Zeta magnetic agitators
For applications in sterile process technology
Zeta agitators – for a wide range of applications

Our agitators are used wherever the highest requirements for sterile design and reliability exist:

- Bioreactors for bacteria and cell cultures
- Processes which use carrier suspensions
- Manufacture of vaccines
- Process tanks in the upstream and downstream areas of fermentation systems
- Infusion and injection solutions
- Fractionation of blood plasma
- Manufacture of active substances
- Fine chemicals
- Food and beverages, for instance:
  - Breweries
  - Milk industry
- Manufacture of fruit juices
- Special applications such as:
  - High-pressure reactors
  - Cooling media
The following table provides an overview of our comprehensive product range:

<table>
<thead>
<tr>
<th>Product group</th>
<th>Product description</th>
<th>Designation</th>
<th>Typical applications</th>
<th>Coupling size</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bottom-mounted magnetic agitators</strong></td>
<td>Standard, with magnetic impeller</td>
<td>BMR</td>
<td>Hygienic and sterile process tanks in pharmaceutical and foodstuffs production, up to 45,000 litres; in the upstream and downstream areas of bioreactors</td>
<td>30 – 20,000 Ncm</td>
</tr>
<tr>
<td></td>
<td>Bioreactor agitators</td>
<td>BMR ...F</td>
<td>In bioreactors for bacteria and cell cultures; multi-stage agitation, application-specific design</td>
<td>30 – 13,000 Ncm</td>
</tr>
<tr>
<td><strong>Top-mounted magnetic agitators</strong></td>
<td>Externally mounted magnetic coupling</td>
<td>AMR e</td>
<td>In, for example, bioreactors for cell cultures; multi-stage agitation, application-specific design</td>
<td>300 – 2500 Ncm</td>
</tr>
<tr>
<td></td>
<td>Internal magnetic coupling</td>
<td>AMR i</td>
<td>Smaller bioreactors and process tanks; multi-stage agitation, application-specific design</td>
<td>30 – 550 Ncm</td>
</tr>
</tbody>
</table>

In addition to the above, our product range also includes agitators with mechanical seal.
Zeta magnetic agitators – Hermetically sealed, reliable and easy to clean

Zeta magnetic agitators are the result of many years of experience which are the basis for our know-how in sterile design and process engineering:

Our magnetic agitators have the advantage that their containment shell hermetically seals the inside of the tank from the surrounding atmosphere. It is not necessary to seal the shaft feedthrough, as is the case in conventional agitators, and this avoids the related drawbacks and risks (leakage, microbial contamination, maintenance). We pay particular attention to the ease of cleaning of our magnetic agitators, something which is extremely important in sterile applications. Independent testing according to EHEDG guidelines guarantees that these agitators can be validated in the most demanding processes.

Wide range of products:
We offer various types of bottom-mounted and top-mounted magnetic agitators. Today, bottom-mounted magnetic agitators are the state of the art for the processing of low-viscosity fluids in the pharmaceutical and biotechnological industries. Important advantages of these agitators are their compact design, minimum maintenance requirements and high reliability. They also leave more space available on the tank cover for probes, fittings or sight-glasses.

Agitators for your application:
In addition to the standard agitators, we can also supply customer-specific modified versions which deviate from the standard versions in the impeller dimensions, the speed or the type of impeller. By monitoring the level and agitator speed together with an EX-proof drive, it is possible to use the agitators in vessels with zone 0 or 1 according to directive 94/9/EC.
Bottom-mounted magnetic agitators BMR: Proven technology – open design

The BMR series of agitators covers a wide spectrum of applications. The following standard agitators are available:

<table>
<thead>
<tr>
<th>Type</th>
<th>ø Impeller mm</th>
<th>Rated power kW</th>
<th>Max. speed rpm</th>
<th>Annular gap containment shell mm</th>
<th>Mixing capacity, depending on task Litre</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMR 30 M</td>
<td>80</td>
<td>0.09</td>
<td>900</td>
<td>2.0</td>
<td>5 to 120</td>
</tr>
<tr>
<td>BMR 75</td>
<td>105</td>
<td>0.18</td>
<td>850</td>
<td>3.3</td>
<td>50 to 250</td>
</tr>
<tr>
<td>BMR 75 M</td>
<td>105</td>
<td>0.12</td>
<td>850</td>
<td>3.3</td>
<td>50 to 250</td>
</tr>
<tr>
<td>BMR 100</td>
<td>125</td>
<td>0.18</td>
<td>525</td>
<td>3.3</td>
<td>100 to 400</td>
</tr>
<tr>
<td>BMR 300</td>
<td>150</td>
<td>0.25</td>
<td>575</td>
<td>3.5</td>
<td>200 to 800</td>
</tr>
<tr>
<td>BMR 550</td>
<td>175</td>
<td>0.37</td>
<td>530</td>
<td>4.5</td>
<td>500 to 1700</td>
</tr>
<tr>
<td>BMR 550 M</td>
<td>110</td>
<td>0.75</td>
<td>1150</td>
<td>4.5</td>
<td>800 to 3000</td>
</tr>
<tr>
<td>BMR 850</td>
<td>210</td>
<td>0.55</td>
<td>440</td>
<td>7.0</td>
<td>800 to 3000</td>
</tr>
<tr>
<td>BMR 1200</td>
<td>250</td>
<td>0.75</td>
<td>325</td>
<td>7.0</td>
<td>1000 to 4000</td>
</tr>
<tr>
<td>BMR 2500</td>
<td>300</td>
<td>1.10</td>
<td>300</td>
<td>7.0</td>
<td>2000 to 8000</td>
</tr>
<tr>
<td>BMR 2500 M</td>
<td>165</td>
<td>2.20</td>
<td>900</td>
<td>7.0</td>
<td>3000 to 10000</td>
</tr>
<tr>
<td>BMR 4000</td>
<td>350</td>
<td>1.50</td>
<td>250</td>
<td>7.0</td>
<td>3500 to 12000</td>
</tr>
<tr>
<td>BMR 7500</td>
<td>400</td>
<td>2.20</td>
<td>250</td>
<td>7.0</td>
<td>6000 to 22000</td>
</tr>
<tr>
<td>BMR 13000</td>
<td>450</td>
<td>4.00</td>
<td>240</td>
<td>7.0</td>
<td>10000 to 33000</td>
</tr>
<tr>
<td>BMR 20000</td>
<td>500</td>
<td>7.50</td>
<td>230</td>
<td>7.0</td>
<td>15000 to 45000</td>
</tr>
</tbody>
</table>
The Zeta magnetic impeller

The design of the standard magnetically coupled mixer impeller, which is suitable for most applications, offers important advantages for our BMR magnetic agitators:

- Open, easy to clean design assures total cleanability in place by spray ball alone, as the hub and magnetic rotor are connected only by the impeller blades
- Very large circular gap between containment shell and rotor offers maximum flow rate and low shear stress (see: BMR Type Series Table, page 5)
- Careful attention to universally accepted CIP/SIP design standards, includes using beveled surfaces with no sharp angles and a high level of surface finish eliminates the potential for product residue by getting rid of dead legs, hidden areas, and cavities that are the source of down stream contamination
- Ceramic slide bearing (Silicon-Carbide vs. Zirconium-Oxide) oversized in terms of diameter and height, for high stability, exceptional sliding properties in low volume situations, and particle generation below detectable levels
- Ease of maintenance – replacing of the female ceramic bushing can be done by the user on site
- CFD investigated mixing results: Radially pumping, with liquid draw from the top. For effective blending, good heat transfer. Suitable for drawing in powdered solids. Sizing to your process requirements (i.e., low shear stress or vigorous mixing). Mixing to minimal volumes
- A special advantage of our magnetic impeller is the „floating bearing system“: The kinked shape of the impeller wings generates a floating action of the mixing head due to hydraulic effects. An oscillating movement is generated on the product lubricated pivot of the slide bearing. Advantage: reduced load for the axial bearing and better flow rate in the bearing gap which result in a superior lubricating effect and improved cleaning properties
Bottom-mounted magnetic agitators for bioreactors – BMR F

State of the art for bioreactors:
The use of bottom-mounted magnetic agitators in bioreactors permits safe process execution for long periods, since there is no risk of contamination entering the reactors through mechanical seals. The expensive condensate supply system for the mechanical seal is also unnecessary. The number and type of impellers can be selected to match the planned application. The agitators are preferably mounted on sealed sliding hubs with sterile design.

The generously dimensioned ceramic bearings of the BMR F agitators permit the use of overhung shafts. These bioreactor agitators are available in various sizes, from laboratory models to models for fermentation volumes of several hundred (microorganisms) or several thousand litres (cell cultures). To support critical mixing tasks and scale up steps, we offer our customers the opportunity of simulations using CFD (Computational Fluid Dynamics) in order to investigate the process.

The simulation includes the following steps:

- Processing of 3D CAD geometry data
- Mesh generation and fitting the numerical solver FIRE
- Simulation of the operating point of the mixing vessel
- Data analysis (such as mixing quality, power curves, pictures and movies from any flow and temperature field)

When appropriate, the possibility exists to test new applications or to rent tanks and agitators from us.
Further details on bottom-mounted magnetic agitators

**Patented bearing-bush design**

The benefits of the floating bearings of the magnetic impeller are not available in other types of impellers. This applies, for example, to bioreactor agitators or agitators which, for design reasons, are mounted above the hub (dissolver discs, marine propellers).

**In such cases, our patented lift-off bearing bush is used:**

The rotary motion presses the liquid being processed into specially shaped channels in the axial surface of the face seal, creating a film of liquid between the static and rotating bearing surfaces and lifting the agitator so that there is little contact between the shoulders of the bearing. This also ensures better cleaning of these surfaces.

**Lowering device**

Agitators capable of transferring a torque of more than 25 Nm are delivered complete with a lowering device.

**This offers the following benefits:**

- Controlled removal and safe installation of the agitator head by lowering of the magnetic rotor, leaving the drive in its normal position.
- Prevention of damage to the ceramic bearings.
- More safety: compliance with the EU Machinery Directive on design of machines to prevent injuries (risk of crushing of hands or fingers when mounting the agitator).
**Speed monitoring**

In normal operation it is advantageous to know the actual speed of the mixer head rather than relying on tachometers or shaft speed. Specific process steps can be determined from this feedback. In failure mode, whether due to incorrect handling, excessive viscosity or speed, the transmittable torque of the magnetic coupling can be exceeded. If this is the case, the drive may continue to operate, but the mixing head is at a stand still. Corrective action needs to be taken immediately.

For this reason, a non-contacting measurement of the speed of the mixing head is available, by applying a speed sensor outside on the vessel. For safety reasons, the speed monitoring option is applied as a standard for Explosive zone (vessel with zone 0, directive 94/9/EC).

**Detachable, insertable containment shell**

As an alternative to the welded-in flange, the containment shell can be of a detachable design to facilitate maintenance work. Also appropriate as a substitute for agitators with a face seal.

**Fixing of the drive with TriClamp**

This facilitates rapid dismantling of the drive, e.g. for containers which are autoclave-safe.
Zeta top-mounted magnetic agitators

For applications which require a magnetic agitator mounted on the cover of the tank, Zeta offers the top-mounted magnetic agitators of the AMR series.

**AMR e:**

*With external magnetic coupling*

Hermetic sealing of the tank with the aid of a magnetic coupling is a prerequisite for long-lasting and demanding processes in sterile technology.

The top-mounted agitator AMR e is a further development of conventional agitators and has been optimised for the best possible sterility. Its important benefits are:

- **Suitable for sterilisation:** the containment shell is vented via a lateral pipe at the highest point and can thus be sterilised reliably
- **Easy to clean:** the vent pipe can also be used for cleaning the containment shell and the bearings mounted inside it (CIP)

Standard sizes: maximum torques from 3 Nm to 25 Nm.
These avoid the problems of conventional agitators with mechanical seals and permit the use of almost any type of impeller. The impellers can be welded to the shaft or mounted with the aid of a sterile sliding hub.

AMR i:
With internal magnetic coupling, for vessel volumes between 2 and 150 litres

On these agitators with torques between 0.3 and 5.5 Nm, the magnetic coupling and the dry running shaft bearings project into the product space and can thus – in contrast to normal laboratory agitators – be cleaned in-situ together with the inside of the tank.

The mounting on the tank cover with, for example, a deadleg-free flange, a TriClamp or a bayonet connector is executed in accordance with the customer’s wishes. Process-specific impellers, such as a segment impeller („elephant ear“) for cell culture fermentation, Rushton turbines or pitched blade impellers, are mounted on the shaft.

Drives: AC motors suitable for Variable Frequency Control (VFD) operation are standard, and as an option, can be supplied with integrated frequency converters. For small sizes, DC motors with integrated speed control are available. Quick-change couplings for the drive are available as an option.
As a technology supplier to the biotech, pharmaceutical and food industries, we design, manufacture and install customer-specific solutions for leading companies around the world.

- Biopharmaceutical systems
- Preparation and formulation systems
- CIP/SIP and media systems
- Engineering & services
- Installation of sterile processing plants
- Automation solutions
- Magnetic and shaft-driven agitators
- Freeze & thaw systems
- Dust extractor rings
- Processing plants for food & beverage industries

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