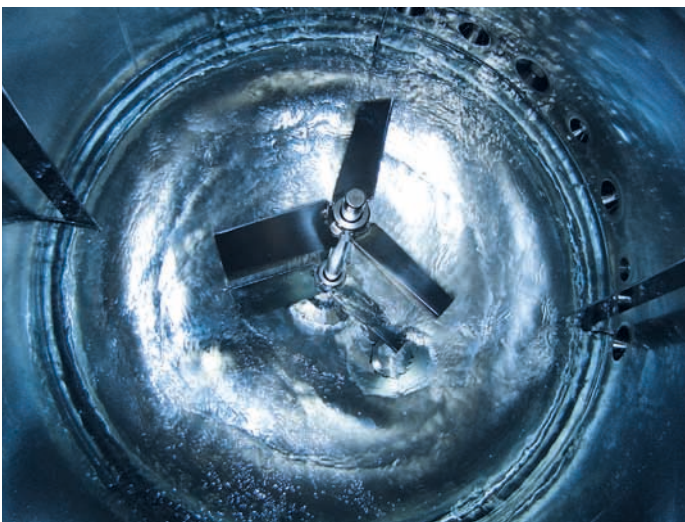


ZETA Magnetic Agitators

For sterile liquid processing

ZETA Agitators – A Versatile Product Family

For every application that places high demands on sterility and reliability, there is a ZETA agitator:

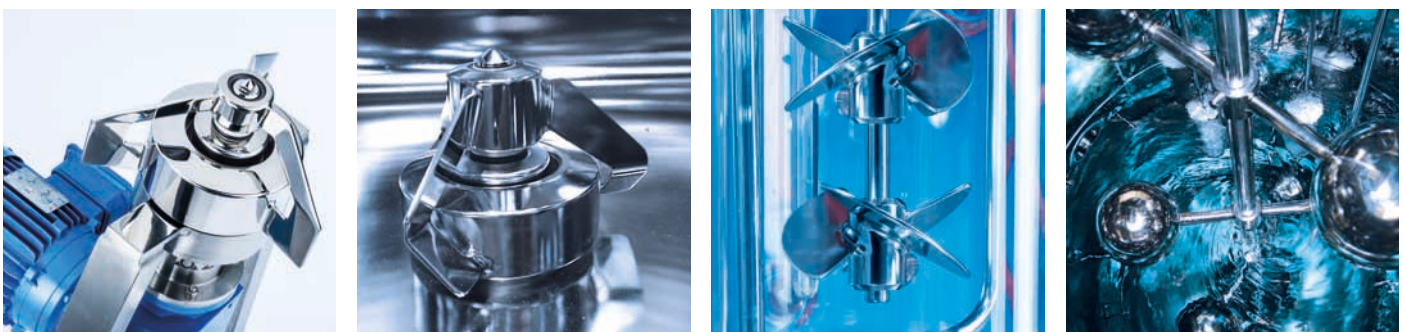


- Bioreactors for bacteria and cell culture
- Process tanks upstream and downstream of fermentation systems
- Processes with carrier suspensions
- Vaccine production
- Solutions for injection and infusion
- Fractionation of blood plasma
- Manufacturing of active ingredients
- Fine chemicals
- Food and drink, including
 - dairy
 - brewing
 - fruit juice
- Special applications, for example
 - high-pressure reactors
 - cooling media

An overview of our product range:

Product group	Product type	Series	Applications	Torque range
Bottom-mounted magnetic agitators	Standard: with levitated impeller	BMRT	Hygienic and sterile process tanks in pharmaceutical and food/beverage production, up to approx. 50,000 litres	50–21,000 Ncm
	Option: classic impeller design	BMR		
	Bioreactor agitators	BMR F	In bioreactors for bacteria and cell cultures; application-specific multiple-impeller design	50–17,000 Ncm
Top-mounted magnetic agitators	Externally mounted magnetic coupling	AMRe	In bioreactors for cell cultures; application-specific multiple-impeller design	300–2500 Ncm
	Internally mounted magnetic coupling	AMRi	Smaller bioreactors and process tanks; application-specific multiple-impeller design	30–550 Ncm

Besides these models, we also offer agitators with mechanical seals.



ZETA Magnetic Agitators – Fully Sealed, Reliable and Perfectly Cleanable

ZETA magnetic agitators are the product of many years of experience with sterile design and process engineering.



Top-mounted magnetic agitator



Bottom-mounted magnetic agitator

Our magnetic agitators have the advantage that the containment shell completely separates the interior of the tank from the outside. In contrast to conventional agitators, there is no shaft penetrating the tank and therefore no mechanical seal with the risk of leaks and contamination and the need for special maintenance. A special feature of our magnetic agitators is their excellent cleanability, which is essential for sterile processes. Independent tests, e.g. EHEDG, confirm that these agitators can be qualified for such applications.

Wide product range:

We offer a variety of types of bottom-mounted and top-mounted magnetic agitators. Bottom-mounted magnetic agitators are the state of the art for low-viscosity liquids in pharmaceutical and biotechnology production. Important advantages are the compact design, low maintenance and high reliability. Using a bottom-mounted agitator also frees up space on the tank lid for sensors, valves and sight glasses.

Customization:

As well as our standard range of agitators, we also make one-off designs to order. Characteristics that we can vary include the dimensions of the impeller, rotation speed or the type of impeller. With monitoring of the liquid level and rotation speed, and using a type-approved motor, the agitators can be used for vessels in ATEX zones 0 or 1 according to the directive 94/9/EC.



Optional: Drive unit in stainless steel casing



BMRT and BMR Bottom-Mounted Magnetic Agitators: Proven Technology – Open Impeller Design

The BMRT and BMR series of agitators cover a wide spectrum of applications. The following standard models are available:

Type	Impeller ø mm	rated power kW	Max. speed rpm	Radial gap betw. containment shell and rotor mm	Mixed volume (depends on application) litres
BMR 30 DC BMRT 35	80 80	0.065 0.065	700 700	2.0 2.0	2 to 100 2 to 100
BMR 30 M BMRT 50	80 80	0.09 0.09	900 1000	2.0 2.0	2 to 120 5 to 140
BMR 75 BMRT 80 M	105 105	0.18 0.18	850 950	3.3 3.3	50 to 250 50 to 350
BMR 100 BMRT 125	125 130	0.18 0.18	525 550	3.3 3.3	100 to 400 100 to 500
BMR 300 BMRT 400	150 165	0.25 0.37	575 520	3.5 3.5	200 to 800 200 to 1200
BMR 550 BMRT 800	175 190	0.37 0.55	530 520	4.5 4.5	500 to 1700 700 to 2500
BMR 550 M	110	0.75	1150	4.5	800 to 3000
BMR 850	210	0.55	440	7.0	800 to 3000
BMR 1200 BMRT 1300	250 250	0.75 0.75	325 350	7.0 7.0	1000 to 4000 1000 to 4500
BMR 2500 BMRT 2600	300 300	1.10 1.50	300 315	7.0 7.0	2000 to 8000 2000 to 8000
BMR 2500 M	165	2.20	900	7.0	3000 to 10000
BMR 4000 BMRT 5000	350 350	1.50 2.20	250 290	7.0 7.0	3500 to 12000 3500 to 15000
BMR 7500 BMRT 10000	400 400	2.20 4.00	250 290	7.0 7.0	6000 to 22000 6000 to 25000
BMR 13000 BMRT 17000	450 450	4.00 5.50	240 270	7.0 7.0	10000 to 33000 10000 to 40000
BMR 20000 BMRT 21000	500 500	7.50 7.50	230 250	7.0 7.0	15000 to 50000 15000 to 55000

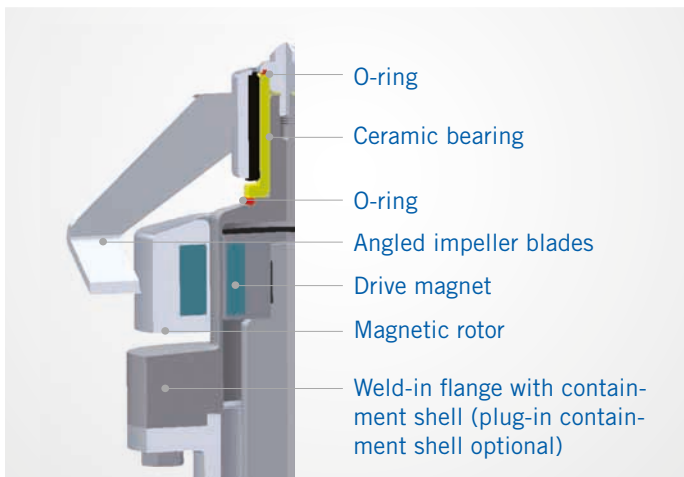
BMR: classic impeller design

BMRT: with levitated magnetic impeller for improved run-dry performance

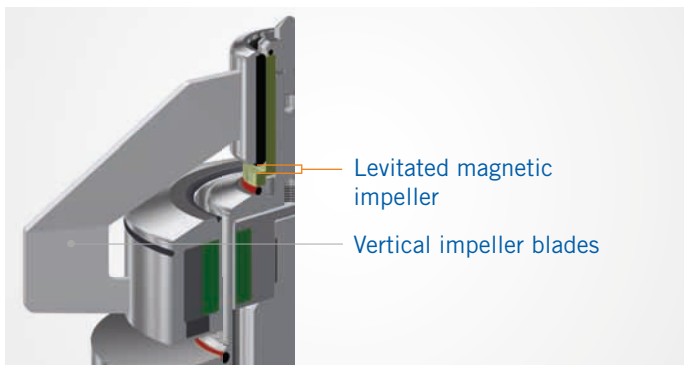
M: direct drive, without gearbox

DC: DC motor

ZETA Magnetic Impellers



The classic BMR impeller



The new BMRT impeller



BMRT impeller

Important advantages of the ZETA BMRT- and BMR-series magnetic impellers:

- Open design with excellent cleaning: Hub and magnetic rotor are connected only by the impeller blades.
- A very large gap between the rotor and the containment shell (see table on page 5) maximizes flow through the gap and minimizes shear stress.
- Slanted rotor surfaces are designed to drip clean with no residues.
- The ceramic bearings are oversized (in diameter and height), product-lubricated and use a silicon carbide/zirconium oxide interface. This results in exceptional stability, good emergency running properties, and particle generation below detectable levels.
- Ease of maintenance – ceramic bearing parts can be replaced by users on site; no spare rotor needed.
- CFD-engineered mixing: fluid is drawn from above and pumped outwards. Perfect for mixing solid powders into liquids; rapid breakdown of temperature and concentration gradients, ensures good heating and cooling.

Series-specific advantages:

BMRT series:

- The BMRT model agitator features an innovative levitated magnetic impeller. New stronger magnets are used to lift the impeller off the bearing. This greatly improves the agitator's run-dry performance. The vessel can be completely emptied of liquid with the agitator running – mixing right down to the last drop.
- The BMRT impeller also has vertical blades which allow shorter mixing times to be achieved with the same energy input.

BMR series:

- A special advantage of our classic magnetic impeller BMR is the floating bearing. The kinked shape of the impeller blades causes the impeller to levitate when running in liquid. The head then oscillates on the bearing, which is lubricated by product. The advantages: less load on the axial bearing; product flow through the bearing is improved, which improves lubrication – and cleaning – of the bearing gap.

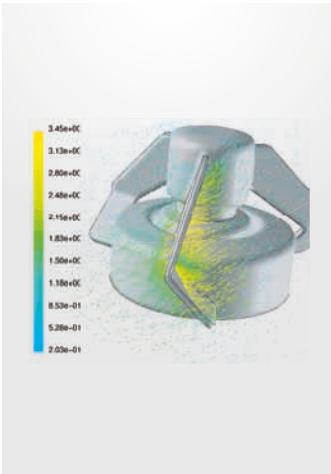
BMR F: Bottom-Mounted Magnetic Agitators for Bioreactors



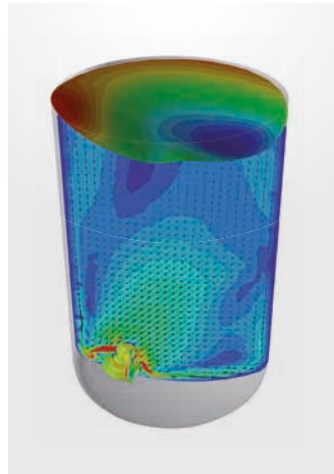
Segment impellers for cell cultures



Rushton turbines for microbiological fermentation



CFD of magnetic impeller



State of the art for bioreactors:

Bottom-mounted magnetic agitators in bioreactors enable the process to be run safely for longer periods than with shaft-driven stirrers. They avoid the contamination risks associated with the mechanical seals where the drive shaft penetrates the tank, and the elaborate systems needed to keep these seals clean, such as flushing with sterile steam condensate, are not needed.

The number and type of impeller blades are designed to suit the specific application. Generally, the impeller rotors are made as push-on elements on the shaft in a sealed sterile design. The generously dimensioned product-lubricated bearings of the BMR F agitators allow the use of long impeller shafts without a top bearing. These bioreactor agitators can be used at a wide range of scales, from lab scale through microbiological fermenters of several hundred litres up to cell-culture tanks of several thousand litres.

CFD simulations:

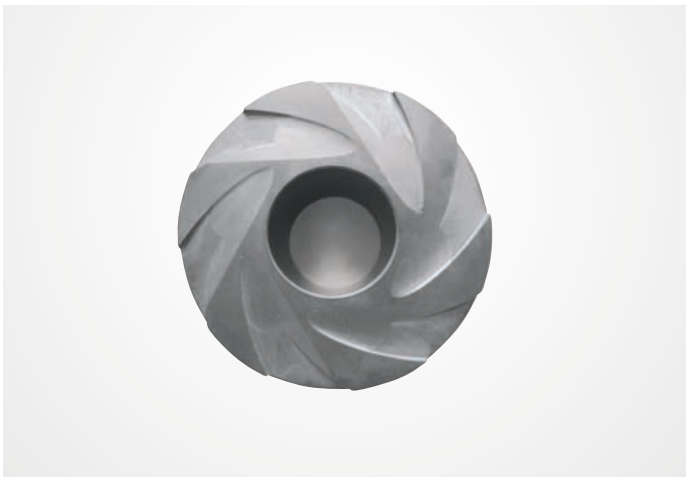
To support our clients in designing critical mixing processes and scale-up, we offer preliminary simulations using computational fluid dynamics (CFD).

These simulations include the following steps:

- Processing of 3D-CAD geometry data
- Mesh generation and parameterization in the numerical solver FIRE
- Simulation of operating conditions of the mixing vessel
- Data analysis (Mixing quality, power curves, images and if relevant films of flow and temperature fields)

If needed, we are also able to perform mixing tests or to provide tanks and agitators on a rental basis.

Bottom-Mounted Magnetic Agitators: Details and Options



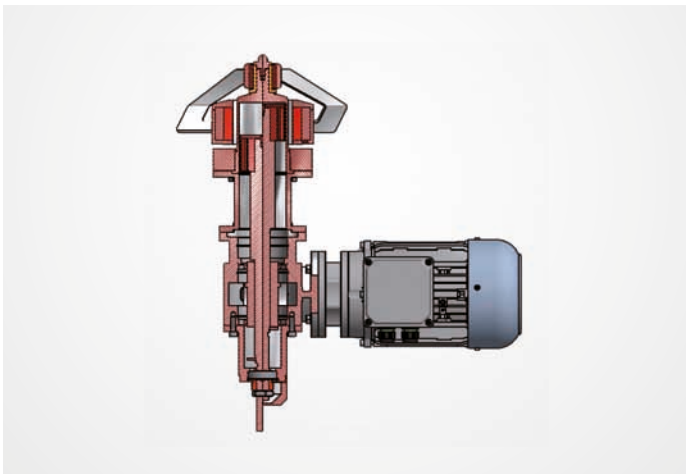
Example of a rotating ZETA bearing bush made of SiC

ZETA self-lubricating bearing:

With some types of impeller it is not possible to use either a magnetic or a hydrodynamic levitating effect – for example with the bioreactor impellers or designs where the impeller blades are attached above the hub (dissolver discs, marine propellers). For these applications we have a special bearing bush that ensures good lubrication.

Advantages:

The axial surface of the bearing bush has specially-shaped channels that draw product liquid into the bearing when the rotor is turning. This creates a film of liquid between the static and rotating parts of the bearing, so that very little direct contact between the parts occurs. The liquid flow through the bearing also improves its cleanability.



Lowering device

Lowering device:

Agitators of the size 2500 (25 Nm) and upwards are supplied with a special lowering device that withdraws the drive magnet out of the containment shell.

This has the following benefits:

- With the drive magnet lowered, the agitator head can be removed and positioned in a safe and controlled procedure without being subject to the magnetic field. The drive unit remains in place.
- Avoidance of damage to the ceramic bearings
- Worker safety: The device protects against the crushing hazard involved in placing the agitator head on the bearing, and thus meets the demand of the EC Machinery Directive for designed protection against injury.



Impeller speed monitoring:

Sometimes a problem inside the tank or an operating error can lead to forces on the agitator head that exceed the maximum transmissible torque, so that the magnetic coupling breaks down. In this situation the agitator head stops turning although the drive is still running. To control this issue, we offer an optional contact-free rpm sensor for the agitator head.

For safety reasons, the rpm sensor is included as standard in agitators for use in ATEX zones (ATEX zone 0, Directive 94/9/EC).



Plug-in (PI) containment shell:

The plug-in containment shell is a bolt-on detachable unit which is available as an alternative to the usual weld-in flange. It can be chosen to facilitate maintenance, and if necessary, the flange diameter can be made big enough to remove the agitator head through the port. The plug-in containment shell can also be used to replace a shaft-driven agitator with a magnetic one.

TriClamp drive connector:

Attaching the drive with a TriClamp fitting enables it to be removed quickly, for example when using the agitator with an autoclavable tank.

Plug-in containment shell

TriClamp drive connector



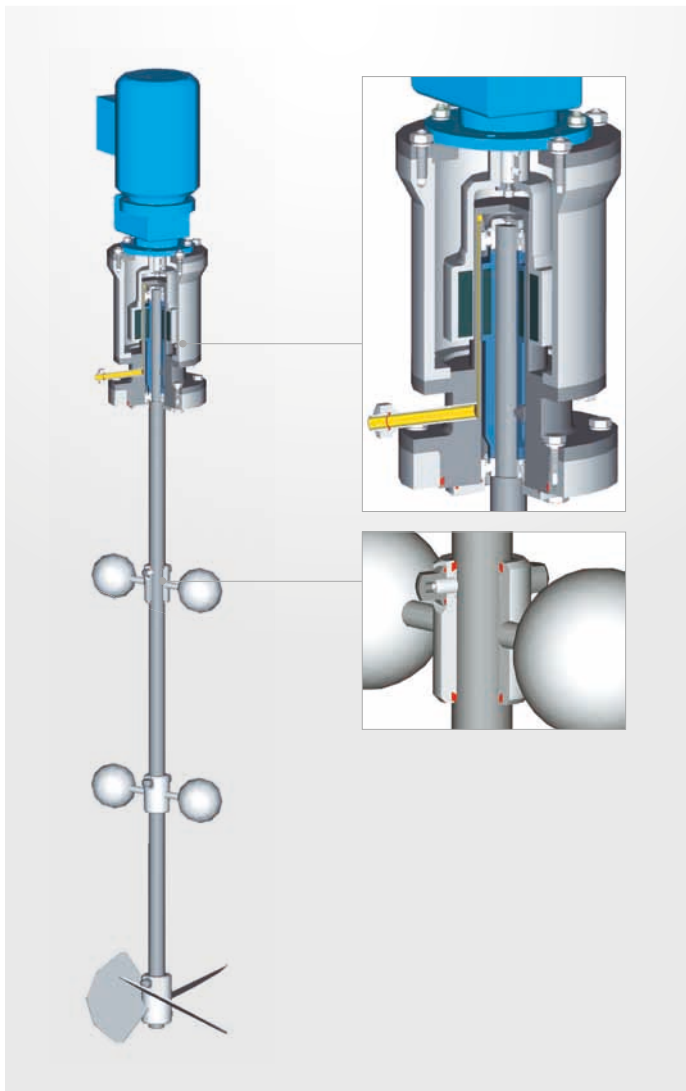
Extractor tool:

An optional tool for the plug-in containment shell. The tool allows the containment shell to be separated from the tank easily and smoothly.

Extractor tool

ZETA Top-Mounted Magnetic Agitators

ZETA AMR series magnetic agitators are designed for applications that require a top-mounted magnetic agitator.



AMRe: Magnetic coupling outside the tank

The hermetic sealing of the tank that can be achieved with a magnetic agitator is essential for long and demanding sterile processes.

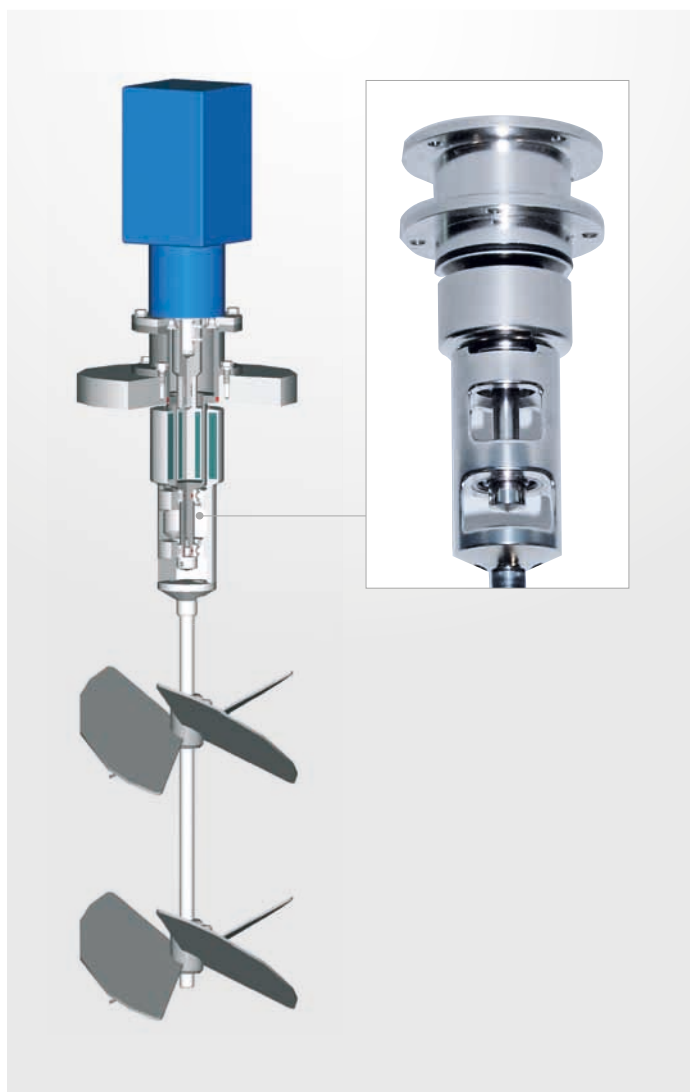
With the AMRe series of top-mounted agitators, ZETA has taken magnetic agitator design a step further, especially to improve sterile performance. Important benefits are:

- **Sterilization:** Reliable sterilization is ensured by means of a lateral pipe that provides a vent from the highest point inside the containment shell.
- **Cleanability:** The vent pipe can also be used for cleaning the containment shell (CIP) and the ceramic agitator bearings, which can be run dry.

Standard sizes: transmissible torques from 3–25 Nm, application-specific impeller designs.



AMR magnetic agitators avoid the problems of shaft-driven agitators with mechanical seals and can be used with almost any type of impeller. The impellers can be welded to the shaft or attached using a sterile push-on design.



AMRi:
Magnetic coupling inside the tank, for low and medium power range

The AMRi series agitators operate with transmissible torques from 0.3–5.5 Nm. Since their magnetic coupling is located inside the tank, they can be cleaned in place in the tank – in contrast to conventional laboratory agitators.

These agitators are mounted on the tank lid and can be supplied with a dead-leg-free flange, a TriClamp or bayonet fitting according to the client's preferences. Impellers are also available in a variety of designs, including segment impellers ('elephant ears') for cell cultures, Rushton turbines or pitched-blade impellers.

Drives: For the smaller sizes, DC electric motors with integrated speed control are used; the other models are equipped with AC motors for frequency control or with integrated frequency converters. Quick-change couplings are available optionally.





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

ZETA Holding GmbH

A-8501 Lieboch/Graz, Zetaplatz 1
 Phone +43 3136 / 90 10 - 0
 Fax +43 3136 / 90 10 - 9100
 eMail office@zeta.com

ZETA Biopharma GmbH

A-8501 Lieboch/Graz, Zetaplatz 1
 Phone +43 3136 / 90 10 - 0
 Fax +43 3136 / 90 10 - 9100
 eMail office@zeta.com

A-1150 Vienna, Graumanngasse 7/B4-2
 Phone +43 1 / 908 10 00

ZETA Automation GmbH

D-85354 Freising, Münchner Straße 8
 Phone +49 8161 / 99 21 - 0
 Fax +49 8161 / 99 21 - 44
 eMail info.automation@zeta.com

ZETA Alro AG

CH-5102 Rapperswil, Suhrhardweg 6
 Phone +41 56 / 624 30 00
 Fax +41 56 / 566 52 59
 eMail office-schweiz@zeta.com

ZETA Biopharma s.r.o.

CZ-664 48 Moravany, Modřická 66
 Phone +420 546 / 211 035
 eMail office@zeta.com

ZETA OOO

RU-129626 Moscow
 Prospekt Mira, 104, Bld. 2
 Phone +7 495 / 721 39 41
 eMail russia@zeta.com