fluitec
mixing + reaction solutions

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Engineering for

Static Mixing and Dosing Plants

Static mixers are apparatus with fixed, geometrically shaped elements that mix the product flowing through them with the help of kinetic energy only. They are used not only for continuous homogenisation but also increasingly for batch homogenisation and dispersion in all areas of chemical process technology. As processes become more and more automated, it becomes necessary to develop complex mixing systems with static mixers. Over the last fifteen years, Fluitec Georg AG has consistently focused on mixing and dosing technology and is meanwhile acknowledged as one of Europe's leading planners and manufacturers of static mixing plants.

Introduction

Static mixers provide an attractive solution for solving mixing and reaction problems in numerous branches of industry. The most diverse mixer geometries are employed to achieve a homogeneous mixture, depending on the application and the flow regime. The choice of geometry is determined by the Reynolds number and the properties of the fluids to be mixed.
Since maintenance and wear are negligible, only a comparatively small space is required for installation, and the equipment is suitable for a wide viscosity range, static mixers are today an increasingly popular alternative for continuous and batch processes.

Fig. 1 Installation of static mixers in a tube reactor with a diameter DN800

Common dosing problems

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. The engineer charged with planning a static mixing plant needs to take account of the following aspects:

1. Pulsations have a negative impact on mixing quality and must be avoided.
2. Additives must be dosed using a conveying system with a characteristic that is as linear as possible.
3. The quality of mixing is also influenced by the position and geometry of the injection nozzle.
4. The additive and main streams must be monitored.

Fig. 2 Redundant pump station for additives

Avoiding pulsations

Static mixers typically have a high radial mixing performance with only minimal axial back-mixing. Interruptions in the flow or strong pulsations of the additive or main stream result in momentary fluctuations in the concentration and hence inferior mixing performance.

The pressure loss in a static mixer can vary considerably due to temperature and viscosity differences. If the additive pump doses with a non-linear characteristic, the dosing error can be crucial, necessitating complicated control measures. Only diaphragm pumps have an approximately linear characteristic, yet they are also pulsating - something that needs to be avoided when static mixers are used. Fluitec's new KMD dosing modules guarantee a pulsation-free pumping stream, which remains constant even if the pressure varies.

Fig. 3 KMD dosing modules in modular design for installation in a plant (installation and piping by the customer)

Fig. 4 Polymer plant with a KMD dosing module, static high-pressure mixers and a CSE-XR mixer/heat exchanger

The apparatus is installed by Fluitec. The piping for the dosing equipment and the heating are provided by the customer. The electrical work is carried out either by a local electrician or by the customer.

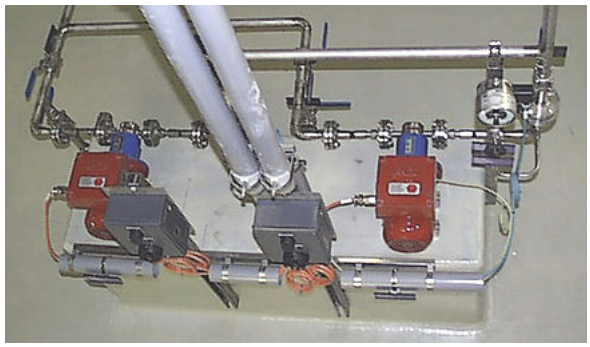

Fig. 5 KMD dosing modules integrated in the plant (installation and electrical work by Fluitec)

Fig. 6 KMD dosing modules integrated in the plant (PLC also provided by Fluitec)

Monitoring the fluid streams

The flow rates of the additive and main streams must be known when static mixers are used. The monitoring complexity is dependent on the flow rate, the viscosity of the fluid, the required mixing precision and the level of automation of the plant. The following flow measurements are normally differentiated:

- Manual KMD dosing for small, low-viscosity volume flows
- Manual flow monitoring according to the pump characteristic and the pressure or speed
- Automatic in-line flow measurement
- Automatic flow measurement with sequential or differential weighing

Fig. 7 Batch filling plant