TECHBRIEF

002
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Distromix and Integrimix Batch High Shear Mixers - Mounting Options

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Introduction

Batch high shear mixers are useful and versatile tools for many applications involving intensive fluid processing. From rapid dispersion of solids into liquids through to emulsification and solids de-agglomeration, batch or "insertion" mixers are finding their way into modern process plants in increasing numbers. The Distromix B and Integrimix B ranges of batch high shear mixers from Maelstrom are new and innovative machines that extend performance over traditional forms of high shear mixer. The Distromix B uses Maelstrom's proprietary FDM technology to create intensive hydraulic shearing of fluids inside the mixing head. Integrimix B, based on IPM technology, uses an entirely different mechanism of positive displacement pumping to drive fluid through small nozzles, rather like a nozzle homogeniser. The form and function of the Distromix is similar to that of a conventional rotor-stator high shear device. I.e. being a general-purpose solid/liquid and liquid/liquid mixer. The Integrimix B on the other hand, is a unique type of machine targeted at emulsification that offers nozzle-homogeniser type performance but in a low-cost insertion form. Both types of mixers are available in inline form as well as batch, but it is the mounting options for batch mixers that will be considered here.

Key Points to Consider for Batch-Mounted High Shear Mixers

Most process engineers will be very familiar with traditional stirred impeller or agitator mountings in open or closed vessels. However, there are some key points to note about high shear mixers compared to agitators when it comes to mounting, such as;

- **Low pumping capabilities** - whereas agitators can move large volumes around a vessel to create good blend uniformity, high shear mixers are primarily intended to create intensive dispersion effects and so their ability to pump is greatly reduced. This is important to remember for sizing, selecting and positioning a suitable high shear mixer in a vessel, as the ability of the mixer to process all of the material in the vessel uniformly and in a reasonable time will depend on the probability of all of the material actually passing through the mixing head. This becomes especially difficult as viscosity increases beyond a few hundred centipoise - high shear mixers are notorious for creating "zoning" effects where the fluid movement in the vessel becomes localised to the mixing head and the rest of the vessel is left untouched. The use of additional agitators in the vessel or changing the process to inline should be considered in such cases.

- **Large motors** - high shear mixing is normally trying to achieve intensive processing, which means that high energy inputs into the fluid are required. This is reflected in the relatively large size of motors fitted; these can be up to ten times the size of agitator motors for an equivalent fluid volume. Mountings have to be able to support this additional weight and centres of gravity must be considered, especially for off-centre mountings.

- **Sealing problems** - for closed vessels, particularly those under pressure or vacuum, the sealing of high shear mixers is generally more difficult than for normal agitators. This is largely due to the high running speeds (typically 1500 - 3600rpm) which preclude the use of many types of conventional gland packing. Although lip or "v-ring" seals and some specialised gland packings and labyrinth types can be used at atmospheric pressure, the more common solution is to use mechanical seals. For top-mounted batch mixers in vessels where the seal is out of the process fluid and is therefore not cooled or lubricated, it is necessary to use a quench cup or a flushed double mechanical seal. These additional complexities incur extra costs and raise maintenance issues, which become even more critical on hygienic or flammable applications where the choice of cooling fluids may be limited.

- **Little or no torque reaction** - as high shear mixers use an enclosed rotor, torque reaction is not transferred to the mounting. This means that lighter shaft structures are possible and mixers can even be suspended from crane hoists without difficulty, for increased flexibility.

- **Increased mixer maintenance/cleaning** - compared to conventional agitators, most types of high shear mixer are relatively high in maintenance, as their speeds are very much higher and wear parts are often running within the process fluid and are therefore susceptible to damage. There are also typically more components in the process fluid and this may involve additional manual cleaning steps, particularly if the fluid cannot be rinsed easily from external support components. The need to access the mixer or withdraw it from a vessel for maintenance or cleaning is an important consideration in minimising operational downtime.

- **No need for baffles** - when high shear mixers are used by themselves in a batch vessel, it is not normally necessary to include baffles or vortex breakers in the vessel. This reduces the cleaning effort inside the vessel between batches.

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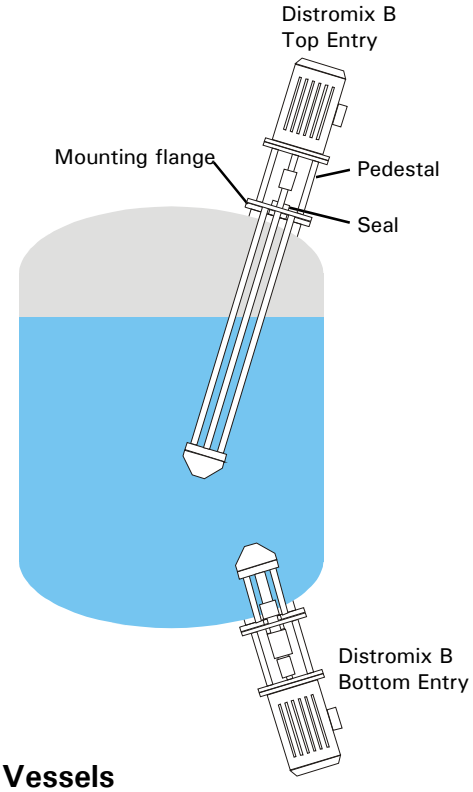
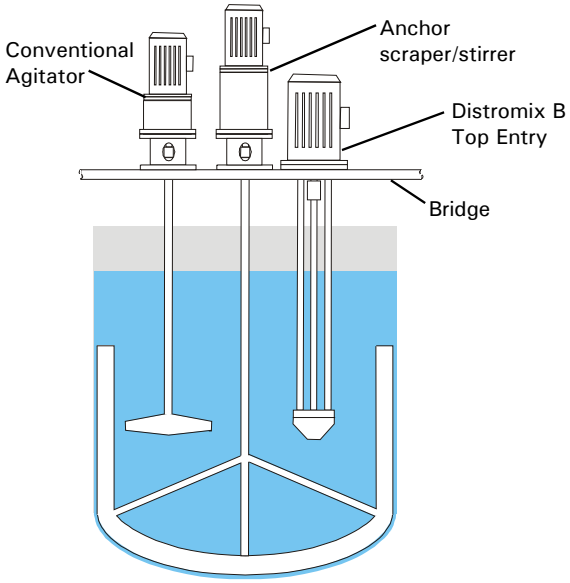


Closed Vessels

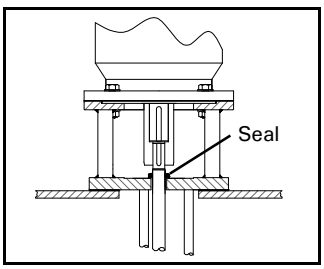
Both top-entry and bottom-entry high shear mixers can be used in closed vessels. Bottom-entry mixers are especially useful if there are solids in the vessel that are likely to sink or if other agitators which may conflict with the high shear mixer are present in the vessel. If the vessel is jacketed for heating or cooling, then a bottom-entry port may not be feasible. All mixers entering the vessel must have their shafts sealed. To gain access to the seal and shaft coupling for fitting and maintenance, the motor is mounted on a stand-off "pedestal" which is usually shrouded with a guard for safety. Increased clearance around the vessel is required to accommodate the pedestal and a longer driveshaft is required. Note that high shear mixers are normally mounted at an offset from the central axis of the vessel for optimum flow patterns to develop. This factor, together with the additional weight of the mixer must be considered when designing the vessel and its support structures, to cope with the loads involved.



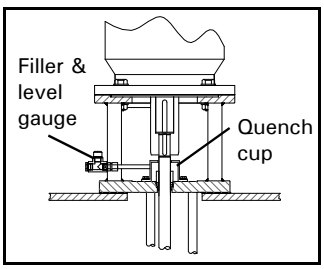
Open Vessels

If the vessel is open to the atmosphere, the simplest way to mount the mixer is on a bridge or support structure above the vessel so that the vessel does not have to carry the weight of the mixer. The above diagram shows how additional impellers may be integrated into a vessel. This becomes particularly important for higher viscosity mixtures where greater fluid movement is required to ensure uniformity. Bridge-mounted mixers are generally cheaper than those mounted directly on vessels as there is no need for a pedestal or seal. Maintenance and cleaning are therefore also simplified. Bottom-entry mixers can be used on open vessels in the same way as on closed types. Where anchor/scraper type impellers are used with bottom-entry high shear mixers, they usually include special cut-outs to avoid clashes. If no other agitators are present, the high shear mixer may be mounted at an angle to improve flow patterns in the fluid.

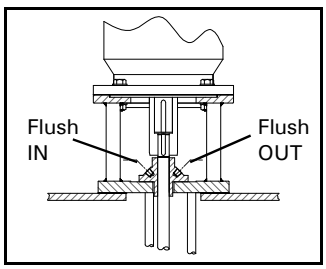
Sealing Options



Lip or V-ring seal



Single Mechanical Seal



Double Mechanical Seal

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