



bio-m® AGITATORS



BIO- AND PROCESSTECHNOLOGY

EVOLUTION OF TECHNOLOGY

1. bio-m[®] AGITATORS

FOR ALL APPLICATIONS IN STERILE PROCESS ENGINEERING

The zeta product range of mixing and agitating systems combines many years of experience in process engineering, exceptional aseptic design, and manufacturing know-how.



zeta agitators are being used in validated processes where the highest requirements are set for sterile design and reliability:

- Bio reactors for bacteria and cell cultures
- Processes with carrier-suspensions
- Production of vaccines
- Process vessels in the upstream and downstream areas of fermentation plants including Bio kill tanks
- Infusion and injection solutions
- Blood plasma fractionation
- Active Pharmaceutical Ingredients (API)
- Fine chemistry
- Food and Beverage Industries
 - Breweries
 - Dairy industry
 - Fruit juice production including pulp suspension
- Special applications
 - High pressure reactors
 - Cooling media



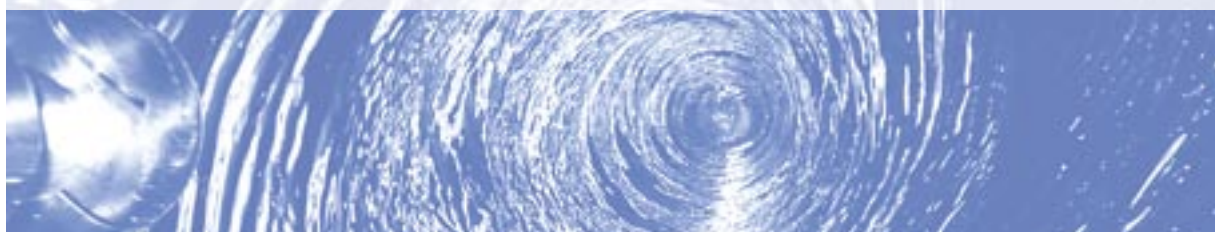
THE FOLLOWING TABLE SHOWS OUR EXTENSIVE PRODUCT RANGE:

PRODUCT GROUP	PRODUCT DESCRIPTION	MODEL/TYPE	TYPICAL APPLICATIONS	SIZE	PAGE	
bio-m® MAGNETIC AGITATORS	BOTTOM-MOUNTED MAGNETIC AGITATORS	Standard design with a magnetic impeller	BMR	hygienic and sterile process vessels in pharmaceutical and food industry, up to 45,000 litre; up and downstream process of bio-reactors	30 - 20.000 Ncm	07
		Bio-reactor agitators	BMR ... F	in bio-reactors for bacteria and cell cultures; multi-stage impeller systems, sizing according to application	30 - 13.000 Ncm	09
		Rotor-stator-technology	BMR ... RS	processes requiring high shear rates, e.g., solid materials with a tendency to form lumps, water/oil emulsions	300 - 20.000 Ncm	10
	TOP-MOUNTED MAGNETIC AGITATORS	Externally placed magnetic coupling	AMR e	bio-reactors for cell cultures; multi-step agitators, sizing according to application	300 - 2500 Ncm	12
		Internal magnetic coupling	AMR i	smaller bio-reactors and smaller process vessels; multi-stage impeller systems, dimensioned in accordance with application	30 - 550 Ncm	13
bio-m® AGITATORS WITH SEAL	Top-mounted agitator, direct drive (additional bearing if required)	AD (L)	for homogenisation of low viscous products in fine chemistry and the food industry	0,25 - 5,5 kW; shaft-Ø up to 50 mm	15	
	Top/bottom mounted agitator with gear (additional bearing if required)	AG(L)/BG(L)	for all mixing tasks; for higher viscosities in fine chemistry, pharmaceuticals, and the food industry	shaft-Ø up to 100 mm	15	
	Top/bottom mounted agitator with gear; dismantling aid for the mechanical seal	AGL/BGL ... DW	for all mixing tasks; for higher viscosities in fine chemistry, pharmaceuticals, and the food industry	shaft-Ø 60 up to 140 mm	15	
	Foam breaker	fufo®	for bio-reactors and sophisticated applications in chemistry e.g., PVC	gas flow rate up to 100 m³/min	16	

2. BASICS OF MIXING TECHNOLOGY

For zeta, a thorough understanding of your mixing process is very important. If agitators are not correctly sized to the process, they might be oversized or even worse, undersized.

Therefore clarifying which task the agitator is to perform is an important pre-condition to ensure the successful handling of your project.



2.1 MIXING TASKS

The first task for zeta is to collect the relevant process data. Based upon this information, zeta then completes the process engineering function of sizing agitators for the mixing task to be performed.

All agitator components are determined from this data (i.e., type of impeller and diameter, speed, motor capacity, etc.).

The following typical mixing tasks may be required individually or in combined form:

BLENDING

Mixing of liquids of similar type

Criteria for sizing: desired mixing time and mixing quality

SUSPENDING

Keeping solids spread in a liquid

(Important for dissolving solids = mass transfer solid -> liquid)

Criteria for sizing: required degree of suspension

Required information: size, density, and quantity of particles

HEAT TRANSFER

To improve heat transfer in cooled, as well as in heated vessels

Criteria for sizing: required internal heat transfer α_i (calorimetric product data has to be stated and upon request, zeta also calculates the complete heat transfer of a vessel)

GASSING

Dispersing of introduced gas quantities for improving the mass transfer

Criteria for sizing: reliable and favorable distribution of the introduced gas quantity without agitator overflow, resulting in optimal mass transfer

(the gas quantity has to be stated)

DISPERSING

Dispersing of liquids which cannot be mixed (i.e., Oil – water)

Criteria for sizing: optimising of mass transfer

zeta owns computation programs and other materials that permit optimal sizing and configuration so that each agitator is adapted to the mixing task.

2.2 PROCESS ENGINEERING CONSULTING SERVICE

As a service, we will readily discuss with you the process engineering requirements for new projects in any phase of development, or processes in place that can benefit from further development. Apart from that we offer you:

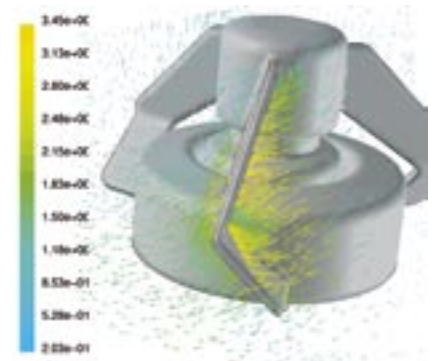
CFD-INVESTIGATIONS

For basic investigations or for customer specific requirements, we have the capability of using numeric methods of computing.

Define fluid dynamics phenomena, load and pressure conditions at the impeller, and shear stress or process engineering values (mass transfer, mixing times) may be determined by means of CFD (Computational Fluid Dynamics).

Therefore processes may be presented faster and better – an important condition for optimising.

Our consulting services are available independently from hardware supplies for optimising existing facilities and processes or for giving support in sizing agitators in the course of planning plants.



CONTOURS OF TURBULENT
LINETIC ENERGY (k) (M^2/s^2).

MIXING TESTS

Our test facilities are available to conduct mixing tests for batch sizes between 5 and 750 liters.

Tasks:

- Is viscosity or the flow behavior in doubt?
- Is it required to quickly mix liquids with different viscosities?
- Should a vortex be formed or, to the contrary, no air should be drawn in?

Send us the tasks required for your process and we will be pleased to make a respective test.

The small test facility is portable and may also be used for testing on your premises.



3. bio-m[®] MAGNETIC AGITATORS HERMETICALLY SEALED, RELIABLE, PERFECT TO CLEAN, ASEPTIC DESIGN

The obvious advantage of our magnetic agitators is that the containment shell hermetically seals off the internal space of the vessel from the surrounding atmospheric environment maintaining the integrity of the mixing vessel.

Mechanical seals are not required.

The respective risks and disadvantages (i.e., leakage, germination, maintenance effort) are eliminated.

bio-m[®] Magnetic Agitators are
a zeta core competence.



Specific focus is placed on the cleanability of our magnetic agitators – a necessity for sterile application.

QHD trained employees and independent testing according to EHEDG guidelines guarantee that these agitators can be validated in the most demanding processes.

Various models of bottom-mounted or top-mounted magnetic agitators are available.



3.1 BOTTOM-MOUNTED MAGNETIC AGITATORS BMR PROVEN TECHNOLOGY, OPEN DESIGN

Today, bottom-mounted magnetic agitators are state-of-the-art in pharmaceutical and bio-technology production for mixing liquids with low viscosities.

Compact build, low maintenance cost, and high reliability are important advantages. Valuable space on the top dish is now free for probes, armatures or sight glasses.

BMR MAGNETIC AGITATORS CAN BE SUPPLIED IN EX-DESIGN.
ZETA HAS THE EXAMINATION CERTIFICATE ACCORDING TO DIRECTIVE 94/9/EC (ATEX).



THE BMR TYPE SERIES COVERS A CONSIDERABLE SPECTRUM
THE FOLLOWING STANDARD AGITATORS ARE AVAILABLE:

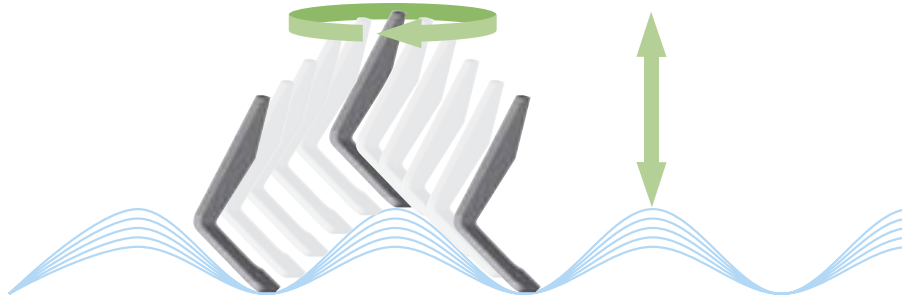
TYPE	Ø IMPELLER	POWER	MAX. SPEED	CIRCULAR GAP CONTAINMENT SHELL	MIXING CAPACITY DEPENDING ON MIXING TASK
	mm	kW	rpm	mm	LITRE
BMR 30	80	0.09	900	2,0	10 to 150
BMR 75	100	0.12	900	3,3	50 to 250
BMR 100	125	0.18	500	3,3	100 to 500
BMR 300	150	0.25	550	3,5	250 to 750
BMR 550	175	0.37	500	4,5	500 to 1600
BMR 850	200	0.55	450	7,0	1000 to 3000
BMR 1200	250	0.75	325	7,0	1500 to 5000
BMR 2500	300	1.10	300	7,0	2500 to 8000
BMR 4000	350	1.50	250	7,0	3500 to 10000
BMR 7500	400	2.20	250	7,0	6000 to 20000
BMR 13000	450	4.00	240	7,0	10000 to 30000
BMR 20000	500	7.50	240	7,0	15000 to 45000

Apart from standard agitators, we also supply custom modified agitators if required.

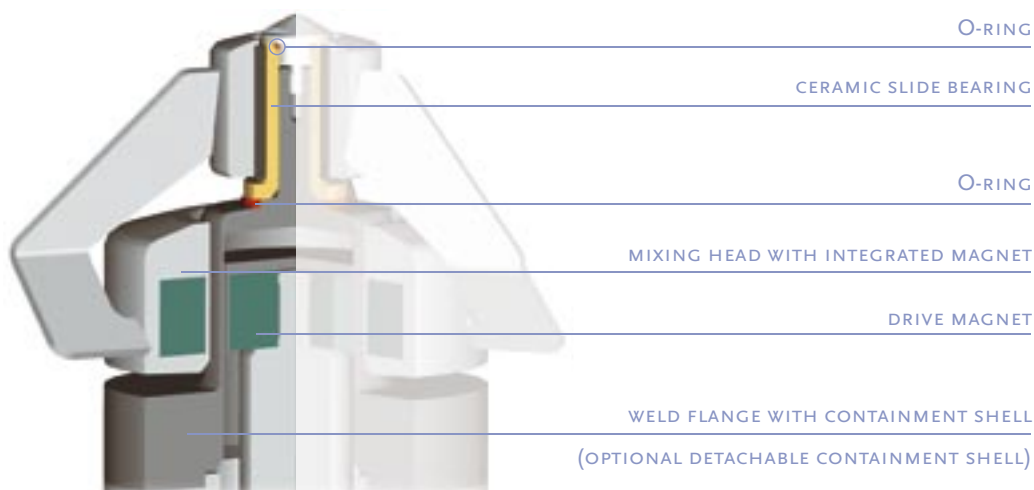
THE bio-m® MAGNETIC IMPELLER

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 offer maximum flow rate and low shear stress (see: BMR Type Series Table, page 7)
- 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 BIO-REACTORS

Application of bottom-mounted magnetic agitators in bio-reactors permits safe process performance over long periods as contamination problems, due to mechanical seals are eliminated.

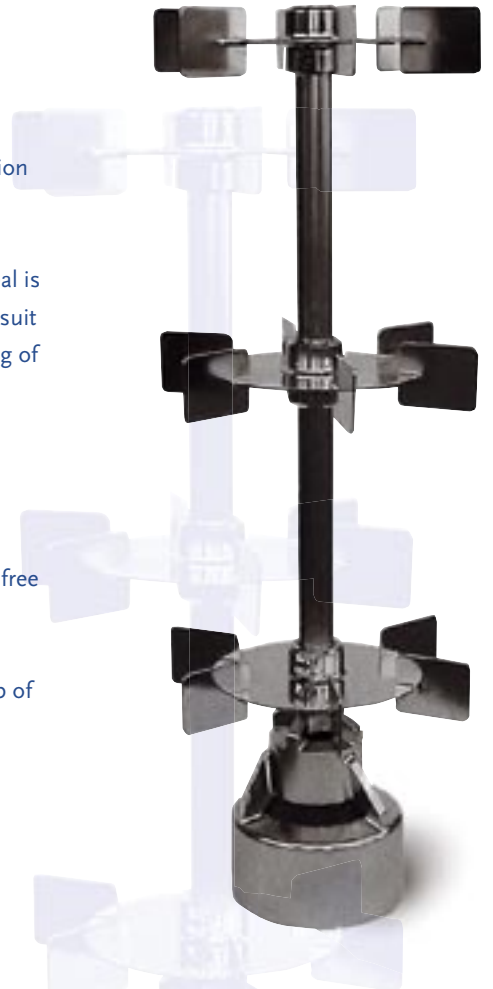
The often complex condensate supply system for the mechanical seal is not required. The number and type of mixing elements are sized to suit the application. To meet stringent sterile design standards, fastening of the mixing elements is accomplished by using a sealed hub.

An optional hub design permits fastening of the hub on the shaft without damage to the surface of the shaft.

The well engineered slide bearing of the BMR agitator permits long free shafts.

If required, an additional support bearing can be provided at the top of the extended mixer shaft.

These bio-reactor agitators may be used from the laboratory scale, e.g., in our bio-t® Multi-fermenter Systems, up to a fermentation volume of several hundred litres (micro-organisms) or even several thousand litres (cell cultures).



EXAMPLE:
RUSHTON TURBINES
FOR THE FERMENTATION
OF MICRO-ORGANISMS

EXAMPLE:
SEGMENT IMPELLER
FOR THE FERMENTATION
OF CELL CULTURES

BMR MAGNETIC AGITATORS WITH ROTOR-STATOR-TECHNOLOGY

Bottom-mounted magnetic agitators series RS: embodies the ongoing development of our proven technology and long term application knowledge where high shear stress is required by the process.

There are numerous examples where processes have to be mixed with high shear stress in order to reach optimal mass transfer. Classical applications for high shear agitation include hard to solubilise solid materials, lump forming powders and floating gels (e.g., media preparation and solutions for tablet coating) as well as liquids which do not readily dissolve in each other.

These agitators may also be used successfully in combined applications with a top-mounted agitator, e.g., in cosmetics industry.

Generally, all sizes of our magnetic agitators are available with an RS series option and with drive capacities of 0,55 kW to more than 11 kW.

The structural design with inside rotor and stator cage can be compared with a conventional rotor-stator system. This design facilitates the use of well developed process engineering experience for this technology.

In the case of anticipated wear, the stator cage can be replaced (e.g., by use of a pharmaceutical sealed screwed connection). Alternatively, the stator cage is welded to the weld flange.



PATENTED DESIGN OF BEARING BUSHING FOR SPECIAL MIXING APPLICATIONS

The advantages of the floating bearing system of our magnetic impeller are not available for other mixing element designs. This applies for bio-reactor agitators or mixing elements, which for design reasons have to be fastened above the hub (e.g., dissolver disk, marine impeller).

Here the patented lift-off bearing bushing can be used. Due to the turning movement, liquid is pressed into the specially shaped flow ducts of the axial slide bearing surface. A liquid film develops between the static and the rotating surface of the bearing which lets the mixing head take off at low speeds, thus largely stopping the contact between the axial bearing faces. Furthermore, cleaning of these surfaces is intensified which ensures fast and reliable validation.

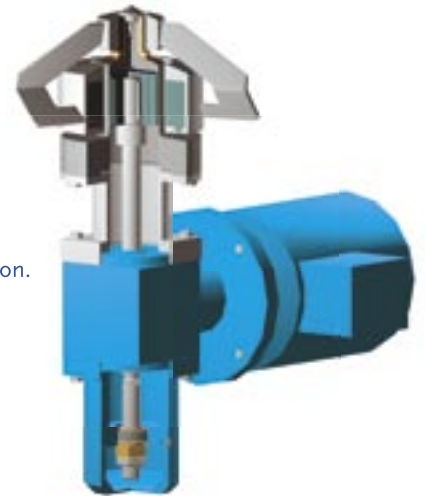


LOWERING DEVICE

For agitators with transmittable torque ≥ 25 Nm, our unique lowering device is available as an option within our scope of delivery.

Advantages:

- Controlled removal and safe mounting of the mixing head by lowering the driving magnetic rotor. No need to remove the entire drive motor as the drive stays in its position.
- Prevents damage to the ceramic bearings.
- The requirement of the EC machinery directive for injury avoiding design (i.e., danger of injury when placing the mixing head) has been met.



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 Ex-range agitators (e.g., category 1/2, directive 94/9/EC)

EMR: THE SOLUTION FOR SMALL HOLD AND TRANSPORT VESSELS

Advantage: no fixtures are required in the vessel; therefore, a glass vessel can be used.

The mixing element with the weld-connected permanent magnets enters into the vessel from the top and is mounted on a bar or dip pipe. It rotates on a ceramic bearing.

The magnetic field is applied by the magnetic drive with integrated speed control which is mounted under the vessel.

Capacity up to 80 Watt and speed up to 600 rpm is available.



3.2 bio-m® TOP-MOUNTED MAGNETIC AGITATOR

For applications requiring a magnetic agitator to be placed on top of the vessel, zeta offers the top-mounted AMR Series magnetic agitators. By avoiding the disadvantages of conventional agitators with mechanical seal, nearly every type of mixing element can be used with AMR Magnetic Agitators.

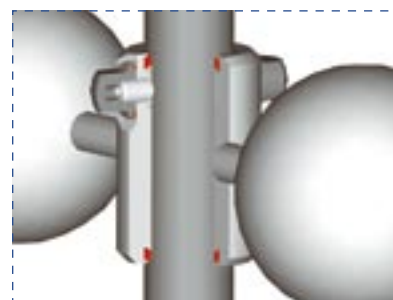
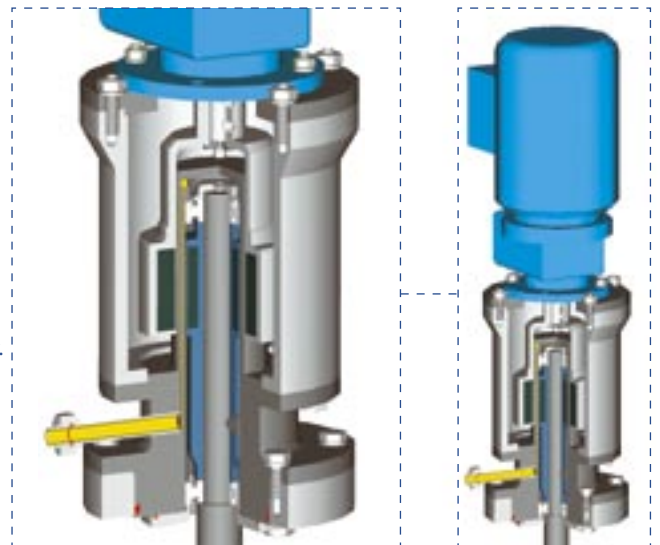
The mixing elements can be firmly welded to the shaft or connected with a set hub in sterile design. (See detailed drawing below.)

AMR e: WITH EXTERNAL MAGNETIC COUPLING

The hermetic enclosure of the internal space of the vessel, by means of a magnetic coupling, is fundamental for long sophisticated processes in sterile technology.

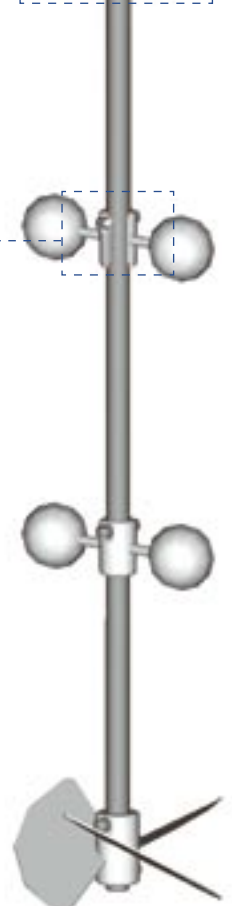
The top-mounted agitator AMR e is a further development of conventional magnetic agitators. This advancement in sterile processing is evidenced in the optimisation of magnetic coupling technology. An important design detail is the integrated ventilation of the containment shell.

To be able to sterilise the dry running ceramic bearings contained in the magnetic coupling located above the process space, there is an access port at the highest point of the containment shell of the magnetic coupling.



Via the lateral nozzle, the containment shell can be ventilated or directly steam sterilised.

Standard sizes with transmittable torque between 3 Nm and 25 Nm.



AMR i: WITH INTERNAL MAGNETIC COUPLING FOR THE LOWER AND MEDIUM PERFORMANCE RANGE

For agitators with a torque between 0,3 and 5,5 Nm, the magnetic couplings and dry running shaft bearings reach into the head room of the vessel and can, in contrast to any other lab agitators, be cleaned together with the inside of the vessel.

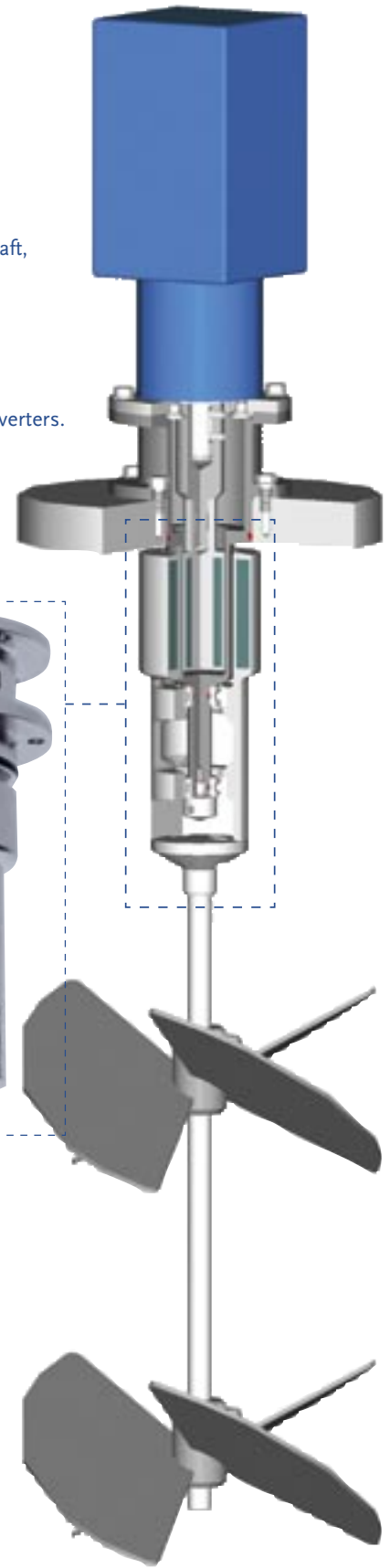
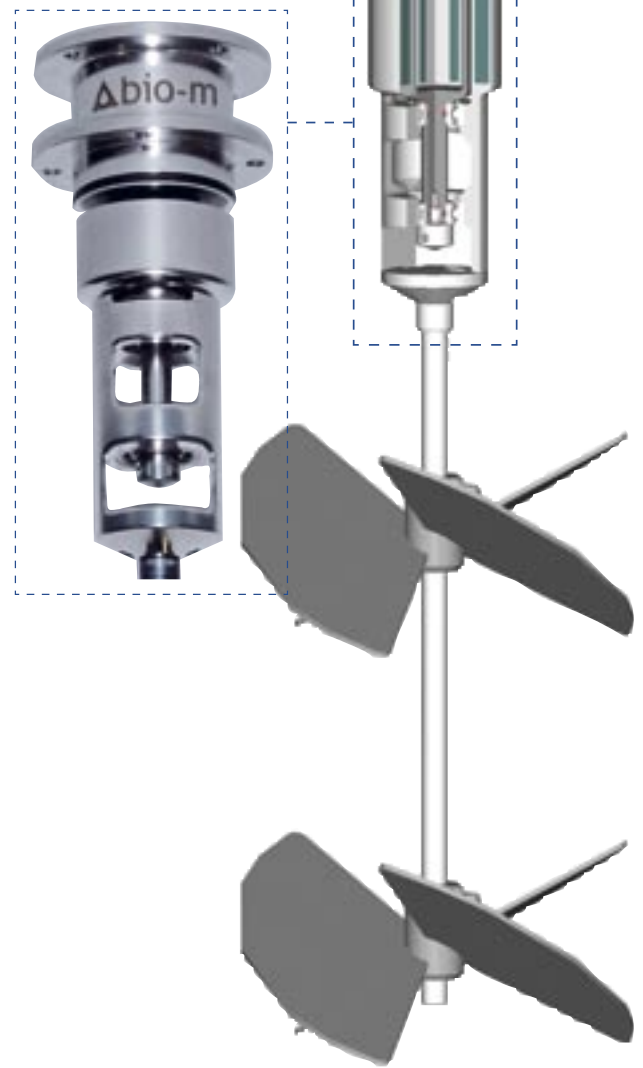
Various types of connections, such as flanged with minimum dead space, tri-clamp or bayonet style connection are available.

Specific mixing elements designed for the process are connected to the shaft, e.g., segment mixer ("Elephant Ear") for fermentation of cell cultures.

Drive Configurations:

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 exchange couplings can also be specified as an option.



4. bio-m[®] AGITATORS WITH SEAL

Apart from agitators with magnetic couplings, zeta also supplies conventionally sealed agitators. These systems are suitable where there is a lower requirement to reduce possible contamination of the product to be handled or if the sizing advises against an agitator with magnetic coupling.

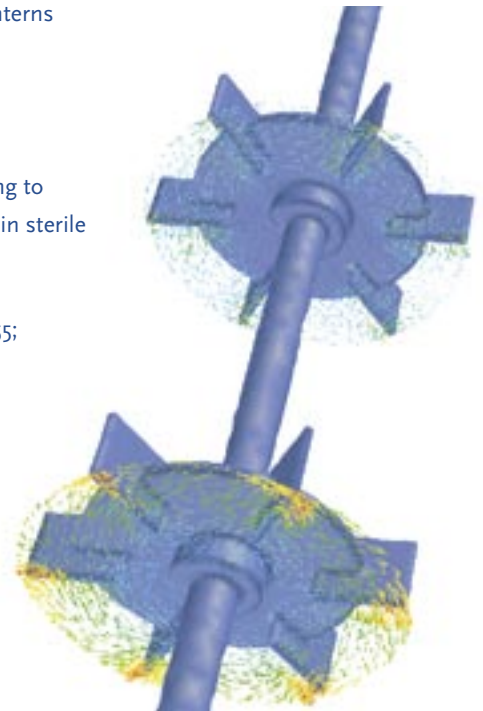
With the zeta sizing and dimensioning software, the power requirement, shaft diameter, and the critical speed (natural frequency), will be determined in order to ensure proper component selection and reliability.

To have the entire speed control range at one's command, the maximum operating speed is defined and should be maintained below the critical speed.

Subject to the process requirements, and in cooperation with the client, zeta will determine the design details of each agitator system.

Some of the main parameters to be determined are:

- Agitator lantern: bio-m[®] Agitators always have stainless steel lanterns
- Seals: from simple radial seal rings to mechanical seals in sterile design
- Agitator mounting: from the standard mounting flange, according to ANSI or DIN 28141, to the plug-in flange of solid stainless steel, in sterile design, with minimum dead space
- Shaft partitions: standard flange coupling according to DIN 28155; flange coupling in sterile design or sealed screwed-on couplings
- Fastening of mixing elements: set hubs, standard or in sealed sterile design; screw-connected hubs; clamped hubs, etc.
- Foot support bearing: if unavoidable, also available in sterile design
- zeta manufactures 3 types of agitators with seals.
(See: bio-m[®] Agitators with Seal, page 3)



4.1 SERIES AD (L)

- Compact agitator with simple sealing system
- Drive directly by means of the electric motor (6 or 8-pole) without gear
- Standard design with marine type propeller on screwed-on hub
- Motor capacity 0,25 to 5,5 kW
- Typical application: storage tanks in food industry
simple process vessels in fine chemistry



4.2 SERIES AG (L) / BG (L)

- Top or bottom-mounted agitator, as a rule the mixers are fitted with a geared motor drive
- Depending on length of shaft and seal type with additional shaft bearing
- Available Seals: from radial shaft ring seal (often for food industry) to sterile mechanical seal for bio-reactor agitators
- Shaft diameter: standard sizes between 25 mm and 100 mm
- Can be combined with all types of mixing elements, (See section 5, page 18) and is suitable for nearly all mixing tasks, including higher viscosity



4.3 SERIES AGL / BGL DW

- An important feature is the design inherent capability of exchanging the mechanical seal without having to dismantle the drive
- Available as top- or bottom-mounted agitator configuration
- With an additional shaft bearing integrated into the mechanical seal
- For shaft diameters > 60 mm
- Sizing of the mixing elements and speed is process specific; often specified for bio-reactors



4.4 MECHANICAL FOAM SEPARATOR fufo® TO COUNTERACT FOAM EFFECTIVELY

Gas can be introduced or released in the course of the process. This often results in unwanted foam development, which can be a major disadvantage for the following process steps. Effective removal of foam without using chemical additives can be done with the fufo® Foam Separator.

The centrifugal force generated by the fast rotating turbine separates the foam into gas, liquid or solid phases.

The latter stay in the vessel and the foam free gas is discharged from the process.

Small separators are direct drive while the larger sizes use a belt drive system in conjunction with a fluid coupling. Sealing is done with mechanical seals.



STANDARD SIZES

fufo® SIZE	AIR/GAS THROUGHPUT RATE m³/min	GAS OUTLET NOZZLE ISO DN	DRIVE CAPACITY kw	TOTAL WEIGHT kg	Ø TURBINE mm	MOUNTING DEPTH mm	TOTAL HEIGHT mm	MAIN EXTERNAL FLANGE Ø mm
00	0,05	10	0,25	12	75	75	600	95
0	0,3	15	1,1	25	120	130	700	120
1	0,6	25	2,2	75	180	150	750	150
2	1,8	40	4	100	200	180	780	175
3	5	80	7,5	325	300	270	1200	265
4	20	150	22	750	400	470	1800	400
5	30	200	37	950	500	580	2000	480
6	50	250	45	1500	600	770	2600	520
7	70	300	55	2250	700	800	2810	915
8	100	350	90	2800	800	800	2900	1065

Dimensions subject to modification

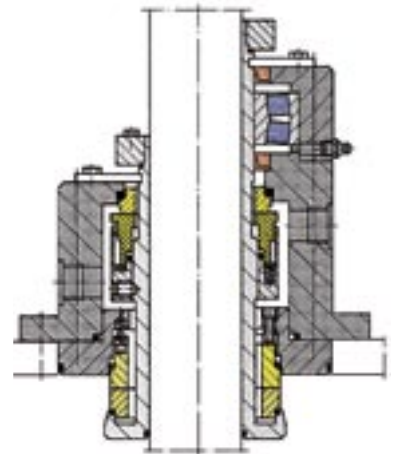


EX-DESIGN ACCORDING TO DIRECTIVE 94/9/EC (ATEX) POSSIBLE

4.5 MECHANICAL SEALS AND SEAL SUPPLY SYSTEMS

The choice of sealing system suitable for any application is a vital one with regard to safety in operation, investment cost, and cleaning properties.

Questions like double or single acting seals, fluid or gas lubricated, position and design of the product side slide rings and the mounting flange design are important distinguishing features.



We will be happy to advise you in these questions – make use of our experience!

SEALS FOR STERILE APPLICATIONS
WITH/WITHOUT BEARING

SEALS FOR CHEMISTRY APPLICATIONS
WITH/WITHOUT BEARING

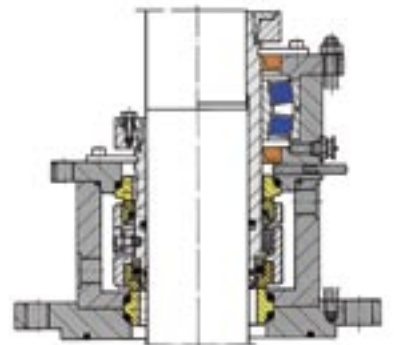
Except for dry running mechanical seals, an auxiliary method to supply the seal with cooling gas or lubricating liquid is required.

For seals with liquid lubrication there are reasonably priced pressure free quench systems and pressurised thermo-siphon systems. The technical features and benefits of each system have to be specified in accordance with the respective application.

Simple and reasonably priced systems consist of a storage vessel with the option of connecting cooling water and pressure gas.

In addition, there are sophisticated systems for sterile applications which use saturated steam condensate for seal lubrication.

Steam traps, diaphragm valves, circulation pumps, measurement and control technology, as well as sterilisation requirements of the system and the seals may lead to considerably higher costs.



Experience with critical applications and attention to customer requirements enables zeta to offer unique customer adapted solutions in addition to our standardised systems.



5. MIXING ELEMENTS

Mixing tasks vary. Product properties such as viscosity and flow behaviour are different. Other criteria such as shear sensitivity, cleaning properties and required torque have an important impact on impeller design.

From the broad array of possible shapes of mixing elements, the best design is chosen to suit your application.

The shape of the mixing element, together with density ρ , the speed of the mixing element n and the diameter d_2 influences the power requirement P_v of the agitator, in accordance with the formula:

$$P_v \sim \rho \times n^3 \times d_2^5$$

Our calculations guarantee that every agitator has the required, correctly sized drive for the respective application.

FREQUENTLY USED MIXING ELEMENTS:



MARINE TYPE IMPELLER



RUSHTON TURBINE



HOLLOW BLADE TURBINE



DISSOLVER DISK



PITCH BLADE IMPELLER



SEGMENT IMPELLER



BALL IMPELLER



PADDLE TYPE IMPELLER



CROSS BAR IMPELLER



COUNTER FLOW IMPELLER



U/Z-IMPELLER



TRAPEZOID IMPELLER

Other mixing elements, as described in DIN 28131, are available.

For highly viscose products, scrapers can be used together with anchor type mixing elements to improve heat transfer and avoid product caking to the wall.



6. ADDITIONAL INFORMATION WORTH KNOWING

6.1 DRIVES

For years, we have been using as a standard, proven drives of leading manufacturers. Customer specifications, which differ regarding design, make of drive, and coating system can be met any time due to the flexible design of our agitators.

As a rule, the drives are built for variable speed control (i.e., frequency converters). For motor capacities up to 7,5 kW the frequency converter can be also mounted on the motor (integrated frequency converter). As an option we supply standard control cabinets as well as complete control systems according to customer specifications.

IN THE AREA WHERE THE EC DIRECTIVE 94/9 (ATEX) IS VALID, NOT ONLY THE DRIVE, BUT THE ENTIRE MACHINE HAS TO HAVE AN EX-CERTIFICATION, DEPENDING ON THE EX-ZONE IN THE VESSEL AND OUTSIDE THE VESSEL. WE WILL BE PLEASED TO SUPPORT YOU WITH DETERMINING THE RESPECTIVE PROCEDURE.



6.2 MATERIALS AND SURFACE FINISH

zeta works exclusively with stainless steel types and nickel based materials such as Hastelloy. Standard material is DIN 1.4435 (AISI 316 L), and upon request the Δ -ferrite-content according to the Basel Standard BN2 can be specified.

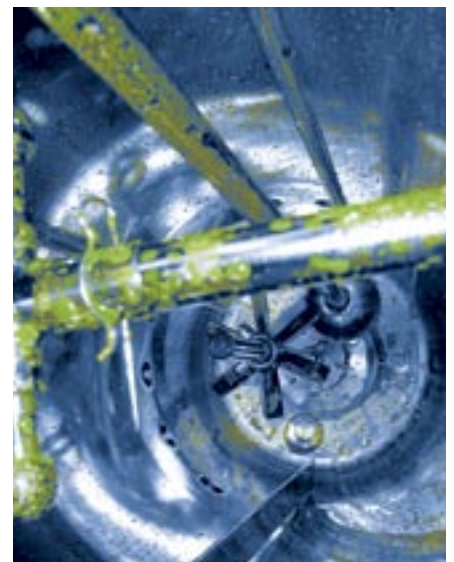
The industries and applications where zeta agitators are used typically specify a product contact surface finish of at least $Ra < 0,8 \mu m$. Electropolishing is available as a standard option. Animal source free polishing needs to be specified prior to ordering.



6.3 QUALIFYING

Machinery which we supply is most used in validated plants. Support of process validation by DQ- / IQ- / OQ-documents is therefore routine for us.

Part of customer support is commissioning of our machinery in a FAT (Factory Acceptance Test) either in our factory or at a third party (vessel, plant supplier). Qualification usually includes testing of the cleaning properties with a riboflavin test.





BIO- AND PROCESSTECHNOLOGY
STERILE PLANT CONSTRUCTION
AUTOMATION

zeta AG

Bio- und Verfahrenstechnik

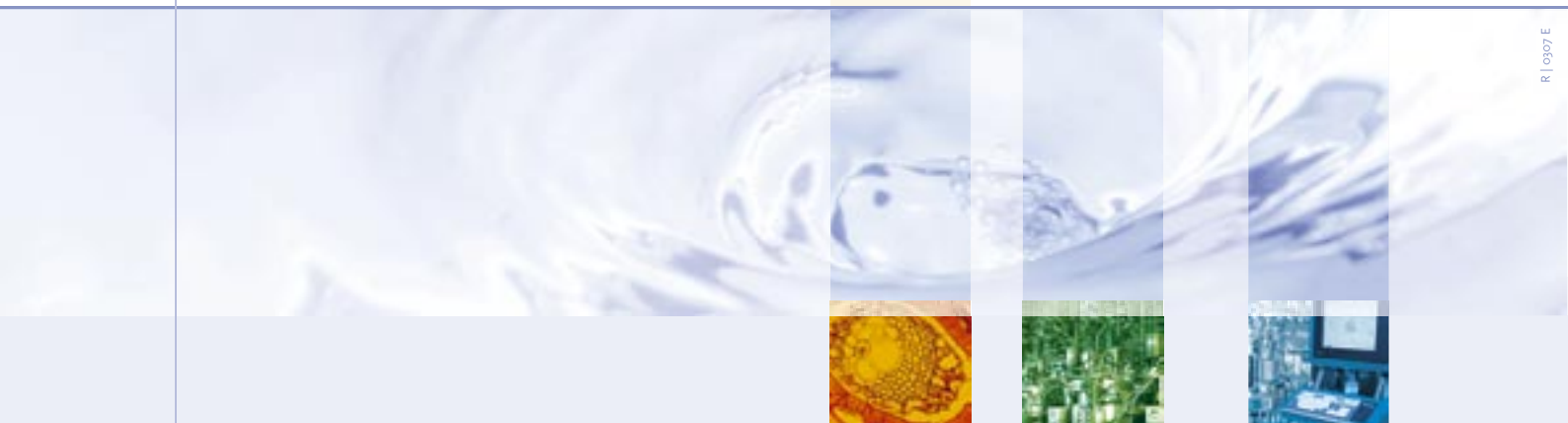
CH-8640 Rapperswil, Alte Jonastrasse 83

Phone: +41 / 55 / 450 60 00

Fax: +41 / 55 / 460 13 33

e-mail: office@zeta.com

www.zeta.com



R | 0307 E

zeta's core competences are engineering, production, automation and installation of turn-key production plants, media systems and high-tech process equipment.

We supply products and services to customers in the biotech and pharmaceutical sector and in the food and cosmetics industry around the world.

EVOLUTION OF TECHNOLOGY