

Distromix and Integrimix Inline High Shear Mixers - Configuration

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Introduction

An increasing number of fluid mixing applications are moving from traditional batch-orientated processing to continuous inline operation. Advantages of process controllability, product uniformity and improved throughput are the primary drivers for this trend. High shear mixers, homogenisers and colloid mills are often at the heart of any inline mixing process where intensive blending and particle or droplet size reduction is required. The Distromix C and Integrimix C ranges of inline high shear mixers from Maelstrom are innovative new machines that extend performance over traditional forms of high shear mixer. The Distromix C is a rotor-stator machine that uses Maelstrom's proprietary FDM technology to create intensive hydraulic shearing of fluids inside the mixing head. Integrimix C, based on IPM technology, uses an entirely different mechanism of positive displacement pumping to drive fluid through small nozzles, achieving homogeniser performance at greatly reduced costs. Both types of mixer are available in batch (insertion) form as well as inline, but it is the system configuration options for inline mixers that will be considered here.

System Configuration Considerations for Inline High Shear Mixers

It is generally true that inline mixers are more flexible processing devices than their batch insertion counterparts. This is because they can be used in a number of configurations ranging from "pure" single-pass inline operation through to batch recirculation and can therefore perform both inline and batch functions. When integrating an inline high shear mixer into a system, it is important to consider its characteristics as a system component. In particular, it is necessary to determine the following points when comparing different type of inline high shear mixer:

- Typical flowrate - this will depend on the type and size of machine
- Viscosity limitations
- Type of self-pumping (if any) - e.g. centrifugal or positive displacement
- Pressure-raising capability or pressure drop across the mixer (if any) - also how higher viscosity may affect this
- Pressure-relief requirements and ability to safely withstand "dead-heading" (i.e. a complete blockage of the outlet flow)

- Maximum system pressure capability - this affects the seals, flange selection and other aspects
- Port sizes and options
- Inlet and outlet orientation - including whether self-draining is possible for hygienic applications
- Mounting options - e.g. horizontal or vertical mounting
- Seal options
- Maintenance and cleaning access and operations possible without removal from the line

Aside from its mixing performance, the most important aspect of the mixer from a system point of view is the type of pumping it utilises. This determines many of the other parameters. The two primary types of pumping that a high shear mixer may employ are centrifugal and positive displacement, the key characteristics of which are highlighted below:

Centrifugal Pumping (e.g. Distromix C)

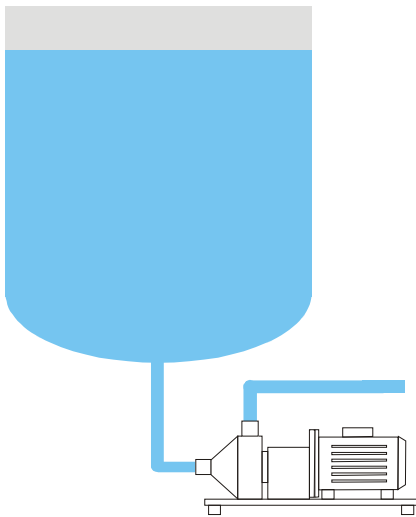
- Higher flowrates, low pressure-raising ability
- Major reduction in pumping performance as viscosity increases
- Suitable for self-pumping low viscosity fluids only
- Dead-heading is normally possible
- Mixer must be primed before running
- Relatively simple and easy to maintain

Positive Displacement Pumping (e.g. Integrimix C)

- Lower flowrates, high pressure raising ability
- Viscosity has little effect on flowrates (up to a certain limit)
- Can self-pump high viscosity fluids, provided suction is flooded
- Dead-heading is not normally advisable - pressure relief required
- Self-priming sometimes possible but seals must not be run dry
- Relatively precise components - careful maintenance needed

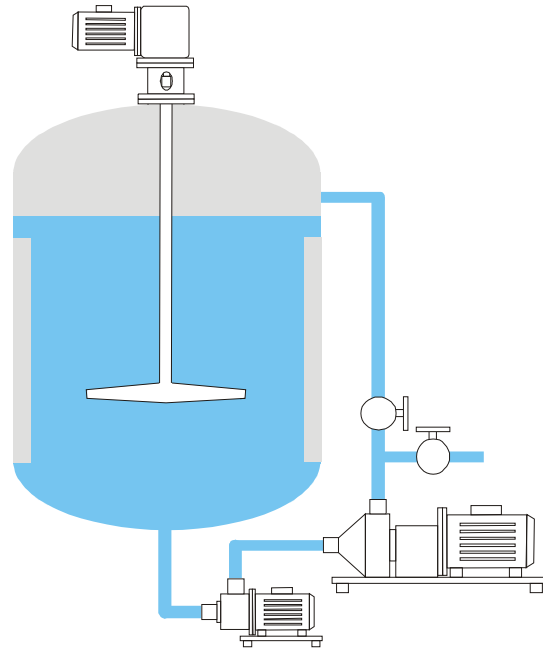
A key feature of inline high shear mixing is the ability to separate the mixing and pumping functions of the device. This is especially true of centrifugally-pumping mixers which do not exhibit particularly good pumping performance, especially at higher viscosities. Using a separate feed pump to the mixer, it is possible to control the flowrate through the line and the amount of mixing of the product using independent variations of speed on each device. If the mixer has a strong positive displacement pumping effect itself, the relationship between the feed pump and mixer must be managed carefully to avoid the two devices "competing" with each other and causing either over pressurisation or starvation of the mixer.





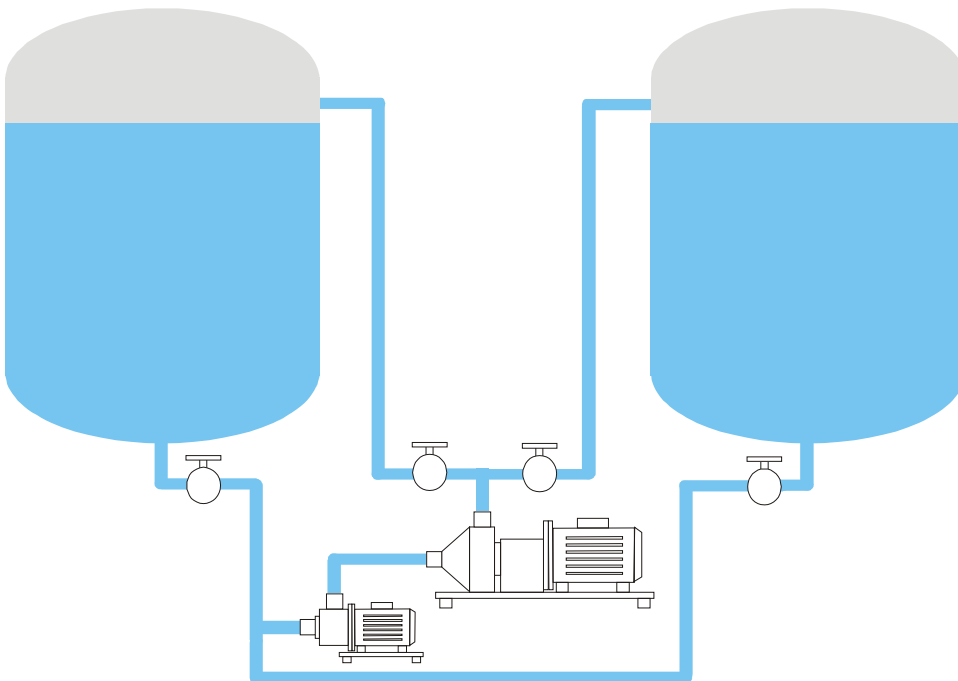
Single Pass Inline

Where the fluid product can be adequately mixed in a single pass, an inline mixer can be used to empty the vessel either with or without the help of a pump, depending on viscosity. Typical applications include product "finishing" to ensure good dispersion of ingredients upstream of a filling system. If the product in the vessel is liable to settling or separation, an agitator may be needed to ensure the vessel is adequately stirred during pump-out.



Batch Recirculation

In this arrangement, the output of the mixer is fed back into the vessel to create a recirculation loop. This is used where multiple passes of the material are required through the mixer. Note that this system can replace the function of a batch high shear mixer. Inline pump-out through the mixer is also possible for a final "finishing" of the material. An agitator is often needed in the vessel to create good macro-level blending uniformity.



Note: In all configurations it is advisable to include isolation valves either side of the mixer and pump (if present) to simplify maintenance.

Multi-pass Inline

Although the standard single vessel recirculation is very useful, a major disadvantage is that not all of the fluid will pass through the mixer an identical number of times. It is therefore hard to guarantee process uniformity unless batch times are very long. A more efficient arrangement is the multi-pass inline setup where two vessels are used. The valves are switched so that one vessel is emptied entirely through the mixer (with a pump if necessary) into the other vessel. The valves are then switched over and the process is repeated from the second vessel to the first and so on. The advantage of this arrangement is that all of the material sees the same process history through the mixer, and uniformity is achieved quickly. The main disadvantages are the additional complexity and the need for a second vessel.

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For more information or to arrange a demonstration or trial please visit our website or contact:

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