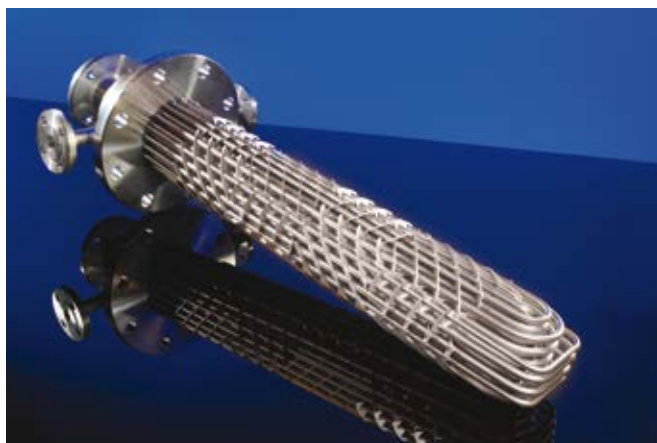
The Fluitec mixer / heat exchanger is a combination of a static mixer and a multitube heat exchanger. It can be used for mixing, heat and mass transfer or – thanks to its optimal residence time distribution – as a plug flow reactor.

Fluitec CSE-XR® mixer / heat exchanger: Reliable temperature conditioning of viscous media

The design of the mixer / heat exchanger equates to a combination of a static mixer and a multitube heat exchanger in which a highly viscous product on the shell side flows through the static mixer. The advantages of these two distinct systems are aggregated for use at laminar flow.

Since the design is consistently based on the geometry of the CSE-X – the most efficient mixer type of all – excellent homogeneity, a narrow residence time distribution and a uniform shear field over the cross-sectional area are guaranteed along the entire length of the apparatus. The very high radial mixing efficiency constantly ensures an intensive flow against the internal heat transferring tubes integrated in the mixing element. Far more heat is transferred than with heat exchanger arrangements with no internal elements (e.g. monotube heat exchangers, where the tubes have a double shell). From a fluid dynamics viewpoint, the heat transferring tubes are ideally positioned in the mixing element; this is very important since it facilitates the exceptionally compact design.

Mixer / heat exchangers can be designed without any dead spots and make perfect tube reactors.



Mixer / heat exchanger with a U-tube bundle

Applications of Fluitec mixer / heat exchangers

Throughput	Approx. 0.5 kg h ⁻¹ to 50'000 kg h ⁻¹
Diameter	6 mm to approx. 1000 mm
Max. pressure	Between 100 and 800 bar depending on the size / version
Max. temperature	Depends on the construction material
Construction material	1.4301, 1.4404, 1.4571, 1.4462, 1.4539, various nickel based alloys, etc.
Viscosity	Also available in carbon steel Min. approx. 300 mPas *) Max. approx. 20'000'000 mPas

*)The apparatus also works with lower viscosities but in this case is less efficient than conventional heat exchanger designs. Applications and reactions where the residence time is critical are an exception.



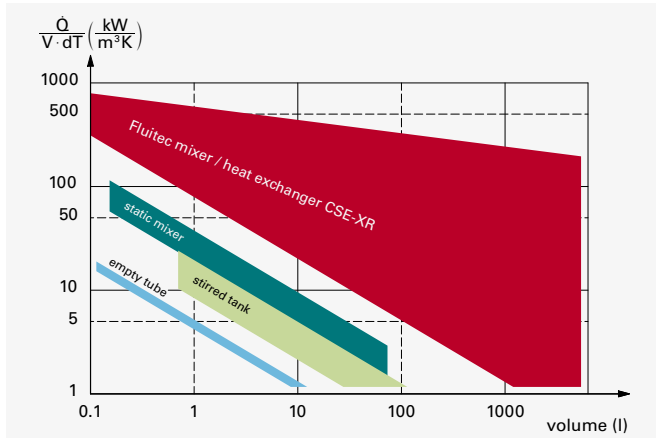
Fluitec Mixer / heat exchangers for the food industry

Heat transfer efficiency of the mixer / heat exchanger

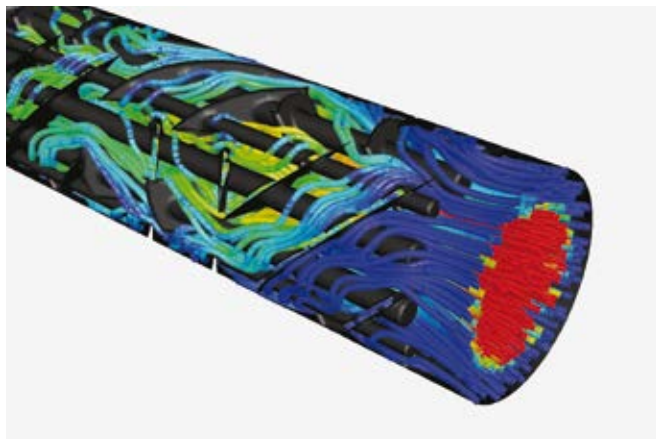
The unique design of the heat exchanger gives rise to extraordinary capabilities, which are particularly evident with complex cooling tasks. Even pseudoplastic (non-Newtonian) or thixotropic media can be mixed without any problems over a wide temperature range and with significant differences between the viscosity at the inlet and outlet or between the temperature of the product and the coolant. Owing to its ability to mix the product homogeneously for long periods, the mixer / heat exchanger rules out the risk of maldistribution, which is a dreaded phenomenon with other heat exchanger types.

The mixer / heat exchanger also enables combinations of different process steps because the apparatus permits simultaneous mixing and temperature conditioning of fluids.

Example of continuous reactant addition and simultaneous transfer of reaction heat:



Heat transfer efficiency of different heat exchanger types



CFD simulation of a CSE-XR mixer / heat exchanger

Fluitec sterile heat exchangers

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 heat 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 as 0.4 µm on the product side.

Fluitec multitube heat exchangers

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.



Fluitec multitube heat exchanger with mixing elements

The modular design of the Contiplant system is based on Fluitec's continuous mixer / heat exchangers. It allows each process to be developed quickly and precisely for the target product on a laboratory scale.

Contiplant – continuous reaction technology

Owing to the modular design of the Fluitec Contiplant system, it is now an easy matter to test the conversion from batch to continuous reaction processes and assess the economic impact. In many cases, significant business potential can be identified based on the higher concentrations, better temperature control or other process intensification measures. This potential can then be leveraged consistently when moving from the laboratory to the pilot plant due to the excellent heat transfer rate of the Fluitec Contiplant modules.

The achievement of full modularity results in a shorter and more straightforward design phase.



CSE-XR mixer / heat exchanger in Contiplant size



ContiplantPILOT rack with redundant reactors and residence time section



ContiplantPILOT reactors with standardised valves and sensors

Contiplant and peripherals

Optimised peripheral devices are essential for continuous reaction processes in the laboratory or in a pilot plant, to guarantee perfect control and monitoring of the reaction. The Contiplant series includes sensors, actuators and other peripherals specially developed for this purpose, which have no detrimental effects on the residence time range, heat transfer or mixing efficiency.

Amongst other things, the Fluitec portfolio contains the specially developed high-speed premixer cooler Helix-Torpedo, injection valves, dosing points, rinsable sampling valves, various temperature sensors such as the axial multipoint temperature sensor for process monitoring, pressure sensors with no dead spots, bursting discs, etc.

Dosing systems developed in-house and PLCs with process visualisation round off the Fluitec Contiplant System.



Complete ContiplantPILOT System (loop reactor with residence time section) incl. two dosing systems and PLC



ContiplantPILOT reaction system made from Hastelloy C-22, including sampling valves, bursting discs and pressure and temperature sensors

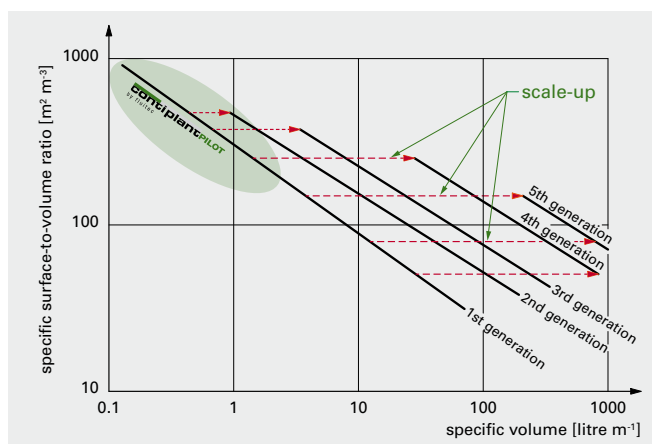
Fluitec mixer / heat exchangers can be scaled up accurately and are equally suited for laboratory equipment, pilot plants and full-scale production. Reaction systems can either be scaled up from a small plant or developed directly, depending on the process and procedure.

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 power – 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.



The Fluitec scale-up concept



Scale-up of a reaction section



Scale-up of a reaction section

Reaction systems

Fluitec designs, builds and manufactures reaction systems. As a result of our highly specific know-how in the field of static mixers and mixer / heat exchangers, we focus on those parts of the system where media are mixed, reactions controlled, temperatures set or narrow residence times maintained.

Apart from simple tube reactor systems, Fluitec can also offer combinations with other reactor or process apparatus such as loop systems, CSTR or agitators.

Reaction systems in sterile design for the pharmaceutical, biotechnology and cosmetics industries are a speciality. Fluitec in-line reaction systems featuring sterile technology are used to meet high requirements regarding GMP, surface quality, CIP / SIP and FDA. If required, novel static mixing elements in polished design are used; these can be manufactured with high precision and very small diameters thanks to a manufacturing process developed in-house. Materials: 1.4435, 1.4435 BN2, 1.4404, Hastelloy C-22 or other high-alloy qualities.



Pilot-scale polymer plant



Fluitec reaction system for sterile applications in the pharmaceutical industry



Residence time reactor with residence time > 2 hours

Fluitec systems cover everything from the engineering and construction of DeNOx systems through static mixing and heat transfer technologies to accessories for continuous mixing and reaction systems.

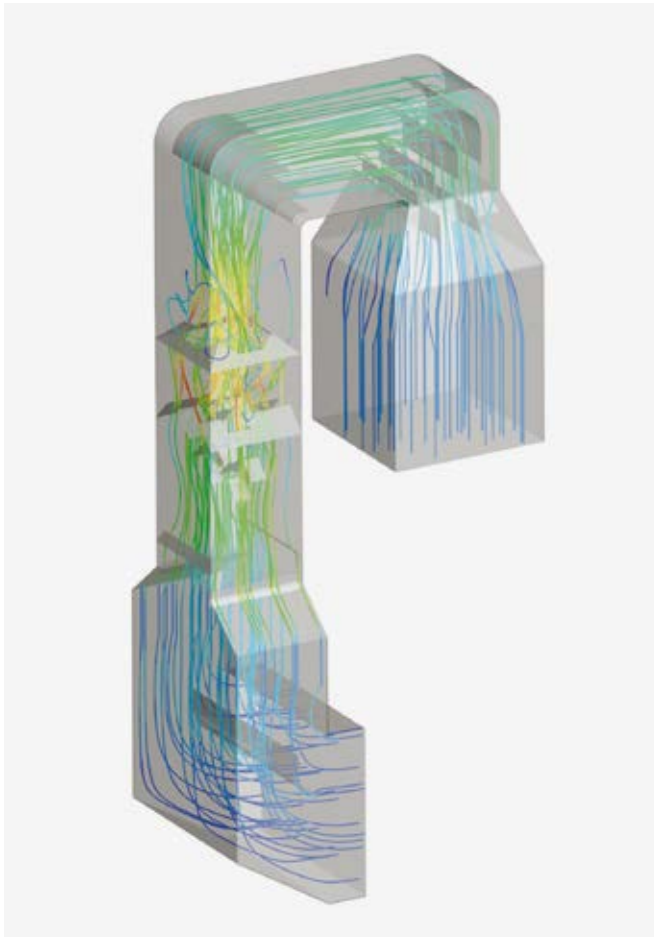
Fluitec DeNOx systems

The design, manufacture and installation of flue gas mixers – including complete ammonia dosing stations for SCR DeNOx processes (catalytic elimination of NOx) – are among Fluitec's outstanding strengths. The equilibration of concentration and temperature profiles over the cross-sectional area of the duct channels must be achieved with the smallest possible pressure drop.

In the old days, Fluitec DeNOx systems were simulated and designed with the aid of complex and time-consuming flow models. Owing to the experience built up over the years, the launch of our mikromakro® mixing technology and advances in computational fluid dynamics (CFD), these models can meanwhile be dispensed with.

Instead, our CFD experts embark on a new design using the latest generation of CFD simulation software, which enables almost perfect predictions of the flow pattern and the concentration profile.

Fluitec can also look back on more than 20 years of theoretical and practical experience in ammonia water dosing technologies, leading to an extensive range of proven and efficient solutions for DeNOx processes such as ammonia dosing stations, injection nozzles, mixing stations, static mixers, etc.



CFD simulation of a flue gas duct



Thanks to CFD, scale models are now a thing of the past



Flue gas duct for a DeNOx system

Engineering and construction of mixing and system technologies

As a specialist for mixing, reaction and heat transfer technologies, Fluitec designs and builds customised solutions for several key processes: static mixing, mixing / heat transfer, reaction, devolatilisation and dosing.

Ever since the company was first founded, Fluitec has focused strongly on mixing and dosing technology and is meanwhile acknowledged as one of Europe's leading planners and manufacturers of static mixing systems.

Static mixing systems are nowadays an increasingly popular alternative for both continuous and batch processes because maintenance and wear are negligible and only a comparatively small space is required for installation.

Dosing stations

Dosing technology for static mixers entails controlled, simultaneous and pulsation-free metering of the additive and main streams into a static mixer. As static mixers are generally designed with only minimal back-mixing, the components have to be dosed constantly over time.

Fluitec dosing stations were specially developed for problematic media.

Our product portfolio includes dosing stations for:

- CO₂ (high and low pressure)
- Air (high and low pressure)
- Nitrogen (high and low pressure)
- Pentane (high and low pressure, liquid)



Polymer cooler with controlled polymer exit temperature



Fluitec gas dosing station

The Fluitec story

- 1993** Fluitec is established by Alain Georg as a sole proprietorship.
- 1994** The CSE mixer is launched in the market.
- 1995** Alain Georg wins a young entrepreneur's award for his innovative static mixer. The prize money pays the rent for a workshop and production facility and enables him to take on two staff. Fluitec becomes a public limited company.
- 1996** The CSE-X/4 mixer is launched in the market.
- 1997** The DeNOx systems and the associated dosing system are developed.
- 1998** The Fluitec Small Bubble Reactor FSBR is developed and used in gasification plants.
- 1999** The AirTrap bioreactor is unveiled.
- 2000** The mixer / heat exchanger is developed, marking Fluitec's entry into the mixing and reaction technology segment. Fluitec finally makes it in the top league.
- 2001** The first complete reaction system based on the Fluitec mixer / heat exchanger is shipped.
- 2002** The premises in Winterthur become too cramped and the company moves to Neftenbach.
- 2003** Fluitec celebrates its 10th anniversary. The firm has made a name for itself over the last decade as an innovative and reliable partner for static mixing and reaction technology.
- 2004** The DeNOx systems are redesigned with the help of computational fluid dynamics (CFD).
- 2005** The Polypeeler for man-made fibres is launched in the market.
- 2006** The double separator mixers are developed. They provide an efficient solution for even the most complex mixing tasks, which were previously impossible using conventional static mixers.



Fluitec in the year 2018



First mixing trials on the garage forecourt in 1993

- 2007** The scraper heat exchanger is developed.
- 2008** Scalable static mixers and mixer / heat exchangers are developed.
- 2009** Fluitec moves into a new and bigger building with ample space for meanwhile 10 staff.
- 2010** A new loop mixer for emulsifying salad dressings and mayonnaise provides fresh impetus to the food industry.
- 2011** The new Contiplant system revolutionises reaction technology.
- 2012** The CSE-X with openings in the wall area is optimised still further. The simplification of the production process enables the costs to be reduced.
- 2013** Fluitec celebrates its 20th anniversary. The first complete scale-up for reaction systems directly from the Contiplant system to full-scale production is realised.
- 2014** Extra offices and a large conference room are built in the attic of the property in Neftenbach. The evaporator systems featuring the Fluitec mixer / heat exchanger are developed.
- 2015** A new residence time mixer with a significantly improved residence time distribution is launched in the market.
- 2016** The Fluitec Mini-Loop Reactor is developed. Fluitec now also builds sterile heat exchangers and sterile apparatus.
- 2017** Several new staff are recruited and a special Fluitec Reaction Systems team established to meet the strong demand for reactors. An experimental laboratory is set up.
- 2018** Fluitec builds complete pilot reactors for reactions that are difficult to control. Today, as the company celebrates its 25th anniversary, the Fluitec team is 28-strong. The know-how, creativity and dedication of every single one of us form the backbone of Fluitec's ability to continue treading new and innovative paths in the future.

Where solutions are created

Apparatus weighing up to 3'500 kg is manufactured in our in-house workshop. Larger apparatus is built under our supervision by a partner firm located close by.

We work with steel, austenite, Duplex, Hastelloy, Inconel, titanium and nickel. Static mixers made from PP, PE, PVC, PVDF or PTFE can likewise be supplied.

Since investing in a modern laser welding line, we are also optimally equipped to serve you with apparatus with virtually any dimensions. Our vertical range of production is exceptionally broad.

The laser welding line allows us to create miniaturised, reproducible welds that would be impossible manually. Orbital or automated TIG welding systems are available for large sizes.



Laser welding line



Much of what goes into our products is hand-made

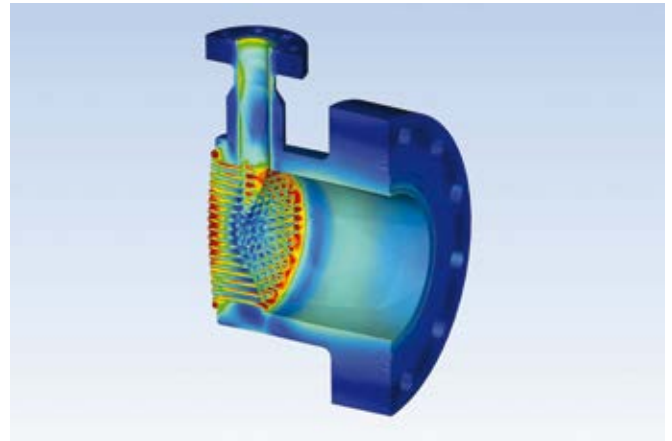
Approvals:

- AD 2000 HP0, Modul A2, CE, ISO 9001
- ASME U-Stamp and China Stamp, manufacture through a subcontractor

All apparatus and equipment are modelled on a modern 3D CAD system. The models can be used directly for strength calculations based on the finite element method (FEM), which are also offered by us as a service. 3D models can be provided to our customers on request.

Research and development

In addition to continuously striving to perfect our mixing, heat transfer and reaction apparatus, we also conduct experiments in the Fluitec laboratory and carry out development work on behalf of our customers. We normally use reference fluids for this purpose to guarantee comparable results.



FEM calculation of a heat exchanger head



Structure of a Fluitec CSE-XR mixer / heat exchanger



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Systems

DeNOx systems, mixing and dosing systems