

Competence in magnetic couplings



An innovative seal concept wins out: hermetically sealed magnetic couplings successfully in use.

Roth Pumps, USA

MAK66 in centrifugal pumps for the chemical industry.

Leistritz, Germany

MAK66 seal screw pumps for crude oil tank farms.

Sanofi Aventis, Italy

High pressure top entry agitator fitted with magnetic coupling.


Russia

Autoclave in refilling facility for radioactive material, sealed with a highly efficient magnetic coupling as a safety seal.

Fraunhofer-Institut, Germany

Drive for high pressure CO2 washing plant at 300 bar (4,350 PSI) sealed securely with magnetic coupling.





MIRO refinery, Germany

HE couplings from NMB seal centrifugal pump shafts.

BASF, Brazil

Magnetic couplings in centrifugal pumps successfully in use in refineries.

Drilling rig, Dutch coast

Vertical inline pump for heat exchanger circuit successfully retrofitted from mechanical seal to magnetic coupling.

Inland oil tanker, Netherlands

Bulkhead shaft feedthrough for unloading pump sealed with magnetic coupling (6,000 Nm).

The specialist for magnetic couplings

EagleBurgmann is one of the leading international providers of magnetic couplings for pumps and agitators. With more than two and a half decades worth of magnetic coupling experience, committed employees as well as a profound knowledge of the machines and the processes in which these systems operate, we are in the position to professionally advise our customers to design the optimal sealing solution.

Reliability and maximum cost-effectiveness

Magnetic couplings are used for demanding seal applications with pumps and agitators. If hermetic sealing is a must and high requirements are made in addition regarding reliability, availability, and safety, then EagleBurgmann magnetic couplings are applied.

Our product range has a modular structure and ranges from standard couplings to customized individual solutions in the high-performance sector. We also supply high-precision ceramic sliding bearings. New challenges to magnetic couplings can be solved with an extensive package containing magnetic and product-specific calculations.

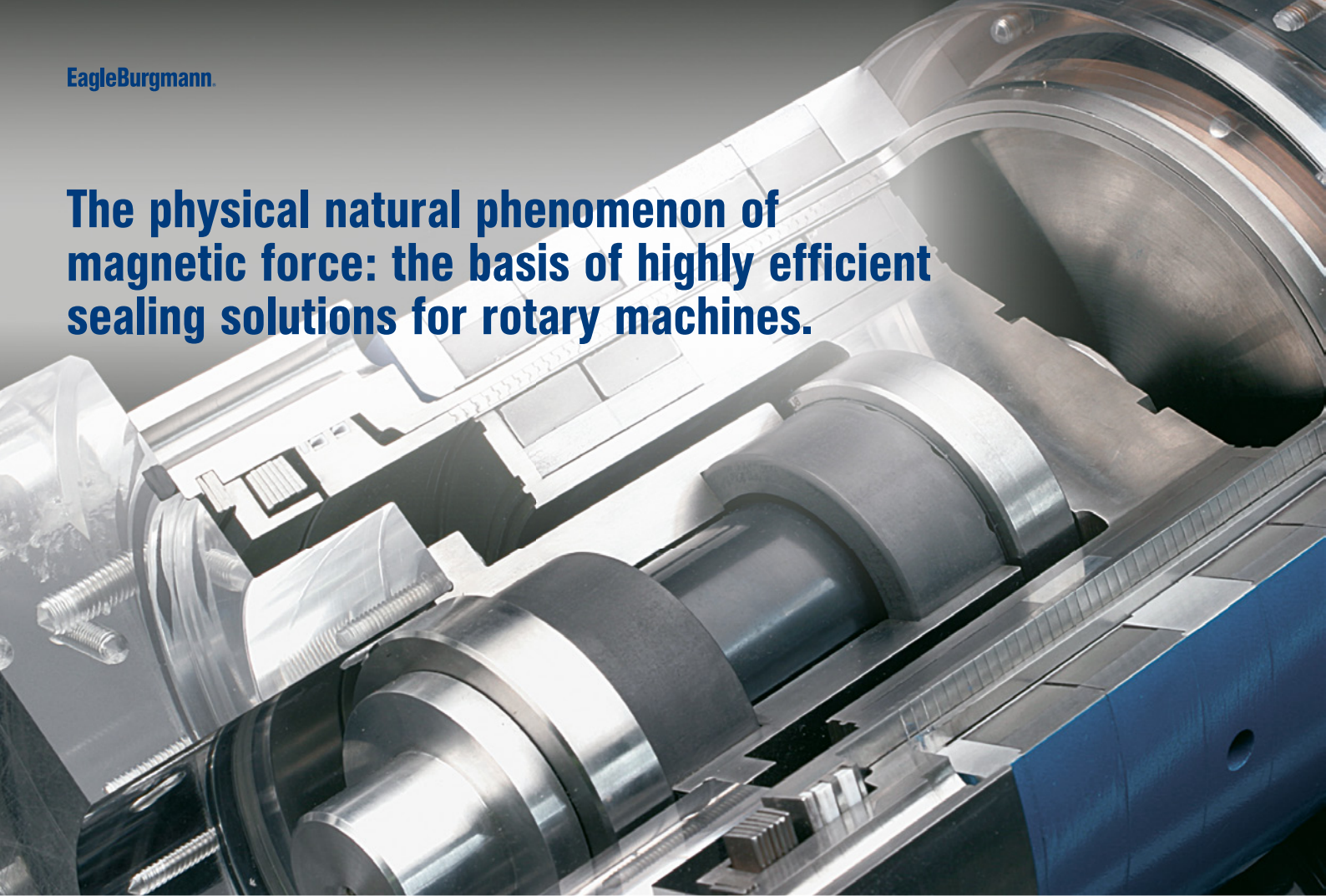
A long service life of over 10 years, when operated properly, is possible due to the best quality in design and production. This is verified by numerous references from the past 25 years.

The greatest requirements towards economical operation are satisfied through the use of highly efficient cans made of innovative materials. You can rely on our service as well: Among other things, our current portfolio offers spare parts from stock for all generations of EagleBurgmann magnetic couplings.

Full service partner with a global presence

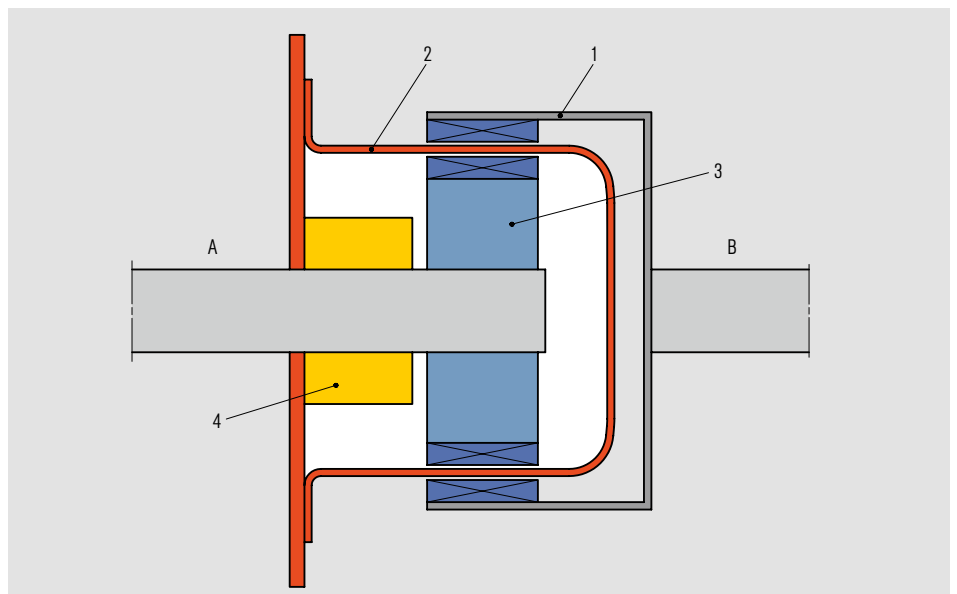
Research and development, advice, engineering, design, production, and a broad range of available modular services are skills that our customers use to their benefit. We operate two magnetic coupling centers in Halifax, Canada and in Wolfratshausen, Germany, to accomplish that. Our comprehensive network of sales and service centers means that we are always close to you, wherever you are in the world.

The physical natural phenomenon of magnetic force: the basis of highly efficient sealing solutions for rotary machines.



Basic principle of magnetic couplings

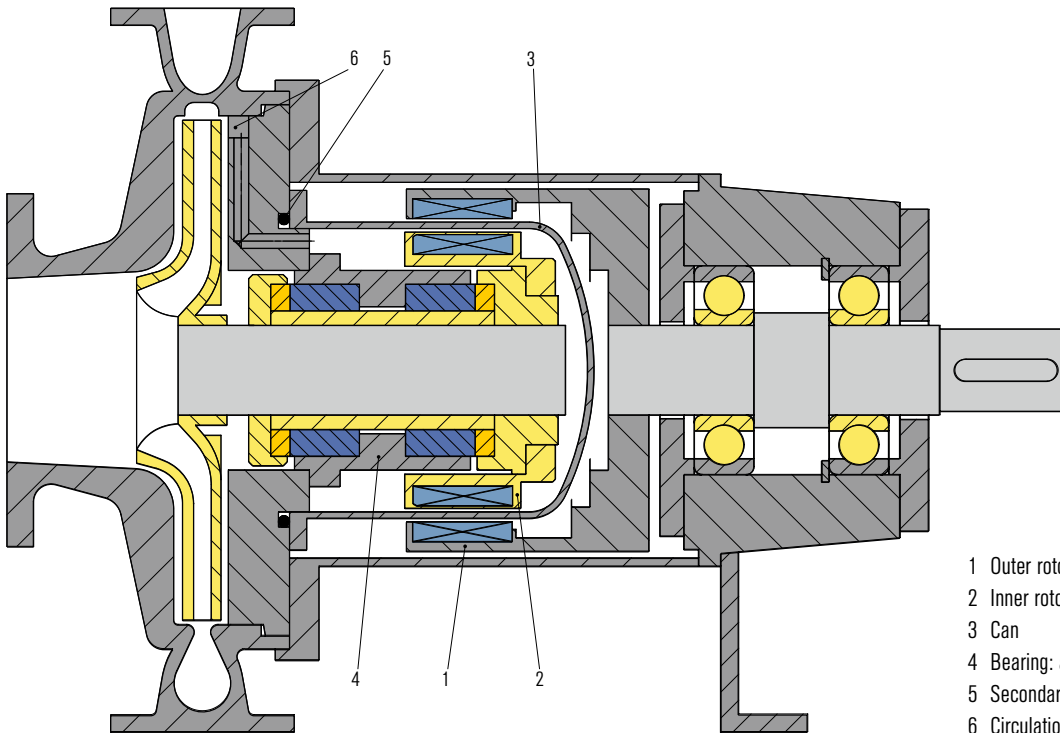
The magnetically fitted outer rotor of the magnetic coupling is driven by a motor. The magnetic fields penetrate the static, non-magnetizable can and cause the magnets to engage positively at the inner rotor, making them turn along synchronously. Radial and axial forces are absorbed by the sliding bearing.



MAK basic principle

A Output
B Input

- 1 Outer rotor with magnets
- 2 Can (static)
- 3 Inner rotor with magnets
- 4 Shaft bearing



- 1 Outer rotor with magnets
- 2 Inner rotor with magnets
- 3 Can
- 4 Bearing: axial, radial
- 5 Secondary seal: O-ring, gasket
- 6 Circulation entry

The magnetic coupling as a shaft seal for centrifugal pumps

Magnetic couplings are most commonly applied in centrifugal pumps. As a rule, they are used together with a product-lubricated sliding bearing. The non magnetizable can is bolted at the pump housing and statically sealed by O-rings or gaskets. The bearing absorbs the radial and axial forces of the impeller. The outer rotor is supported by the motor bearing or an additional roller bearing. Operation requires product circulation which ensures lubrication and heat dissipation. Clean pumped media only requires an internal circulation from the pressurized area of the pump to the can chamber.

Latest generation of high-performance magnets

The availability of permanent magnets with extreme energy density enabled the development of compact magnetic couplings for high torques in small installation spaces. This allows us to build magnetic couplings for the standardized dimensions of standard chemical pumps as well as for larger process pumps.

In addition to maximum energy density, the latest generation of rare earth magnets today specifically offer good temperature stability and improved corrosion resistance. The magnets of the inner rotor are hermetically encapsulated and therefore not in contact with the product.

EagleBurgmann magnetic couplings use high quality neodymium ferrum boron (NdFeB) or samarium cobalt (SmCo) magnets according to the temperature operating limit.

Technical benefits of magnetic couplings

Compared to other dynamic seal systems, magnet couplings have decisive advantages: The housing of the machine delivering fluid or gas is not penetrated by a rotating drive shaft. Wear to the sealing surfaces will not occur. Power transmitted from the motor to the shaft is non-contacting. The magnetic coupling is hermetically sealed; supply systems are not required. Maintenance is not required when operation is contact free, and the operation of the magnetic couplings is economical and energy efficient thanks to the highly efficient can materials.

The right product for every application: EagleBurgmann magnetic couplings and bearings.

From small laboratory stirrers and water pumps to multistage unloading pumps on oil tankers and on to high pressure reactors: EagleBurgmann offers the right magnetic coupling for virtually all cases.

Next to the standard products introduced here, we also supply special versions tailored to the application case, e.g., for use in high and low temperatures, with heating or cooling chamber, in versions that can be sterilized or in accordance with the API 685 standard. We also offer optional sensor devices for monitoring the temperature and rotational speed.



MAK66

Standard series, originally developed for the installation spaces of standard chemical pumps, used in many application cases. The modular system and material variations enable adaptation to even difficult operating conditions.

Advantages

- Magnetic coupling for standard applications – high availability
- Compact design
- Modular system
- With product lubricated sliding bearings – heatable as option
- Hastelloy® can for efficient operation
- Non metallic can as an option

Operating range

Pressure: $p = 25 \text{ bar}$ (363 PSI)
 Temperature: $t = 250 \text{ °C}$ (482 °F) (SmCo), 120 °C (248 °F) (NdFeB)
 Rotational speed: $n = 3,600 \text{ min}^{-1}$
 Chemical resistance: pH 0 ... 14
 Viscosity: 0.3 ... 5,000 mPa·s (SiC)
 Torque: max. 462 Nm
 Solids: max. 0.1 mm; max. 5% weight component;
 Max. grain hardness: 700 HV



MAK685

Series for applications in accordance with API 685. Based on the MAK66, adapted to the higher requirements regarding pressure, medium circulation, balance quality, and design safety.

Advantages

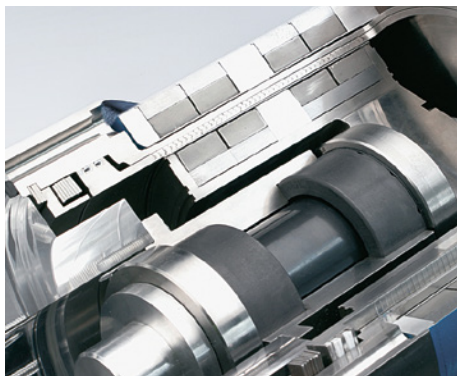
- Magnetic coupling for API 685-compliant applications (similar to API 610)
- With product lubricated sliding bearing
- Encapsulated outer rotor
- Hastelloy® can for efficient operation
- Fiber reinforced PEEK can without eddy currents (optional)

Operating range

Pressure: $p = 40 \text{ bar}$ (580 PSI)
 Temperature: $t = 250 \text{ °C}$ (482 °F) (SmCo), 120 °C (248 °F) (NdFeB)
 Rotational speed: $n = 3,600 \text{ min}^{-1}$
 Chemical resistance: pH 0 ... 14
 Viscosity: 0.3 ... 5,000 mPa·s (SiC)
 Torque: 417 Nm
 Solids: max. 0.1 mm; max. 5% weight component;
 Max. grain hardness: 700 HV

Detailed product
information:





NMB High Efficiency

The HE series combine many requirements in one product: highest efficiency at high pressure and broadest range of use. The minor eddy current losses enable large machines, even in dry running situations, to be sealed with one magnetic coupling – gases as well.

Advantages

- Magnetic coupling for API 685-compliant applications
- (similar to API 610)
- High performance can in segmented construction for minimal eddy current losses (approx. 2% of the drive capacity)
- Optional sliding bearing
- Broad range of transmittable torques

Operating range

Pressure: $p = 45$ bar (653 PSI)
 Temperature: $t = 250$ °C (482 °F) (SmCo), 120 °C (248 °F) (NdFeB)
 Torque: 18 ... 2726 Nm



SMAK

The series for sterile agitator drives. Hygienically designed construction without dead spaces, with polished surfaces. The sterile sector is the ideal field of use for magnetic couplings because contaminations are eliminated from entering through the drive.

Advantages

- Hygienic design for CIP and SIP
- Polished surfaces
- Included sliding bearing for bottom entry
- Ceramic roller bearing with cleaning channels for top entry
- Optional rotational speed monitoring
- Welded or screw flange available

Operating range

Temperature: $t = 150$ °C (302 °F) (SmCo)
 Rotational speed: $n = \dots$ 1,000 min⁻¹
 Chemical resistance: pH 0 ... 14
 Viscosity: 0.3 ... 5,000 mPa·s (SiC)
 Torque: max. 270 Nm (bottom entry), 330 Nm (top entry)
 Solids: max. 0.1 mm; max. 5% weight component;
 Max. grain hardness: 700 HV



LMF1

High-efficiency bearings for magnetic coupled centrifugal or displacement pumps with ceramic or carbon bearing materials.

Advantages

- Sliding bearing for supporting the shaft end of a magnetic coupled pump
- Lubrication through the pump medium
- Radial grooves in the bearing bushes for improved medium circulation
- Suitable for MAK66, MAK685 and NMB HE magnetic couplings
- Bearing for increased usage conditions can be supplied (LMF10)

Operating range

Viscosity: 0.3 ... 5,000 mPa·s (SiC)
 Rotational speed: $n = 3,600$ min⁻¹
 Solids: max. 0.1 mm; max. 5% weight component;
 Max. grain hardness: 700 HV

Innovative and user-oriented: maximum efficiency through optimal technical solutions.



Focus on energy efficiency: optimal results thanks to high tech solutions

The movement of the magnetic field around a metallic can cause eddy current losses. It increases with magnetic field strength, wall thickness, velocity, and electrical conductivity of the material. The optimal geometry of the magnetic coupling and the choice of can material can significantly reduce these losses. For fixed geometry, a can material with the least possible electrical conductivity is the material of choice.

A centrifugal pump with magnetic coupling (8,000 h/a operating period, 38 kW shaft output, $n = 3.000 \text{ min}^{-1}$) when using a ceramic or CFPEEK can instead of a Hastelloy®C4 can can save up to €4,500 a year. The energy savings corresponds to 23 tons of CO₂.

Can materials with the least electrical conductivity for minimum eddy current losses

Ceramic can

- Reduces eddy current losses up to 100%
- Massive ceramic can (ZrO₂) with metal flange
- Good resistance against many aggressive media
- High temperatures possible (320 °C / 608 °F)
- Operating pressure: 16 bar (232 PSI)

CF-PEEK can

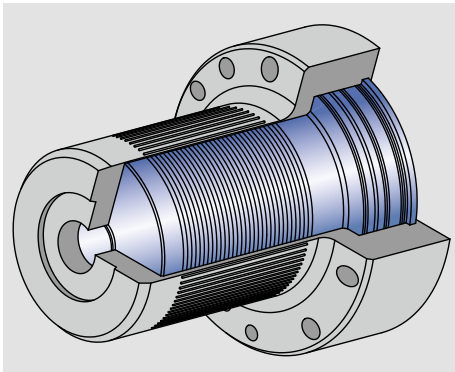
- Reduces eddy current losses up to 100%
- Carbon fiber reinforced PEEK
- Resistant to numerous media
- Complies with API 685 (42 bar / 609 PSI maximum pressure)
- Temperature operating limit 120 °C (248 °F)



NMB high efficiency can: greatest efficiency, flexible construction.

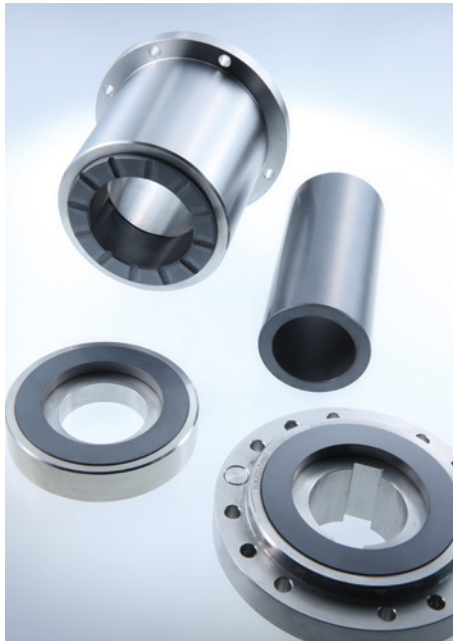
The can of the high-efficiency coupling has a multi-part structure. The inner laminated can consists of separately insulated rings, the outer can exhibits slits in the axial direction. The breaks between the conducting metal parts make it harder for the eddy currents to expand, and eddy current losses are reduced to a minimum.

This means it can be used in demanding applications (up to 2,700 Nm and 45 bar (653 PSI) at 3,000 min⁻¹, 280 °C (536 °F) with standard design), since frequently only metallic materials can be used there due to the system pressure but where the losses were too great for the solid version.



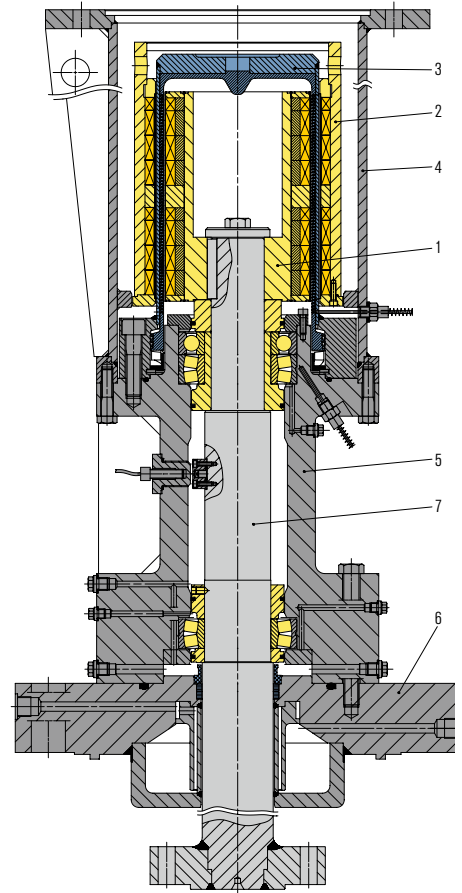
Center of the magnetic coupling: a high-precision bearing.

Sliding bearings are used to support the pump impeller shaft of centrifugal or displacement pumps in conjunction with a magnetic coupling. The sliding surfaces usually consist of ceramic materials. The medium to be delivered circulates between the sliding surfaces and ensures lubrication and cooling. EagleBurgmann has taken its experience and competence in mechanical seal design and construction and incorporated it in the development and production of high quality and stress-specific sliding bearings. EagleBurgmann LMF sliding bearings have been successfully in use all over the world for many years. When the operating conditions are observed, they run nearly free of wear and therefore have an extremely long service life.



All included in the delivered package: From engineering to series production.

Next to the magnetic coupling and the associated bearings, some conditions of use for safe operation require a tailored solution with a greater scope of delivery. If, e.g., a large agitator drive needs to be sealed at high temperature and pressure and if, at the same time, no lubricant may leak from the bearing into the container, then we will supply an individually designed, ready-to-install unit (motor flange to connection agitator element) with a low eddy current magnetic coupling, shaft bearing, housing parts, cooling and lubricant circuits, and sensors for monitoring.

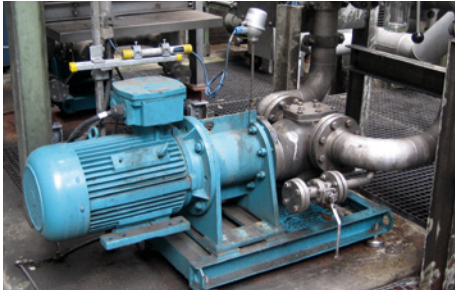


MAK unit

- | | |
|-----------------------|------------------|
| 1 Inner rotor | 5 Casing |
| 2 Outer rotor | 6 Cooling flange |
| 3 Can | 7 Shaft |
| 4 Motor/mount gearbox | |

Example of a customer-specific version of a magnetic coupling for the agitator drive of a hydrogenating reactor. Conditions of use: Pressure $p = 50$ bar (725 PSI), temperature $t = -25$ °C ... $+200$ °C (-13 °F ... $+392$ °F), rotational speed $n = 480$... 740 min⁻¹, output $P = 30$ kW. The coupling is fitted with a pressure-bearing housing with shaft bearing and lubricating channels, a cooling flange as well as temperature and rotational speed monitoring.

Exemplary uses: successful for our customers worldwide.



At Bayer in Leverkusen, Germany, Leistritz type L2NG 70/96 IFHGIOMAK pumps are used to deliver polyether. They are sealed by EagleBurgmann type **MAK66-135-8-00** magnetic couplings. Operating conditions: $p = 6 \text{ bar (87 PSI)}$; $n = 1,500 \text{ min}^{-1}$ viscosity of the medium: $3,500 \text{ mPa}\cdot\text{s}$.



The heat circulation of the St. Radboud university clinic in Nijmegen, Netherlands, uses an EagleBurgmann **NML-22P-5R-52-SC2** magnetic coupling in an SPX Johnson pump (CM150-400 R6 L3). It delivers hot water up to $379 \text{ m}^3/\text{h}$. Operating conditions: Drive power 90 kW ; $n = 1,480 \text{ min}^{-1}$; $t = 160 \text{ }^\circ\text{C (320 }^\circ\text{F)}$; $p = 52 \text{ bar (754 PSI)}$.



Expro Subsea Well Intervention Gear Box, reliably sealed with a high-performance **NMB-10P** coupling. Operating conditions: External pressure $p = 482 \text{ bar (6.989 PSI)}$; $t = 0 \text{ }^\circ\text{C} \dots +120 \text{ }^\circ\text{C (32 }^\circ\text{F} \dots +248 \text{ }^\circ\text{F)}$; $n = 0 \dots 3,000 \text{ min}^{-1}$; torque: 400 Nm . Medium: Gear oil.



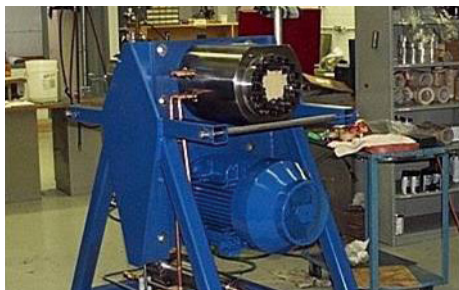
Equipment for manufacturing polyurethane (Krauss-Maffei) **MAK66** for sealing the metering pumps for isocyanate and polyol.



A Roth pump, sealed with the **MAK66** magnetic coupling, in use at a manufacturer of soap and cleaning agents in the U.S. Operating conditions: $p = 22 \text{ bar (319 PSI)}$; $t = 50 \text{ }^\circ\text{C (122 }^\circ\text{F)}$; $n = 3,500 \text{ min}^{-1}$.



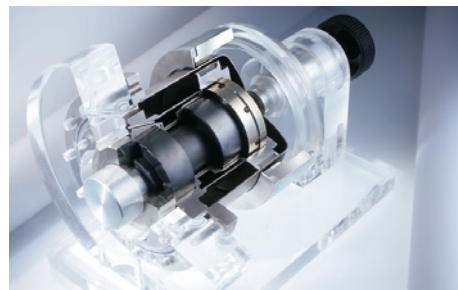
NMB-10P-2R is the standard EagleBurgmann RoTechBooster seal that is used for the reliable continuous supply of dry purging gas for compressor seals (DGS). Operating conditions: $p = \text{vacuum} \dots 120 \text{ bar (1.740 PSI)}$; $t = 200 \text{ }^\circ\text{C (392 }^\circ\text{F)}$; $n = 1,200 \dots 4,200 \text{ min}^{-1}$.



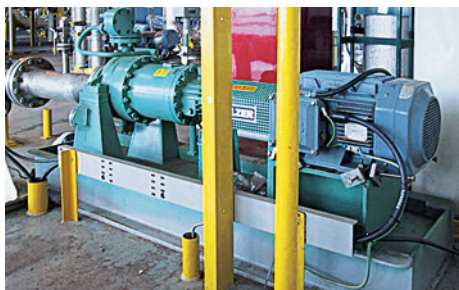
Drive for autoclave in foam production of Zotefoam, UK, sealed with **NMB coupling**. Operating conditions: $p = 690 \text{ bar}$ (4,205 PSI), $t = 250 \text{ }^{\circ}\text{C}$ (482 $^{\circ}\text{F}$). Medium: Nitrogen. The system has been operating since 1985.



The nuclear power station in Gösigen, Switzerland, uses EagleBurgmann **22P-10R-40-SC2** HE magnetic couplings. They are used with four Sulzer centrifugal pumps (TMC 200-400) to deliver condensate in the cooling circuit. The powerful torque (1,120 Nm when starting up) is transferred to the hermetically sealed system circuit in a highly efficient manner. Operating conditions: $p = 26 \text{ bar}$ (377 PSI); $t = 185 \text{ }^{\circ}\text{C}$ (365 $^{\circ}\text{F}$).



In use on the drilling rig PRA1 off Brazil are 18 **MAKH66-110-4/43-00** magnetic couplings. They seal Sulzer centrifugal pumps (ZF 25-200) in a buffer pressure system at 90 bar for supplying the mechanical seals of crude oil pumps. Since 2005, the magnetic couplings have been proving their low maintenance at a difficult to access site. Medium: Buffer fluid ISO Vg 46; operating conditions: $p = 90 \text{ bar}$ (1,305 PSI); $t = 70 \text{ }^{\circ}\text{C}$ (158 $^{\circ}\text{F}$); $n = 3,500 \text{ min}^{-1}$.



Seal of a centrifugal pump for the manufacture of aromatic compounds at Shell in the Netherlands. The high drive power of 75 kW makes it necessary to use the high efficiency **NMB-22P-9R-35-ND** magnet coupling. This uniquely efficient magnetic coupling drastically reduces power losses and the associated heat generation. Operating conditions: $p = 35 \text{ bar}$ (508 PSI); $t = 20 \text{ }^{\circ}\text{C}$ (68 $^{\circ}\text{F}$); $n = 990 \text{ min}^{-1}$.



The high-efficiency **NMB-16P-2R-45-SC** magnetic coupling as a hermetic seal in a vertical pump. The process medium - a mixture of ammonia and propane - has very poor lubricating properties. The low temperature of $-45 \text{ }^{\circ}\text{C}$ (-49 $^{\circ}\text{F}$) plays a decisive role in the choice of materials.



SMAK sterile coupling in use as frequency-regulated bottom entry drive with rotational speed monitoring for agitator tanks in the pharmaceutical production at SANOFI in France. All metal surfaces in contact with the product are polished with a roughness of $< 0.4 \text{ } \mu\text{m}$, the elastomers are FDA compliant.

Argentina · Australia · Austria · Belarus · Belgium · Bulgaria · Brazil · Canada · Chile · China · Colombia · Cyprus · Czech Republic · Denmark · Ecuador · Egypt · Estonia
 Finland · France · Germany · Great Britain · Greece · Hungary · India · Indonesia · Iraq · Israel · Italy · Japan · Jordan · Kazakhstan · Korea · Kuwait · Latvia · Libya · Lithuania
 Malaysia · Mauritius · Mexico · Morocco · Myanmar · Netherlands · New Zealand · Nigeria · Norway · Oman · Pakistan · Paraguay · Peru · Philippines · Poland · Qatar
 Romania · Russia · Saudi Arabia · Singapore · Slovenia · Slovak Republic · South Africa · Spain · Sweden · Switzerland · Syria · Taiwan · Thailand · Trinidad and Tobago · Tunisia
 Turkey · Turkmenistan · Ukraine · United Arab Emirates · Uruguay · USA · Uzbekistan · Venezuela · Vietnam · www.eagleburgmann.com/world



K-MAKE / E1 / 3.000 / 03.14 / 9.7.1 © EagleBurgmann Group Marketing, Germany

EagleBurgmann is one of the internationally leading companies for industrial sealing technology. Our products are used everywhere where safety and reliability are important: in the oil and gas industry, refining technology, the petrochemical, chemical and pharmaceutical industries, food processing, power, water, mining, pulp & paper, aerospace and many other spheres. Every day, more than 6,000 employees contribute their ideas, solutions and commitment towards ensuring that customers all over the world can rely on our seals. Our modular TotalSealCare service underlines our strong customer orientation and offers tailor-made services for every application.

eagleburgmann.com

info@eagleburgmann.com

EagleBurgmann®
 Rely on excellence