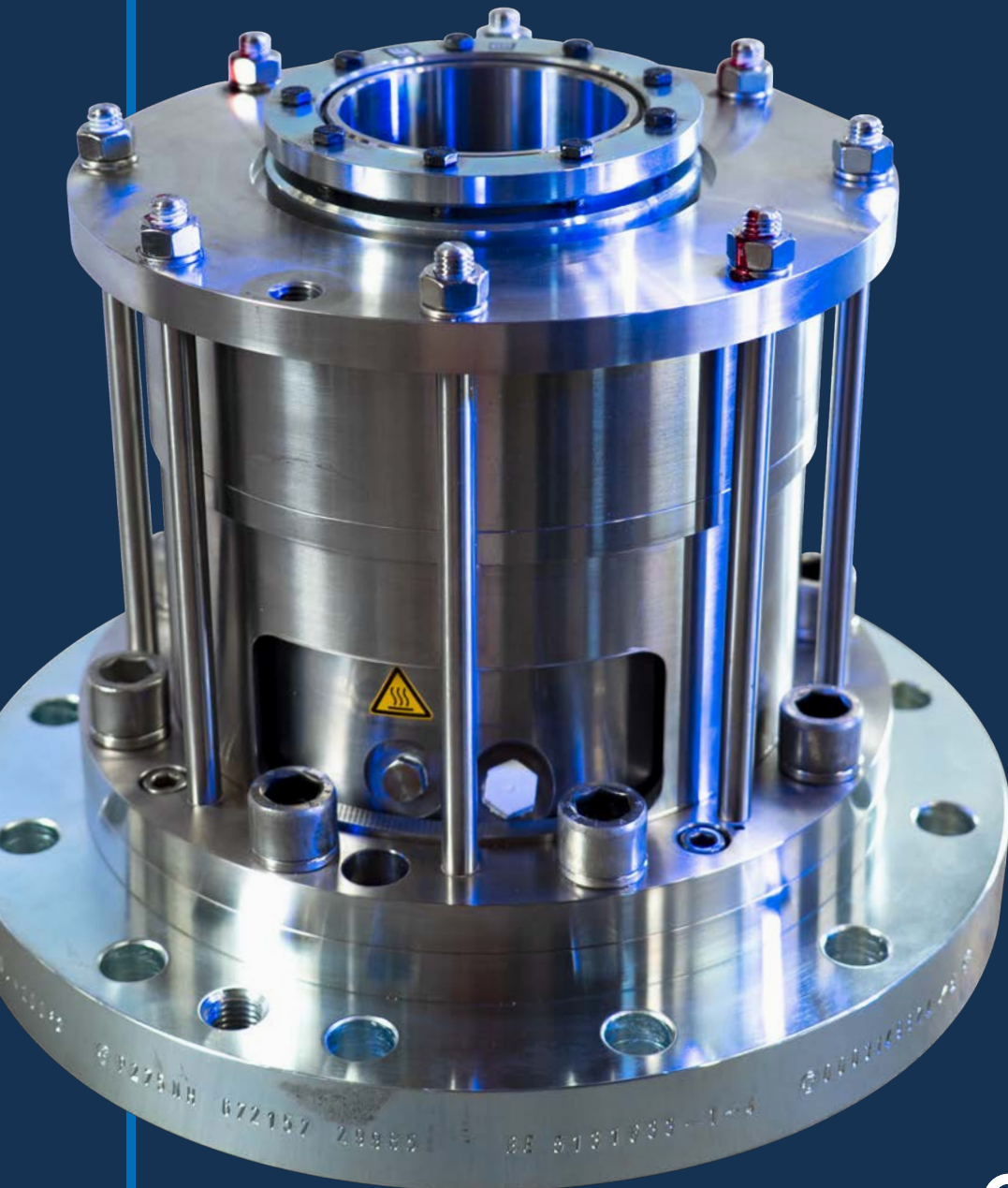


INTERSEAL

Sealing Technology

dry9000[®] seal



GMM
Pfaudler

INTERSEAL

— Sealing Technology

As a supplier of innovative sealing technology products, Interseal has concentrated on the manufacture of seals, sealing components and valves for applications in the chemical, petrochemical, pharmaceutical and other industries.

With the dry9000®, Interseal has developed a technically and economically mature shaft seal that is not only able to accommodate the characteristic swaying movements of shafts, but also prevents any contamination of the finished product as it runs dry.

The dry9000® is the better alternative to a mechanical seal or packing, finally converting the weakest link in the production chain to a genuine factor for success.

Interseal is a competent engineering partner for sealing solutions.

PRODUCTS & EQUIPMENT

dry9000® **Sealing Technology**

state-of-the-art technology

for DIN agitators

for custom-sized solutions

for horizontal mixers

for filter dryers

options transfer



Tempe

id (S)

interseal dry9000®

Makes the weakest link become a success factor

Many agitators and mixers are still using conventional sealing systems which require extensive maintenance. Typically they are vulnerable to the occurring axial and radial shaft movements in your machines. Even upon the intended use of conventional sealing technologies there may also occur contamination of your product. This is avoidable!

Our patented dry9000® offers the standardized solution for your

- Agitators
- Mixers
- Thin film evaporators
- Screw conveyor
- Nutsche filters
- Filter dryers
- Specific applications

Runs dry, is 100 % leak proof and ensures that your productivity runs permanently smoothly. The specially developed tribological system between the shaft protection sleeve and the sealing lips ensures that no liquid or gas has to be used – the dry9000® runs completely dry. This is why the interseal dry9000® system has no need of any supply systems. Due to the patented arrangement of compensation parts, the dry9000® sealing lips are completely free of forces. By being completely leak proof, our shaft seal reduces the risk of a production loss to an absolute minimum and protects people and the environment.

Challenges are welcome – the dry9000® follows every movement

Whether motion is abrupt, vibrating or tumbling: With a conventional seal the shaft deflections that are acting as forces in the production process lead to gaps between the sealing surfaces. This results in wear followed by leakage through to the failure of the seal. This demonstrates the superiority of our shaft lip seal, as the interseal dry9000® follows the movements of the shaft.

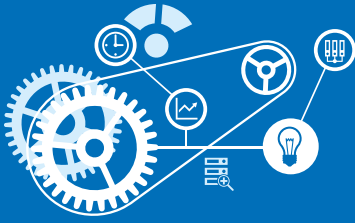


Conclusion:

As there is no relative movement at the dry9000® sealing components, gaps between the sealing surfaces are not existent and therefore no medium can penetrate the sealing system.

DIN, ATEX, TA Luft, GMP and FDA – Standards you can rely on

- Plug & play dry9000® cartridge for steel and glass-lined vessels according to DIN 28136. The connecting dimensions of the mounting flanges comply with DIN 28141 and DIN 28137, the shaft ends comply with DIN 28154 and DIN 28159. Of course, customized installation dimensions are also possible.
- Meets all security requirements that are summarized in the ATEX directives.
- The sealing system is compliant with TA-Luft.
- The seamless production process guarantees GMP-compliance for all products.
- Dead space minimized design.
- All product contacted parts are available in FDA-compliant quality.



OPTIMIZATION

**HIGH
QUALITY
COMPONENTS**



interseal dry9000[®]

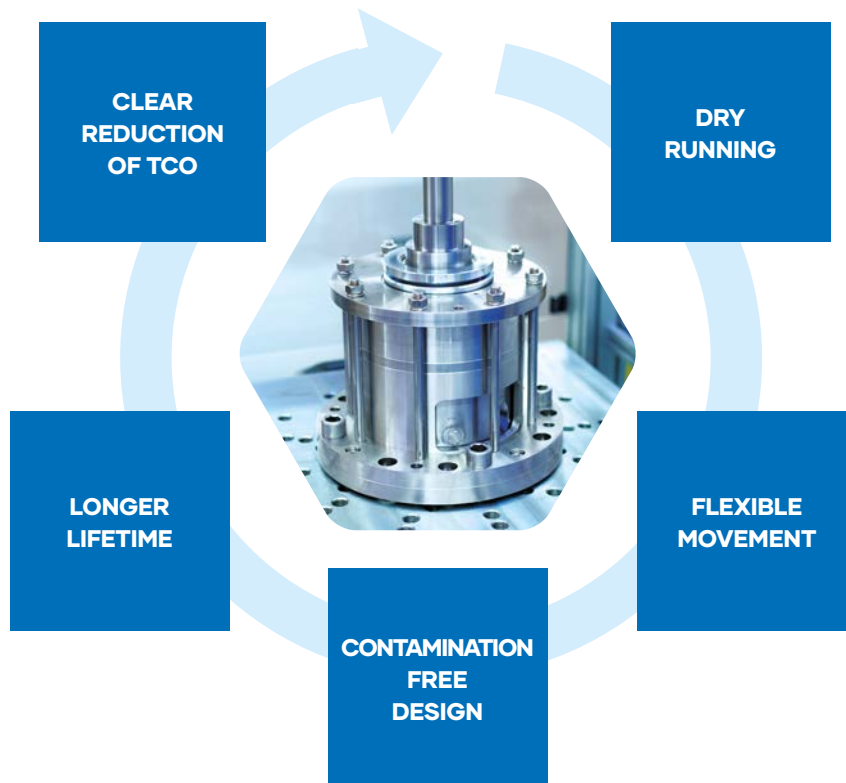
Advantages & Applications

Advantages

- No additional cost: pharma design included in standard version
- No loss of product: contamination free production
- CIP: Easy cleaning/sterilization
- FDA-compliant
- GMP-Design
- ATEX-conformity in all zones and temperature classes
- No-start up requirements
- Easier to plan a revision
- Reduced effort for installation

Save Cost & Time

- No supply system needed
- No loss of product because of contamination
- No continuous cleaning of contaminated supply system
- No constant monitoring necessary due to patented dry running technology



Pharmaceutical Industry



Chemical Industry



Petrochemical Industry



Food Industry



Maintenance Service



Engineering



Service Contracts



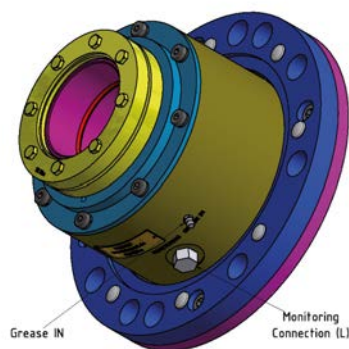
Trade



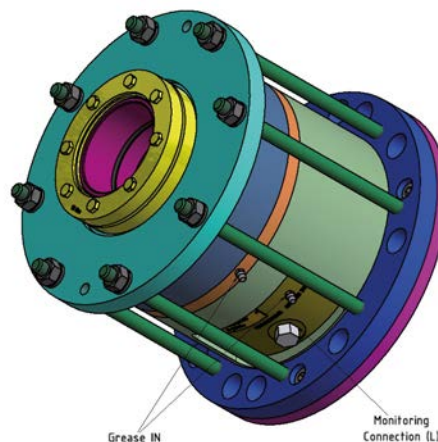
interseal dry9000[®] for DIN agitators

Seals for drives according to
DIN standard for steel vessels –
dry9000[®] twin, dry9000[®] twin+

Patented axial-radial-flexible seal with dual
O-rings (dry9000[®] twin) and integrated
floating bearing for the machine shaft
(dry9000[®] twin+).



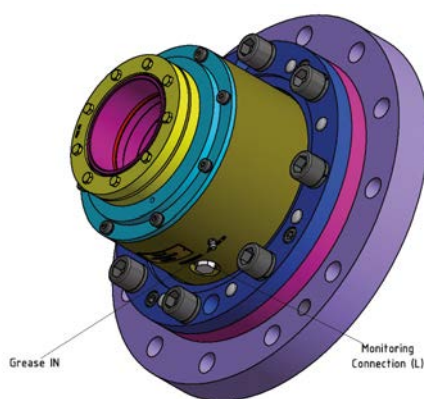
dry9000[®] twin without machine bearing



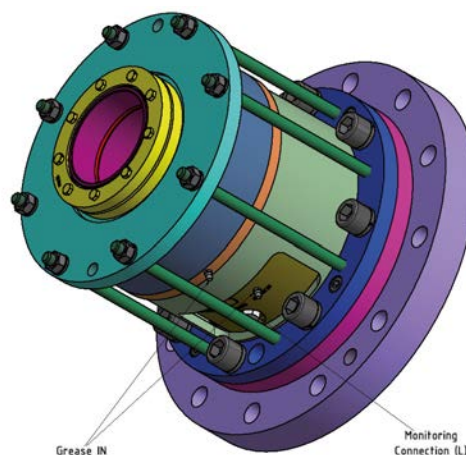
dry9000[®] twin+ with integrated machine bearing

Seals for top drives according to
DIN standard for glass-lined vessels –
dry9000[®] twin E, dry9000[®] twin E+

Patented axial-radial-flexible seal in enameled
design with dual O-rings (dry9000[®] twin E)
and integrated floating bearing for the
machine shaft (dry9000[®] twin E+).



dry9000[®] twin E without machine bearing



dry9000[®] twin E+ with integrated machine bearing

Recommended applications

- Refining technology
- Petrochemical industry
- Chemical industry
- Pharmaceutical industry

- Food and beverage industry
- Agitators
- Mixers
- Filter dryers

interseal dry9000® for custom sized solutions

The modular concept dry9000®: One system – unlimited options

Productivity has got many manifestations but mostly totally different requirements. Our motto is "yes we can"! Starting with the standard solution which is available within 24 hours or the customized standard solution up to the custom-made special product: the interseal dry9000® is available in various formats of the modular concept. This ensures that every production benefits from all advantages of our patented seal. The interseal dry9000® can easily be integrated into every machine, not dependent on a specific manufacturer.

Available within 24 hours: our standard solution

For agitators and mixers manufactured according to DIN standards with shaft diameters from 40 to 140 mm the appropriate dry9000® is available from stock.



Right for you: your customized standard solution

For various reasons some machine manufacturers waive the requirements of the German industrial standards. But this is no problem for us! interseal simply customizes the dry9000® to your requirements.

Develop advantage: our custom-made special seal for your environment

Does your production occur in an exceptional environment? We are ready to take up the challenge. Upon request we develop an adapted variation of the dry9000® that meets your individual requirements

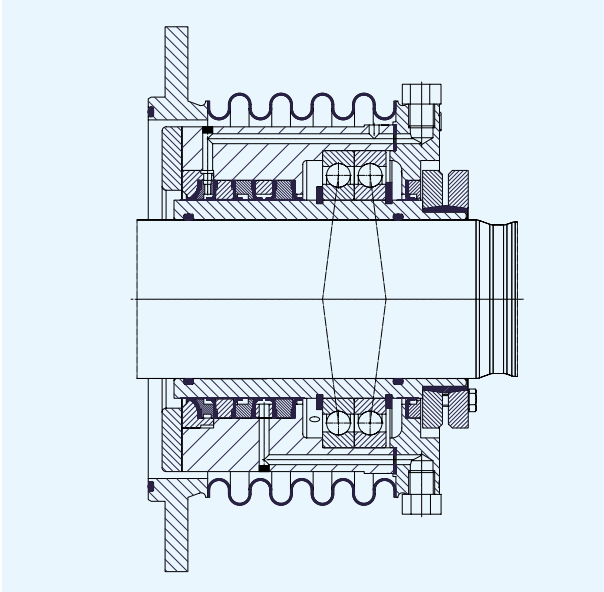


interseal dry9000® for horizontal mixers

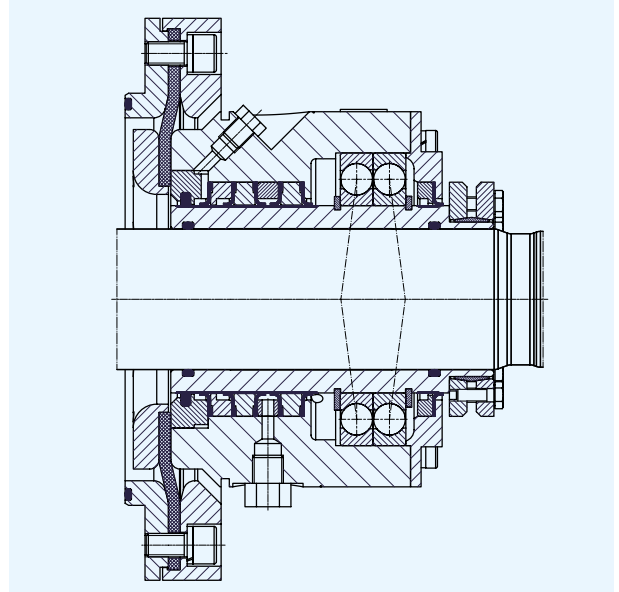
Horizontal mixer seal – dry9000® extend

Axial-radial-flexible seal with compensation using an expansion disc or metal bellows for machines with larger shaft expansion.

The seal is available as plug & play cartridge and will be adjusted to the connection situation of the machine.



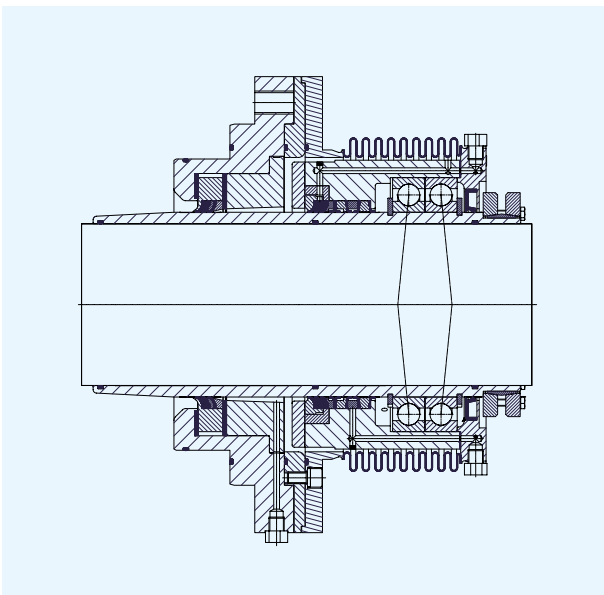
dry9000® extend for axial expansions > 10 mm



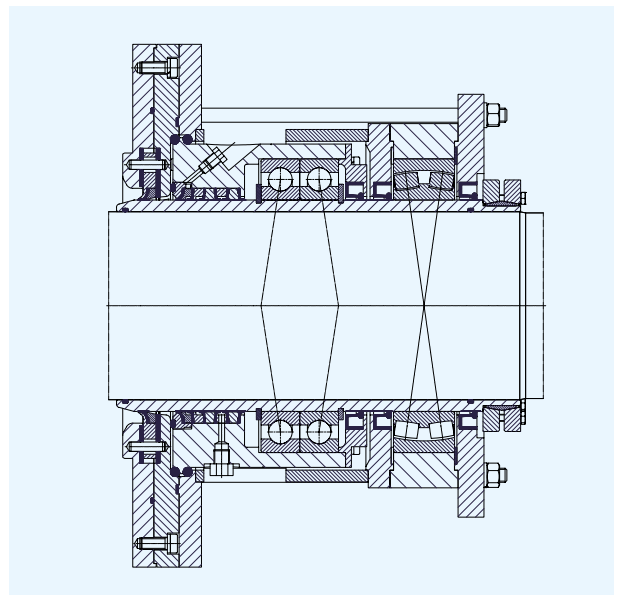
dry9000® extend for axial expansions 2-10 mm

Horizontal mixer seal – dry9000® extend

The seal is available as plug & play cartridge and will be adjusted to the connection situation of the machine.

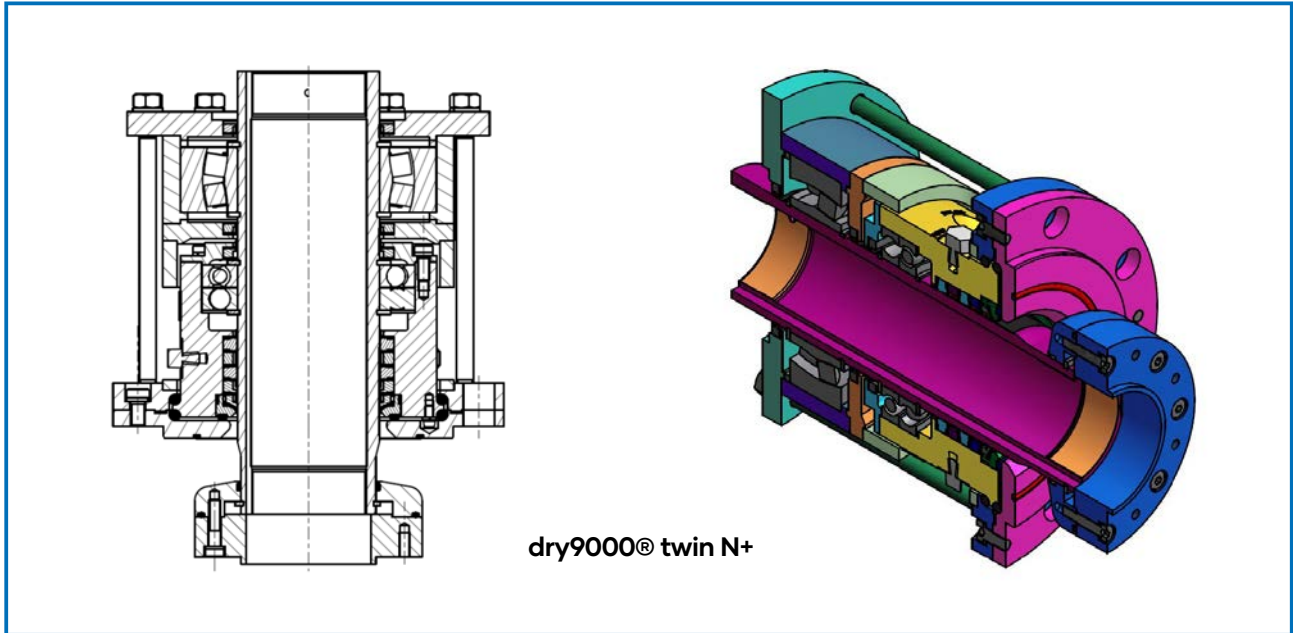


dry9000® extend with movable stripper on the product side - floating bearing side for axial expansions > 10 mm



dry9000® twin+ with movable stripper on the product side and integrated machine bearing - fixed bearing side

interseal dry9000[®] for filter dryers



Mavazwag[®] Agitated Nutsche Filters and Filter Dryers

Interseal produces sealing solutions for that kind of machines.

MAVAZWAG[®] ANF and ANFD are versatile units for deep bed, solid-liquid separation using a filter screen. MAVAZWAG[®] ANF and ANFD perform most effective in Pharmaceutical and Chemical Industries where filtration and cake washing is required.

For further informations about these machines we recommend to get in touch with Mavag.

The innovative movable stripper for the dry9000®

Protection concept for dynamic sealing systems in demanding procedure environment

Practicable problems

Production of solid- and drying processes demands higher requirements for the dynamic sealing technology.

Products (like solid, crystalline parts), typically are right in front of/ touch with the sealing parts. Products which molecular structure are fitting to get into the sealing system himself must be prevented to do so. Intruded product damage the sealing elements and leads to the reduction of lifetime and on that way to needless production losses and increased production costs.

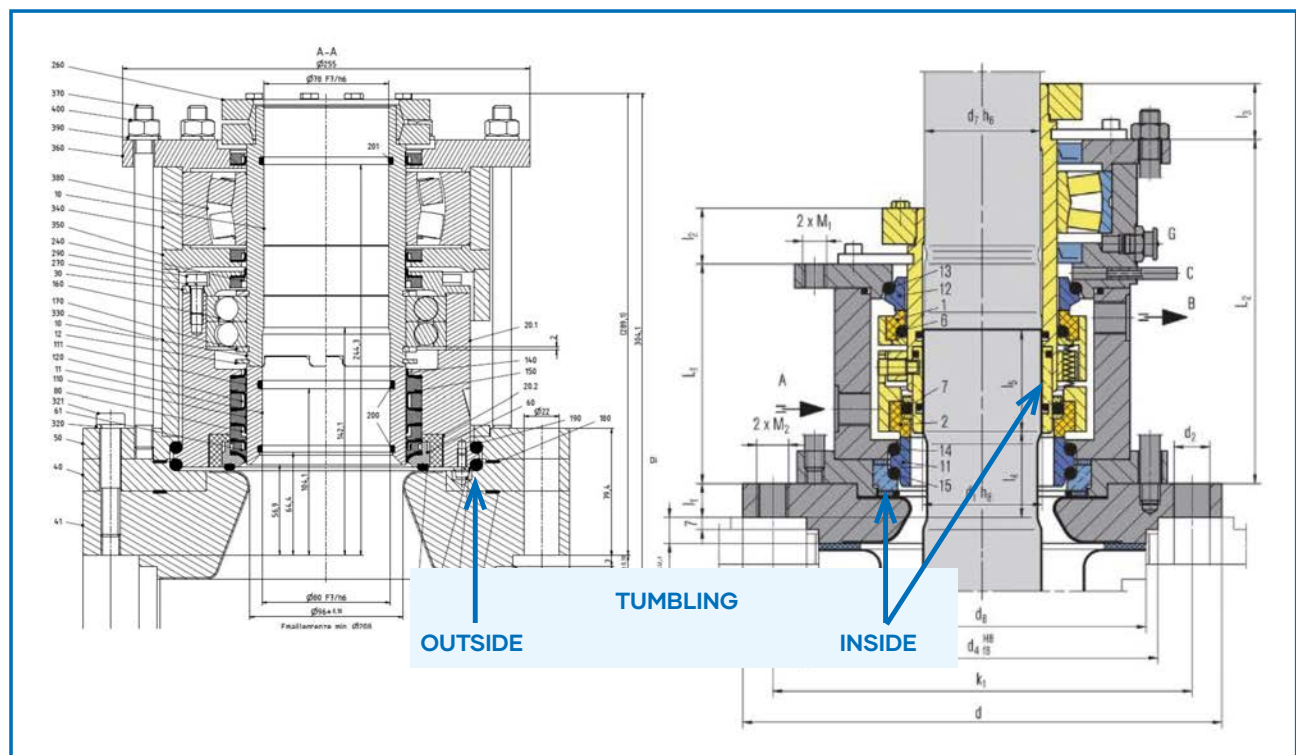
For the pharmaceutical production we do have the additional challenge for a GMP - cleanliness requirement - design for the sealing solutions. For those applications it is fundamental to reduce the dead spaces to an Minimum. Target for a perfect design is a solution where the product does not have the possibility to stick in difficult areas, without the possibility for cleaning.

The typically abrupt, vibrating or lurching movements at the mixer shaft are the reason for the main problem at a dynamic seal. The deviation power during the mixing process do reach the seal himself and cause a split effect (mechanical seal) and stress at the lip (lipseal systems).

The perfect solution is a design without a relative movement of the actual sealing components. That means no stress inside the sealing system - no axial or radial moments which could cause problems.

For some machines - especially horizontal shafts- the effect of forces from the shaft movements are moving ahead the primary sealing elements.

Innovation vs traditional solution



The innovative movable stripper for the dry9000®

Development and high end solution

Target of the development was a protective unit pursuant to create a solution which would be able to protect the dynamic seal himself against challenging products to enlarge the lifetime and reduce the TCO.

The solution should fit into the modular system of our dry9000 – ready to assemble as a cartridge unit. Especially for horizontal mixer the product is always on the way to the sealing system and caused stress to the dynamic sealing systems. The development of the today available high end solution walked through two stages of development.

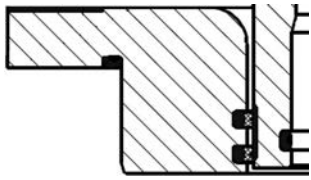
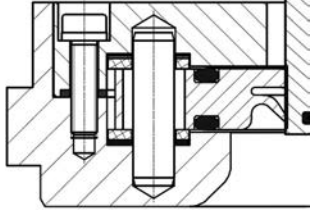
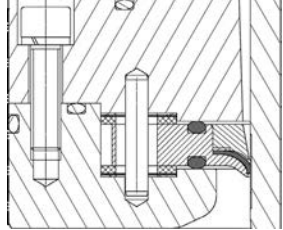
First step consist of two – in a row – spring loaded „throttle rings“. Optional to flush Nitrogen between the two throttle rings was part of the solution. This solution did have some negative aspects. On the one hand the self heating for a dry running seal was not perfect and on the other side the dead space was kind of not acceptable for the pharmaceutical process industry. (pic. 1). Based on the first experiences and feedback from the users the decision was made to change the design for that throttle ring. The design was a based on a one piece solution, what did mean that we machined the part out of one piece. (pic 2). Idea was to relieve the forces on a protection lip with an integrated

support ring. In addition to that this part was able to follow the radial movement of the mixer shaft as well.

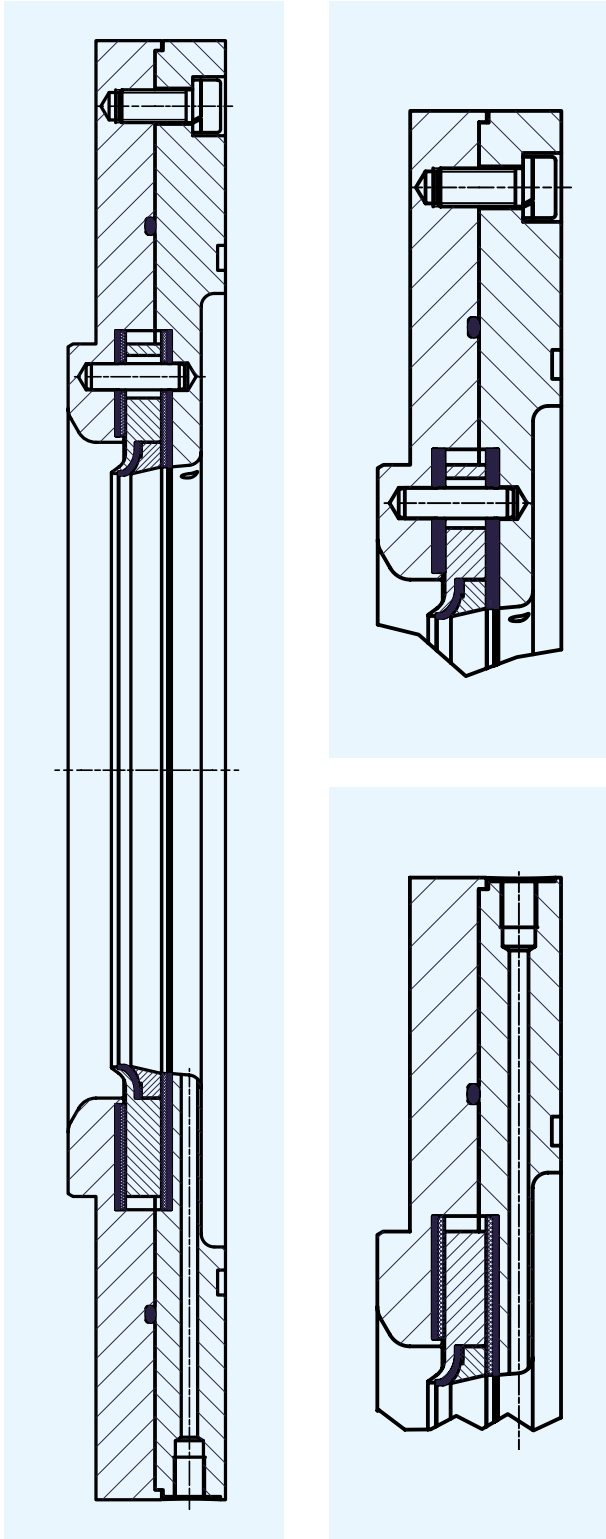
Problem for that solution was at the end of the day, that the product was still in contact with the protection lip – what does mean the complete front surface is in contact with demanding product and causes damage. More over – as a logic result for that design – the dead space did not match the requirements for a GMP design as well as the possibility for CIP cleaning in place (CIP would just destroy this solution).

Within the third step forward we succeeded a design which full filled all requirements from the pharmaceutical process industry. High light is the so called shape of a “metallic lip” – which works like a shield in front of the sealing lip. The product is not able to get in touch with the lip anymore and can not damage it. Of course this high end solution is able to follow the shaft movement what does mean that we do not have any gap – even if the agitator shaft vibrates. GMP design and CIP possibility is just another great and unique result of this innovation (pic. 3).

One nice option is that the user is able to put additional nitrogen in between this scrapper and the seal himself. Another option to increase the lifetime and reduce the TCO.

| Type | Throttle ring (first step) | Movable stripper (step forward) | Movable metallic lip stripper (high end version) |
|------------|--|---|---|
| Design |  |  |  |
| Advantages | <ul style="list-style-type: none"> • Critical product can not reach the sealing system • Increase the lifetime | <ul style="list-style-type: none"> • Critical product can not reach the sealing system • Increase the lifetime • Radial movements are possible. • Throttle ring machined as one piece | <ul style="list-style-type: none"> • Critical product can not reach the sealing system • Increase the lifetime • Radial movements are possible. • Metallic lip design • This design protects the sealing lip • GMP-compliant • CIP compliant |

The innovative movable stripper for the dry9000®



A movable stripper that acts like a snow pusher can be installed in front of the dry9000®. This stripper prevents that media gets to the primary sealing package, although the shaft is moving axially or radially. The stripper with the metallic protected sealing lip is radial flexible.

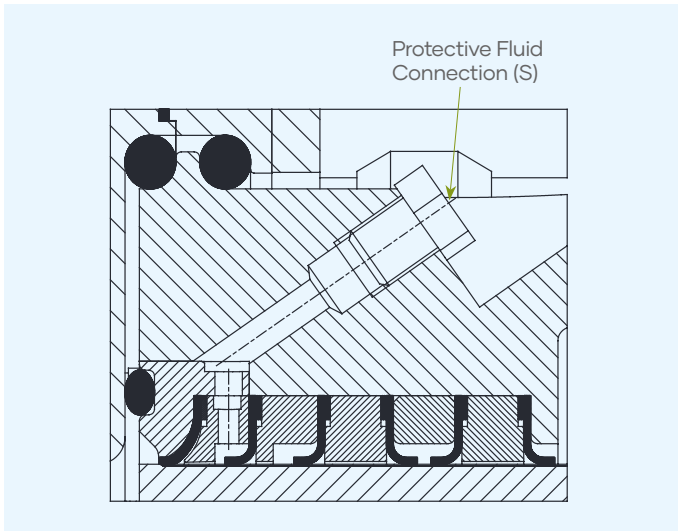
This avoids splitting between the sealing lip and the protection sleeve which is tumbling with the shaft.

Furthermore the movable stripper is an optional protection against quickly adhering product.



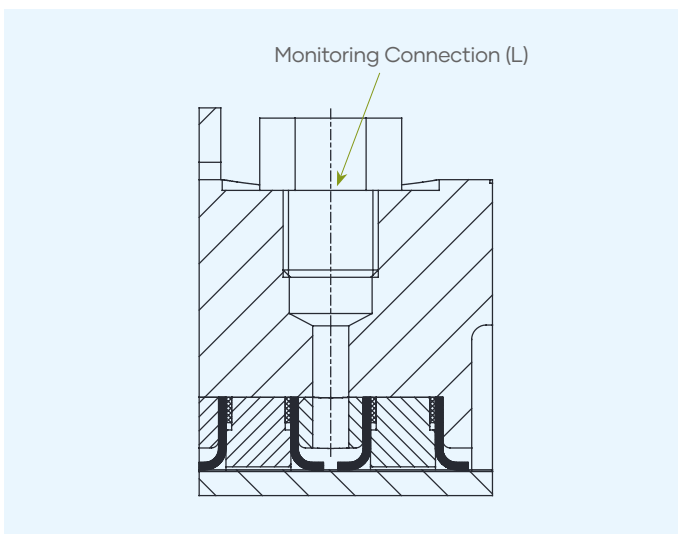
Product side movable stripper for dry9000®

The three options of the dry9000®



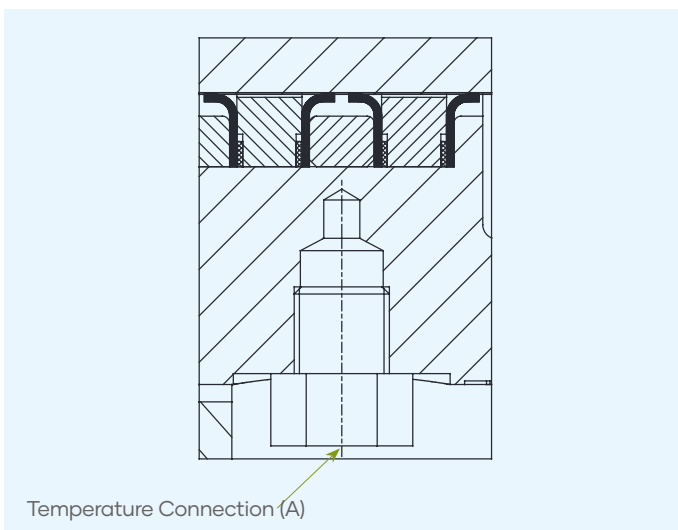
Hole for optional protective fluid

Here is the possibility to protect the seal over a protective fluid against crystalline media.



Hole for monitoring control

Over this hole you can check the tightness of the seal. In case of a signal the seal remains fully operational through further lips. This allows an efficiently planned review.



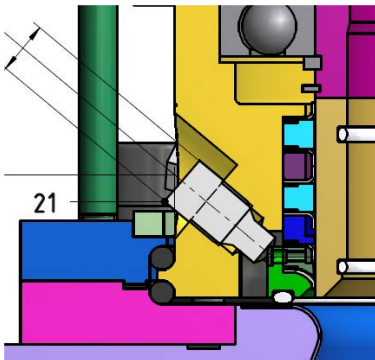
Hole for temperature control

Here is the possibility to check the temperature inside the seal.

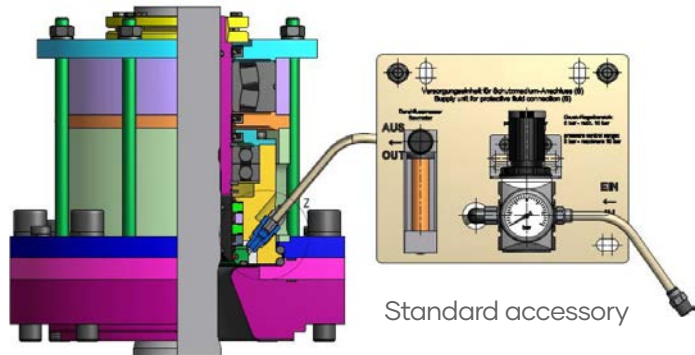
Get connected to the dry9000®

The dry9000® has three connections by standard

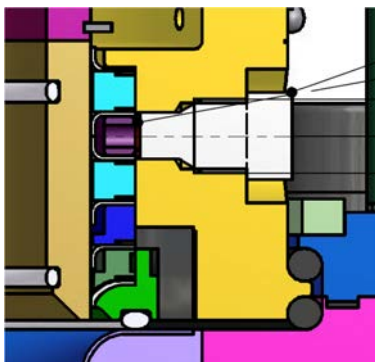
Protective Fluid Connection (S)



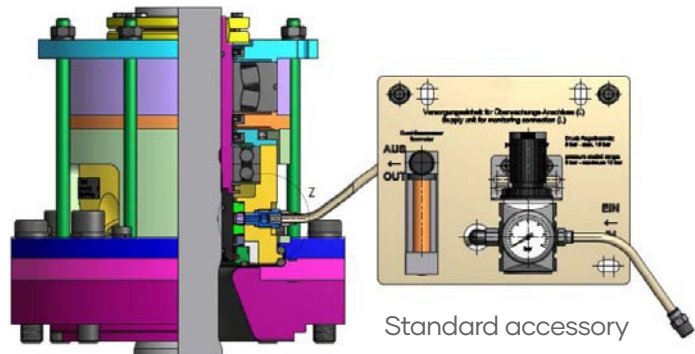
- Purpose:
- Protective shield in front of the seal
 - Flushing / Sterilization
 - Inertization



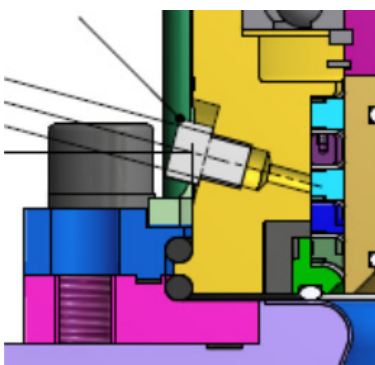
Monitoring Connection (L)



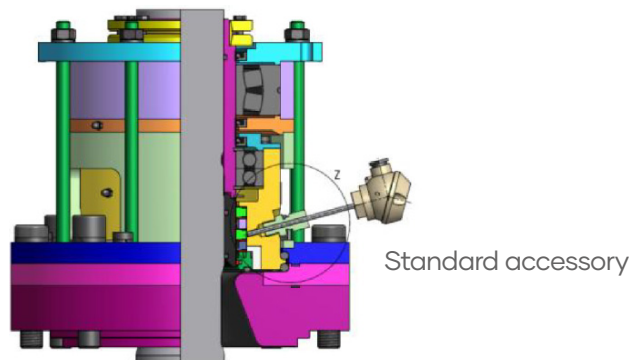
- Purpose:
- Service control



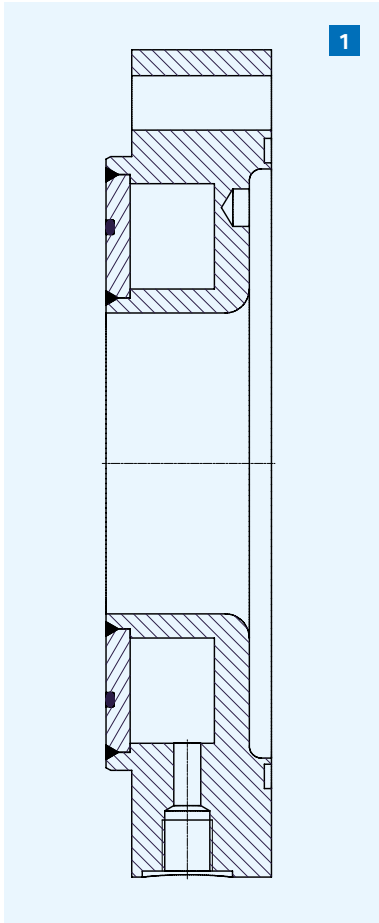
Temperature Connection (A)



- Purpose:
- Monitor temperature of the seal
 - ATEX (Explosion protection)



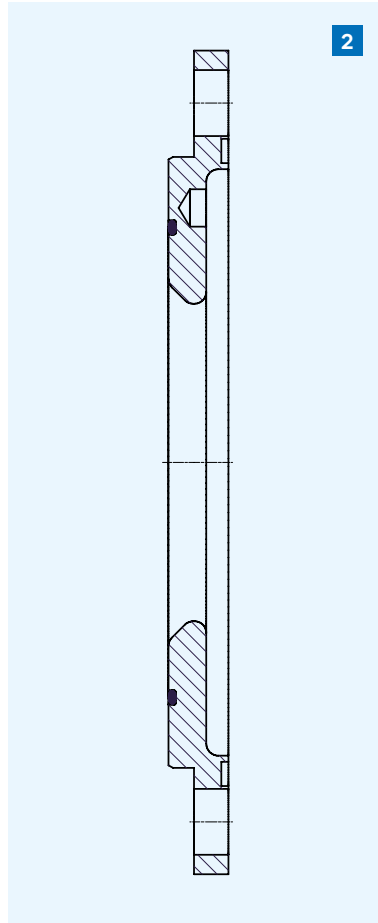
Standard flange option of the dry9000®



1 Cooling flange

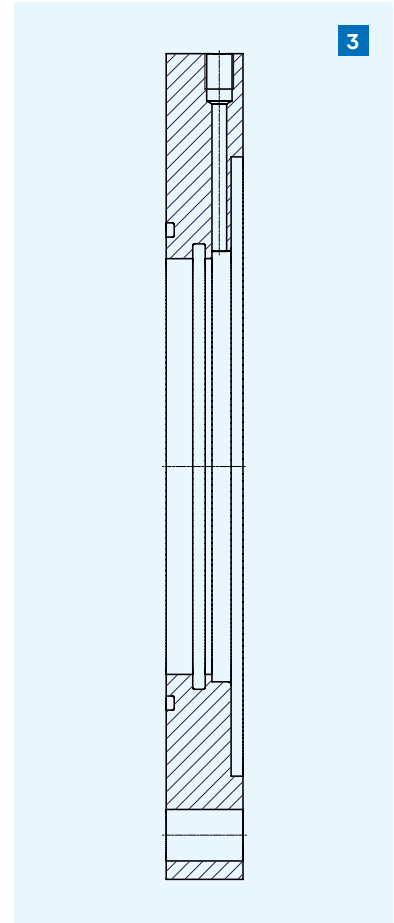
In case of higher temperatures the cooling flange is protecting the dry9000®.

Standard cooling flanges for shaft diameters of 40 to 140 mm are available on stock.



2 GMP-flange

Cavity minimized version for the pharmaceutical variation. Standard GMP-flanges for shaft diameters of 40 to 140 mm are available on stock.

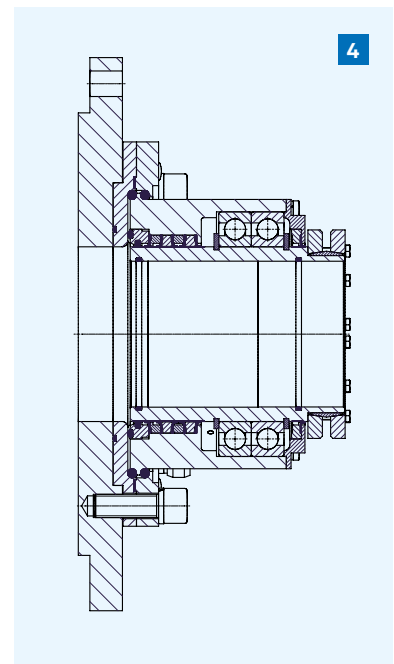


3 Flange with flushing option

Flange with integrated hole for an optimal setup of sealing media.

4 Adapter flange

For connecting the dry9000® to a non-DIN compliant connecting situation..



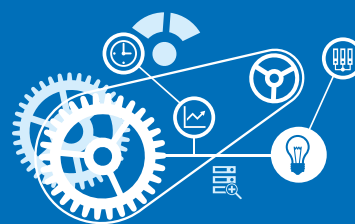
Design parameters

Temperatures, pressures and what keeps the interseal dry9000® together at its core

| Design parameters | |
|--------------------|--|
| Pressure (p) | Vacuum - 25 bar |
| Temperature (t) | - 40 °C to + 220 °C (+ 350 °C with cooling flange) |
| Sliding speed (vg) | 7.5 m / s |

| Materials | Standard materials | Standard special materials |
|----------------------------------|----------------------|----------------------------|
| Product contacted metallic parts | 1.4571 / Tantalum | Hastelloy |
| | Ceramic | Titan |
| | DLC | 1.4539 |
| | Enamel | - |
| Metallic parts | 1.4122 | 1.4404 |
| | 1.4301 | - |
| O-rings | FEP-Viton / FFKM-FDA | FFKM / Paroflon / EPDM |
| Sealing elements | PTFE-PPS-compound * | - |

* also available in FDA-compliant quality



OPTIMIZATION

**HIGH
QUALITY
COMPONENTS**

Worldwide Presence



GMM Pfaudler is a global leader in corrosion-resistant technologies, systems, and services for the chemical, pharmaceutical, food and energy industry.

Our Branded Product Lines that include PFAUDLER, NORMAG, MAVAG, MIXION, INTERSEAL, EQUILLOY and EDLON, showcase our strength as a group, our capabilities, and our pursuit for constant innovation. With an end-to-end solutions-oriented approach, a global footprint, and a perfectly integrated offering system we are able to meet complex industry demands worldwide.

GMM Pfaudler is driven by 1500+ individuals across 4 continents and 14 global manufacturing facilities around the world. The Group's targeted investments in strategic markets, innovation and competitiveness paves the way forward for GMM Pfaudler's continued legacy.

100
Countries

1500 +
Employees

04
Continents

Our Global Contacts

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| | | |
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| China | <ul style="list-style-type: none">■ Li Yang | <ul style="list-style-type: none">sales-cn@pfaudler.com |
| India | <ul style="list-style-type: none">■ Mumbai■ Delhi-NCR■ Chennai■ Hyderabad■ Ahmedabad■ Karamsad | <ul style="list-style-type: none">sales-in@pfaudler.comsales-in@pfaudler.comsales-in@pfaudler.com |
| Singapore | <ul style="list-style-type: none">■ Singapore | <ul style="list-style-type: none">service-sgp@pfaudler.com |
| Korea | <ul style="list-style-type: none">■ Suncheon Si | <ul style="list-style-type: none">sales-kr@pfaudler.com |
| Rest of Asia-Pacific | | <ul style="list-style-type: none">restofasiapacific@pfaudler.com |



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