fluitec
mixing + reaction solutions

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Static Mixer for Turbulent Flow

Aquamix and Flash Mixer

The Fluitec slide-in mixers CSE-F® and CSE-B® were developed in 1997 in close cooperation with the Zurich University of Applied Sciences. Many features of these mixers were unique at this time and they were rapidly wide spread in different applications of turbulent flow. Our customers desire for more compact and even more reasonably priced mixers with the same mixing performance led to the novel designs of the Aquamix and of the Flash Mixer. The very high and well controlled mixing efficiency, a compact design, the easy assembling, the low investment costs and the low pressure drop are the main characteristics for these novel mixers.

Fig. 1 5% of blue additive is dosed direct before an Aquamix/Flash Mixer (Re = 18'000)

Well established technology

The CSE-F® and the CSE-B® slide-in mixers were developed and characterised at the Zurich University of Applied Sciences in Winterthur. They belonged to the first static mixers, which are simply clamped between two flanges. The excellent ratio of price to performance opened the way to many different applications at turbulent flow. The low pressure drop of the CSE-F® Mixer together with its high mixing performance was outstanding. For some mounting situations, however, the length of the mixer appeared to be a problem and as an alternative the CSE-B® Mixer was often used. Unfortunately the higher pressure drop often limited operation at high flow velocities.

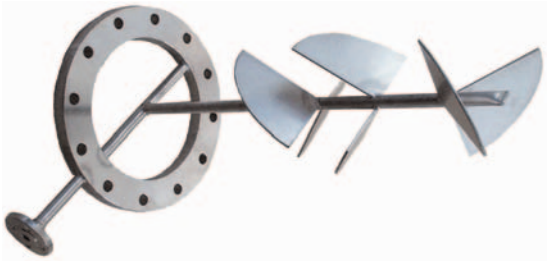

Fig. 2 CSE-F® Mixer (photo: Fenner 1997)

Intensive investigations over many years made clear that it is possible to mix liquids of low viscosities rapidly and in a short length using well defined vortexes. It was therefore the goal of Fluitec to develop a single mixing element which generates several vortexes at the same time at only little pressure drop.

Due to economical reason, the costs for stockkeeping had also to be reduced to a minimum and shortest delivery time had to be ensured. A modification of the in laminar flow very successful CSE-X® Mixer showed to be capable of fulfilling all these high requirements. In the Aquamix one half of a CSE-X® element is fixed to a brides plate of PN10 or PN16 and simply

clamped between two flanges of the existing tubes. The Flash Mixer is used as a complete in-between flange mixer. The latter has the advantage of being removable in radial direction without any need of disassembling the tubes.

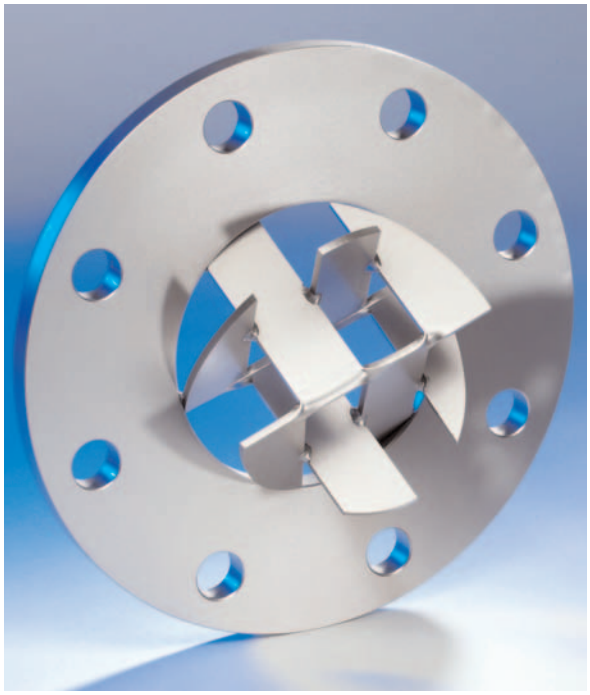

Fig. 3 Aquamix DN100 / PN10, material 316 L

Mixing performance and pressure drop

The mixing performances of the Aquamix and the Flash Mixer are based on two contrarily rotating vortexes. These vortexes stretch over the whole cross sectional area thus ensuring the excellent, stable and well controlled mixing efficiency. The homogeneity is normally expressed by the coefficient of the standard deviation. A coefficient of variation of < 0.03 is assessed as homogeneous. Full performance of the mixer is achieved at flow velocities of > 0.3 ms^{-1}. In the Aquamix, the additive is dosed before the flange connection, while the dosing device of the Flash Mixer can be integrated directly in the in-between flange. For additive concentrations of lower than 1%, the dosing nozzle must be mounted concentric before the mixing element. Otherwise a normal T-piece can be applied in a distance of 2 to 5D (D=diameters of the tube) before the mixing element. Fig. 4 shows the coefficient of variation in function of the relative mixing length. The table indicates that measuring points such as temperature probes or pH probes must be installed at a minimum distance of 10 D to the mixing element.

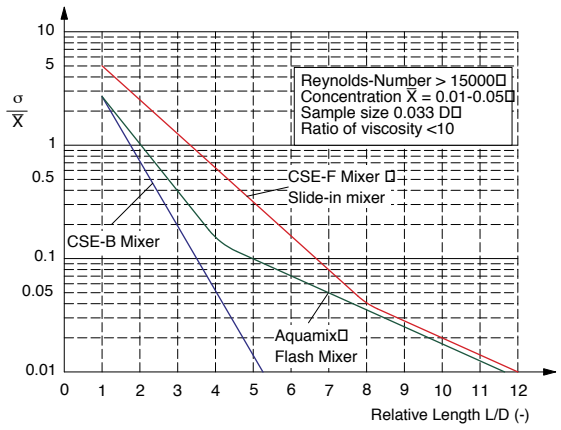

Fig. 4 Coefficient of variation in function of the relative mixing length

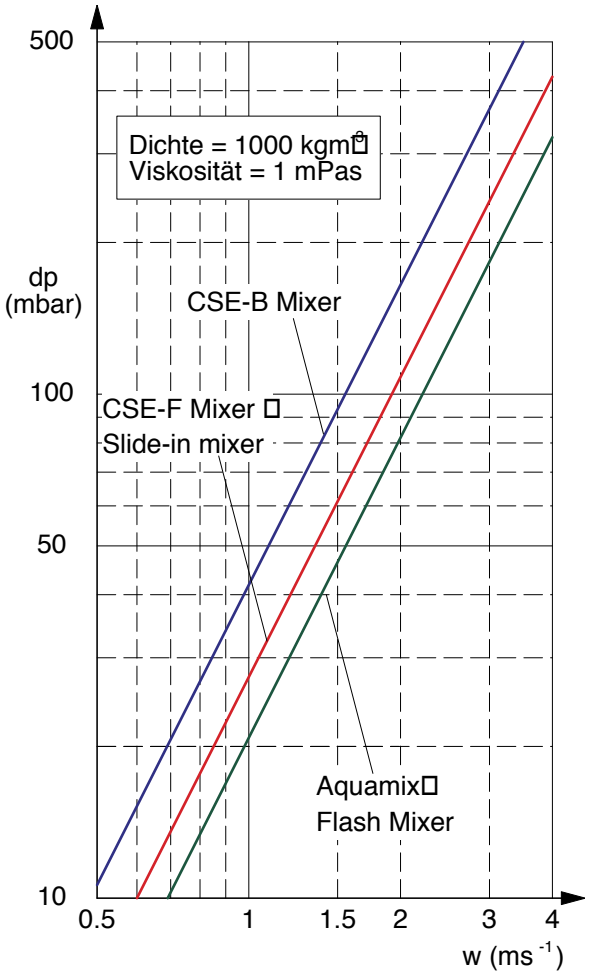

Fig. 5 Pressure drop for Fluitec mixers (water)

The remarkable low pressure drops of the newly developed Aquamix and of the Flash Mix allow for the first time the application of static mixers at liquid velocities of up to 4 ms^{-1}.

Abb. 6 Fluitec Flash Mischer DN65 /PN10-PN64