Specialty gaskets:

*Metaloseal*®—*metal-elastomer—elastomer.*

Extremely versatile, extremely robust.
Cylinder head gaskets | Specialty gaskets | Housing modules | Topographic housing components | Shielding systems | Transmission applications

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Metaloseal® specialty gaskets

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Experience mobility—Drive the future: The ElringKlinger group of companies.

ElringKlinger—innovative development partner and series supplier to the international automotive industry and other industries. We think ahead and take on responsibility. For more sustainability and environmental compatibility. Today and tomorrow.

Our trendsetting technologies and sophisticated product solutions contribute to further reduce fuel consumption and emissions, and enable the use of alternative fuels and the development of new drive technologies. With comprehensive engineering and production expertise, we allow more freedom of design for engines, transmissions, exhaust systems, and auxiliary aggregates. Together with our customers, we successfully promote new technologies. To this end, we have around 3,400 employees working at 21 locations throughout the world.
**At a glance:**
Specialty gaskets for engine, transmission, and exhaust system.

Reliable from -40°C to +1100°C.
Modern sealing systems accomplish a great deal: They guarantee a reliable sealing of various media (oil, coolant, fuels, fuel gases) both from the outside as well as in relation to each other. Furthermore, they act as power transmission elements between engine components while performing significant additional functions.

With Metaloseal® specialty gaskets as well as metal-elastomer and elastomer specialty gaskets, ElringKlinger provides suitable product solutions for a variety of sealing tasks in the engine, transmission, exhaust system, and auxiliary aggregates, e.g., compressors and pumps. Materials and design are matched optimally to the specific requirements.
Metaloseal® specialty gaskets.
The sealing system without compromises.

A highly efficient sealing system based on elastomer-coated and uncoated metal carrier materials. The functional principle: line sealing by means of a bead.

One of its greatest advantages is the ability to combine different metals with various types of elastomer depending on the application location. The additionally coined beads can be used to optimally match the properties of the carrier material to the sealing system. The beads reduce the sealing pressure to a line compression. This helps achieve higher sealing pressures at constant bolt force, or vice versa a lower bolt force is used at constant sealing pressures.

The variety of combinations between metallic carrier materials and elastomer materials can cover almost all application locations in engine, transmission, exhaust system, and auxiliary aggregates.

Furthermore, Metaloseal® gaskets can perform additional functions. Thus, for example, oil baffles or sensors can be integrated for even more efficient engine management.
Systems expertise.
Welcome to the future.

Metaloseal® gaskets and thermal shielding part for SCR injection systems for exhaust aftertreatment.

Metal/soft material gasket for automatic transmissions.

Metal gasket with partial elastomer coating for automatic transmissions.

FEM analyses and state-of-the-art testing and simulation techniques help us ensure the readiness of our Metaloseal® sealing systems for series production as early as in the prototype phase. Engineering in close cooperation with our customers. Fast, reliable, and economical.

For us, systems expertise also means working consistently on new materials, technologies, designs, and applications. For innovative product solutions. For the sealing tasks of tomorrow.

Dynamic hot gas test bench

Dynamic hot gas testing of exhaust system components under realistic conditions.

Test bench components
Reverse bending test bench

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biaxial test bench</td>
<td>horizontal and vertical axis</td>
</tr>
<tr>
<td>Max. force amplitude</td>
<td>15 kN</td>
</tr>
<tr>
<td>Max. half-wave amplitude</td>
<td>150 mm</td>
</tr>
</tbody>
</table>

Hot gas burner

<table>
<thead>
<tr>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of burners</td>
</tr>
<tr>
<td>Gas temperatures</td>
</tr>
<tr>
<td>Max. counter pressure</td>
</tr>
<tr>
<td>Volume flow rate</td>
</tr>
</tbody>
</table>

Elasticity behavior of Metaloseal® gaskets in the sealing gap.
Car manufacturers and automotive suppliers are confronted with new and complex challenges in the form of the increasingly strict emission limit values worldwide. The resulting downsizing programs and exhaust aftertreatment systems set partly new and demanding general conditions, especially for sealing technology. Thus, high requirements are placed especially on the leak tightness of exhaust systems. In the Metaloseal® technology, the use of heat-resistant carrier materials and coatings has optimized the sealing function and also provided the basis for reliably mastering critical boundary conditions.

Metaloseal® exhaust gaskets by ElringKlinger reliably meet the requirements of both modern and future exhaust systems. They effectively perform sealing and durability functions under the most difficult operating conditions. For maximum reliability.
Advantages at a glance

Compared with conventional composite gaskets, the Metaloseal® system is characterized by the following decisive advantages:

• Use of materials having maximum resistance to thermo-mechanical stresses
• Good adaptability to heavily deformed sealing surfaces
• Long-term durability
• Variable design (absorption of sliding movements of head/manifold)
• Reliable engineering based on defined material properties
• Heat-resistant coatings ensure the best sealing and frictional behavior
Multifunctional Metaloseal® exhaust gaskets

Innovative and versatile—exhaust gaskets with advanced tasks:
• Additional elements for easier and reliable installation
• Customized gaskets with pre-assembly elements suitable for modular integration
• Integration of the coolant passage
• Integration of the check valve
• Combination with heat shield
• Sealing plus shielding for exhaust aftertreatment systems
  (AdBlue® injection and SCR catalyst)

ADBlue® module—a contribution to reduce emissions

As a competent development partner, ElringKlinger is also involved in this module solution for SCR injection systems for exhaust aftertreatment: with Metaloseal® gaskets as well as a multi-layer Elrotherm® heat shield. In addition, we take on the complete assembly.

AdBlue®-based SCR systems are considered to be a key technology for complying with the stricter emissions standards for passenger cars and commercial vehicles. The urea-water solution AdBlue® enables the conversion of poisonous nitrogen oxides into the exhaust to water vapor and elemental nitrogen.

The module performs the following functions: sealing in relation to the urea-water solution (AdBlue®), air gap insulation, cooling of valve tips in the area of the injection, as well as thermal shielding of connections.
<table>
<thead>
<tr>
<th>Sealing area/requirements</th>
<th>Carrier materials</th>
<th>Coatings</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGR system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150°C to 250°C</td>
<td>Cold-rolled strip</td>
<td>FPM (based)</td>
</tr>
<tr>
<td>Corrosion resistance</td>
<td>Spring steel</td>
<td>FRM (based)/NBR (based)</td>
</tr>
<tr>
<td>Coolant resistance</td>
<td>Corrosion-resistant steel</td>
<td></td>
</tr>
<tr>
<td>Cylinder head/manifold</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature up to 350°C</td>
<td>Spring steel</td>
<td>Resin-stabilized NBR</td>
</tr>
<tr>
<td>Dynamic load</td>
<td>Spring steel</td>
<td></td>
</tr>
<tr>
<td>Friction wear</td>
<td>Spring steel</td>
<td>Solid lubricant in synthetic resin matrix</td>
</tr>
<tr>
<td>Exhaust aftertreatment systems (AdBlue® injection and SCR catalyst)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150°C to 750°C</td>
<td>Spring steel</td>
<td>FPM (based)</td>
</tr>
<tr>
<td>Thermal isolation</td>
<td>HT-resistant steel</td>
<td>Solid lubricant in synthetic resin matrix</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heat-resistant coating</td>
</tr>
<tr>
<td>Exhaust pipe, turbocharger, precatalytic converter, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature up to 1100°C</td>
<td>HT-resistant steel, HT-resistant alloy (Ni-based), mica</td>
<td>High-temperature resistant coating</td>
</tr>
</tbody>
</table>
No compromises. Metaloseal® sealing system for oil, coolant, and fuel systems.

Elastomer-coated beaded metal gaskets have proven to be a reliable and cost-effective sealing concept. With impressive advantages: Elastomer and metallic materials as well as the bead design can be combined flexibly, thus enabling a tailor-made gasket design oriented precisely to the respective application.

Each functional component fulfills specific requirements. And this clear assignment of sealing tasks constitutes the special strengths of the Metaloseal® sealing system:

- Adaptation to major component deformations by means of beads (macro sealing)
- Adaptation to component roughness by means of elastomer coating (micro sealing)
- High chemical resistance by means of special elastomer formulas
- Cross-sectional leak tightness by means of thin elastomer layers
- High rigidity provided by metal carriers

Further advantages

- Dependable long-term performance
- Additional partial elastomer coatings seal components with graded surfaces.
- Reliable engineering based on defined material properties
- High dimensional stability
- Fully recyclable
Multifunctional Metaloseal® gaskets

Metaloseal® can do more. In addition to performing sealing tasks, Metaloseal® also enables the implementation of numerous additional functions:

- Oil baffle integrated into the gasket
- Gasket with channeling function
- Gasket with elements for pre-assembly and easier installation
- Check valve integrated into the gasket

**Advantages**

- Fewer components
- Less work required for assembly
- Optimized functionality
- Weight reduction
- Lower cost

**Material combinations**

<table>
<thead>
<tr>
<th>Metal carrier</th>
<th>Aluminum</th>
<th>Static sealing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cold-rolled strip</td>
<td>Static sealing</td>
</tr>
<tr>
<td></td>
<td>Spring steel</td>
<td>Dynamic sealing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coating</th>
<th>Static sealing</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBR</td>
<td>Resistant to oil, coolant, and fuel, temperature range of operation: -40 to +160°C</td>
</tr>
<tr>
<td>NBR with enhanced friction coefficient</td>
<td>Resistant to oil, coolant, and fuel, torque transmission, temperature range of operation: -40 to +160°C</td>
</tr>
<tr>
<td>FPM</td>
<td>Especially high chemical resistance, temperature range of operation: -40 to +210°C</td>
</tr>
<tr>
<td>PUR and silicone</td>
<td>Resistant to oil, coolant, and fuel, high temperature resistance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bead form</th>
<th>2-line sealing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Half bead</td>
<td>3-line sealing</td>
</tr>
<tr>
<td>Full bead</td>
<td>For large distances between bolts and flanges with a high degree of deformation</td>
</tr>
<tr>
<td>Topographical bead geometry</td>
<td></td>
</tr>
</tbody>
</table>

The Metaloseal® sealing system can be adapted to exactly meet the individual requirement profile by using a variable combination of metal carriers, coating, and bead parameters.
**Metal-elastomer and elastomer specialty gaskets.**
Maximum performance—safe and reliable.

State-of-the-art engine technology calls for innovative sealing systems. Components and build-on parts are increasingly made of plastic for reasons related to weight and functionality. The result: reduced component stiffness and the associated increased deformations, which occur during distortion and must be compensated for by the sealing system.

Metal-elastomer and elastomer specialty gaskets by ElringKlinger provide reliability and functionality even under extreme conditions. Tried and tested a million times over. Both sealing systems—with and without metal carriers—have been adapted precisely to the sealing tasks, in addition to being optimized in terms of functionality and costs. The elastomer materials used are developed and produced by ElringKlinger. This also ensures the highest quality possible.

**Performance**
- Reliable sealing, even at low sealing pressures
- Compensation of large component tolerances
- Three-dimensional shaping
- Reduced bolt force and fewer bolts
- Acoustic isolation of components

**Engineering service**
ElringKlinger determines the best possible elastomer gasket design for each application with respect to material, profile geometry, and design of the sealing system.
**Metal-elastomer specialty gaskets**

The sealing system consists of a metal carrier with molded-on elastomer profiles—for maximum functionality and service life in the sealing of components subject to high stresses. It is especially suitable for use in load-carrying joints. Modern injection molding technology also makes it possible to bond different materials on a carrier (metal/plastic) in order to use the ideal material for each medium to be sealed.

*For example*
- Oil pump gasket
- Heat exchanger gasket
- Timing case gasket
- Thermostat housing gasket

*Design of a metal-elastomer specialty gasket.*

*Two-component technology: EPDM for water, ACM for oil.*

*Timing case gasket.*

*Metal-elastomer gasket for crankcase. This gasket consists of different metal segments connected by means of the elastomer sealing lip.*
Elastomer specialty gaskets

Ideal for basically all sealing joints on the engine. With specifically matched profile geometries, for maximum functionality at lowest sealing pressures. In load-carrying joints, elastomer gaskets must be fitted in the ancillary frictional connection, e.g., by using grooves on the part, or metal limiters under the bolts.

ElringKlinger develops
- the elastomer profile corresponding to the engine components
- the elastomer material corresponding to the requirements related to automotive fluids and temperature

Exemplary. For many applications.

Oil pan gaskets

- Available for engine and transmission applications
- Noise-isolated and rigidly bolted designs possible
- Useable in combination with different oil pan materials (aluminum, stamped steel, and plastic)
- Various systems can be configured, thus enabling optimum adaptation to the respective installation environment

The sealing systems used for plastic oil pans are similar to those used in plastic cam cover gaskets.
Requirements | Solutions
--- | ---
Isolation of structure-borne noise | Elastic mounting of the component between elastomer gasket and isolating element
Reliable screw system | Component combination of bolt and sleeve
Sealing | Elastomer materials optimized in terms of price and performance, and a gasket design with optimum functionality
Pre-assembled system | The isolating system is fixed to the component in a loss-proof fashion
Assembly | The bolt is mounted adjustably in the sleeve. The module is mounted on the engine as a single, complete unit. A centering tip on the bolt facilitates automatic assembly.
Service | The isolating system can be replaced easily and cost-effectively

Force-deformation curves of the isolating system. The combination of finite element calculations, laboratory simulations, and material development enables customized, noise-isolated sealing systems.
• Universal applications in plastic, aluminum, and stamped steel cam covers
• Sealing system and isolating system from one source—optimally adapted to each other
• Materials adapted precisely to the respective application for maximum reliability

Cam cover gasket with elastomer-overmolded steel carrier for cam covers made of aluminum, magnesium, and steel.

Elastomer gasket for three-dimensional flange geometry and isolating system.

Non-noise-isolated
• Economical sealing solution for cam covers made of plastics, aluminum, magnesium, and steel
• Variety of systems enabling optimum adaptation to the installation space in each case
• Integration of additional component functions

Cam cover gasket with integrated cable duct.
**Intake manifold gaskets**

- Available for gasoline and diesel engines
- Noise-isolated and hard-mounted versions possible
- Various designs depending on the material of the intake and the installation environment
- The heat-resistant and fluid-resistant properties of the materials enable their uncompromisingly reliable use at usually high exhaust gas recirculation rates and also in combination with intake fuel injection systems

**Cam cover gaskets**

*Noise-isolated*

Engine noise can be reduced effectively by the elastic isolation of resonant bodies, such as cam covers, intake manifolds, and oil pans. In doing so, the conflicting requirements and characteristics of the components must be combined in the isolating system: the increased damping effect of an isolating element and the increased sealing force of the elastomer gasket. The quiet solution by ElringKlinger: noise-isolated sealing systems. Precisely designed right down to the last detail.
Materials expertise. Elastomers of the finest quality.

Engineering service

ElringKlinger determines the best possible gasket design for each application with respect to material, profile geometry/design of the sealing system.

Identification of thermodynamic characteristics

Elastomers must provide a reliable sealing performance for a wide range of engine operating conditions. At an operating temperature of -40°C and at 150°C alike, regardless of the extent of the dynamic sealing gap movements.

Material tests

In order to guarantee the sealing performance of ElringKlinger materials throughout the service life of the components, tests have been established that make it possible to predict the sealing behavior of our components depending on their lifetime, temperature, and the dynamics of the sealing system. These results are also processed further in our FEM analyses.
Elastomer materials

As elastomer materials for sealing systems, ElringKlinger exclusively uses in-house developments, which are optimized to special customer requirements. Specialization in high-performance materials emphasizes the systems expertise in sealing systems for engine and transmission applications.

Overview of elastomer materials

Elastomer selection based on oil and temperature resistance.

<table>
<thead>
<tr>
<th>Abbreviation (ISO 1629)</th>
<th>FPM</th>
<th>MVQ</th>
<th>MFQ</th>
<th>ACM</th>
<th>AEM</th>
<th>EPDM</th>
<th>ECO</th>
<th>HNBR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical term</td>
<td>Fluorocarbon rubber</td>
<td>Silicone rubber</td>
<td>Fluorocarbon silicone rubber</td>
<td>Polyyacrylate rubber</td>
<td>Ethylene polyacrylate rubber</td>
<td>Ethylene propylene diene rubber</td>
<td>Epichlorhydrin rubber</td>
<td>Hydrated nitril rubber</td>
</tr>
<tr>
<td>Range of applications</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>o</td>
<td>0</td>
</tr>
<tr>
<td>Fuel</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Coolant</td>
<td>+</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Oil</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Thermal application</td>
<td>-60 to +230°C</td>
<td>-70 to +200°C</td>
<td>-70 to +180°C</td>
<td>-40 to +160°C</td>
<td>-40 to +160°C</td>
<td>-50 to +150°C</td>
<td>-60 to +120°C</td>
<td>-30 to +150°C</td>
</tr>
<tr>
<td>Product examples</td>
<td>CHG intake area</td>
<td>CHG special applications</td>
<td>CHG special applications</td>
<td>Oil pan, cam cover</td>
<td>Oil pan, cam cover</td>
<td>Water pump</td>
<td>Special applications in the fuel system</td>
<td>Special applications</td>
</tr>
</tbody>
</table>

+ well suitable / o suitable / - unsuitable / CHG = cylinder head gasket

Temperature resistance

Better cold flexibility

Better resistance to fuels/oils

Temperature resistance

Oil resistance

[Diagram showing temperature resistance and oil resistance for different elastomer materials]
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