Elrotherm® shielding systems.

Thermal and acoustic protection for high functional reliability, more comfort, and fewer emissions.
ElringKlinger—present in automotive markets

Canada Leamington | USA Livonia · Branchburg | Mexico Toluca | Brazil Piracicaba | Germany Dettingen/Erms · Langenzenn · Runkel · Dettingen/Erms · Langenzenn · Runkel · Dettingen/Erms · Langenzenn · Runkel
Spain Reus | Italy Mazzo di Rho | South Africa Johannesburg | People’s Republic of China

Cylinder head gaskets | Specialty gaskets | Housing modules | Topographic housing components | Shielding systems | Transmission applications

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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.
In modern motor vehicles, thermal and acoustic shielding systems assist in increasing functional reliability, comfort, and environmental protection.

The requirements placed on shielding systems are increasing constantly and so is the number of application areas.

Indeed, modern techniques for heat management are becoming increasingly complex: catalyst technology, exhaust gas turbocharger, minimum cooling air flows, compactly installed aggregates, consumption-oriented engine management, and engine encapsulation lead to high temperatures in the engine compartment and on the vehicle underbody. At the same time, there is an increasing number of heat-sensitive components such as electronic control units, plastic parts, rubber gaskets, power-steering pump, air-conditioning compressor, generator, starter, as well as fuel and brake fluid lines, all of which need to be protected from excessive heat. This calls for high-performance heat shields that carry out these “hot” tasks in the engine reliably: Elrotherm® shielding systems from ElringKlinger.

**Elrotherm®.**

**Protective shields against heat and noise.**

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**Protection that can be seen and heard.**

Noise reduction and aerodynamics are also increasingly gaining in importance—a decisive contribution toward enhanced driving comfort and environmental protection.

An attractive component design and appearance as well as functionality are all important aspects of the design of modern vehicles and their engine compartments. That is why we customize our shielding systems according to the specific customer requirements, providing the systems with the required surface quality.
A variety of additional functions can be integrated by adding components such as gaskets or fastening and connecting elements.

With Elrotherm®, ElringKlinger has an individual product solution ready for each application, finely tuned to the given surroundings: This product solution is composed of a wide variety of metals, with or without insulation layers, and in combination with plastic or fiberglass cloth, etc. Elrotherm® shielding systems are used wherever thermal and/or noise protection is required, for example, around the engine and the exhaust system, on the vehicle floor, and on the steering gear and transfer case.

The advantages of Elrotherm® at a glance:

- High temperature resistance
- Good acoustic shielding effect
- Durability
- Long-term resistance to aggressive media such as oil, fuel, coolants, and cleaning agents
- Corrosion resistance
- Multifunctionality thanks to the integration of build-on parts
- Less weight/lightweight construction
- High dimensional stability
- Freedom of design (shape, color, and structure)
- Attractive appearance/visual shield
- Recyclable
- Easy to install
**Six Elrotherm® systems.**
Always the right solution.

As an experienced and innovative development partner and series supplier, ElringKlinger provides tailor-made shielding parts for the entire vehicle. The choice of the six Elrotherm® construction types used—ML, Light, Acoustic, D, SL or Tex—depends on the specific requirements in terms of thermal and noise protection as well as design. Materials and shape are then adapted to best meet the requirements of the individual application.

### Comparison on ElringKlinger shielding systems

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<thead>
<tr>
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<th>ML</th>
<th>Light</th>
<th>Acoustic</th>
<th>D</th>
<th>SL</th>
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<tbody>
<tr>
<td>Temperature shielding</td>
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<td>Noise reduction</td>
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<td>Weight reduction</td>
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<td>Durability</td>
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<tr>
<td>Recyclability</td>
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<td>Operating efficiency</td>
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</tr>
</tbody>
</table>

+++ Very good  ++ Good  + Sufficient  – Negative

**Elrotherm® for exhaust systems: maximum protection.**

The exhaust area of a vehicle is required to meet stringent demands with respect to thermal and noise protection as well as reduction in harmful emissions. In close cooperation with car manufacturers, ElringKlinger’s sophisticated solutions for shielding systems contribute toward meeting ever stricter global legal requirements.

In addition to Elrotherm® systems, which are used exclusively as thermal protection, combined systems for acoustic and thermal shielding are increasingly being used in modern exhaust systems. Thus, for example, manifold and turbocharger shielding parts of the Elrotherm® Acoustic and Elrotherm® D construction types firstly contribute toward reaching the high temperatures in the exhaust area that are required for the optimum functionality of the catalytic converter. Secondly, they absorb the noise resulting from the vibrations of build-on components—without compromising on durability and recyclability.

Environmental protection is of utmost importance at ElringKlinger. Our development process is therefore geared continuously toward solutions, which support processes in exhaust systems to further reduce emissions.
Elrotherm® ML

Properties
- Average thermal shielding effect 93%
- Materials joined by flanging the edges (flanging)
- Combines high drawability during production with good thermal and acoustic insulating effect

Range of applications
This material combination is used in the majority of applications.

Temperature range of operation
Up to 1100°C.

Material structure of Elrotherm® ML
(ML = multi-layer).

Elrotherm® Light

Properties
- Average thermal shielding effect 96%
- Materials joined by flanging the edges
- Weight reduction
- Use of stainless steel enables high temperatures

Range of applications
High-temperature applications and wherever weight reduction is required due to the dynamic characteristics.

Temperature range of operation
Up to 1100°C.

Material structure of Elrotherm® Light.
Elrotherm® Acoustic

Properties

- Average thermal shielding effect 95%

- Elrotherm® Acoustic 1
  Composite of the materials created by means of a viscoelastic intermediate layer (bonding effect)
  - High degree of deformation
  - Reduction in tool costs
  - High thermal protection in the intermediate temperature range

- Elrotherm® Acoustic 2
  ML (multi-layer) structure with heat-resistant and acoustically extremely effective inner layer
  - Very effective in absorbing sound energy generated
  - High damping of structure-borne noise
  - High thermal protection at high temperatures

Range of applications
Wherever high requirements are placed on heat management and acoustic management.

Temperature range of operation
Up to 1100°C.
Elrotherm® D

Properties
• Average thermal shielding effect 93%
• Aluminum-coated silicate nonwoven; permits direct contact with the surface of the component to be protected
• Better acoustic absorption with constant thermal protection

Range of applications
Wherever high requirements are placed on thermal and acoustic management, as well as in areas where protection is recommended for components.

Temperature range of operation
Up to 1100°C.

Material structure of Elrotherm® D
\(D = \text{Direct shielding} \)

Elrotherm® SL

Properties
• Average thermal shielding effect 85%
• Low manufacturing costs
• Special dimpled structure of the material used
  - minimizes the risk of structure-borne noise being generated
  - increases component stiffness, i.e., weight reduction enabled by saving on material
• With safety edge

Range of applications
Primarily for low-temperature applications, for example, in the underbody or in areas requiring lesser thermal shielding.

Temperature range of operation
Up to 1100°C.

Material structure of Elrotherm® SL
\(SL = \text{single-layer} \)
Elrotherm® Tex

Properties

• Average thermal shielding effect 92 %
• Fiberglass matt with vacuum-metalized coating; permits direct contact with component surface

Range of applications

• Shielding of the component requiring protection (not the heat source itself); also applicable as an additional protective measure
• Heat-sensitive components (e.g., cable) can be fully enclosed
• Combination with other Elrotherm® products possible

Temperature range of operation

Up to 480°C.

Material structure of Elrotherm® Tex.
**Multifunctional shielding systems.**

**Extras included.**

In vehicle and engine development, it is becoming ever more common for various individual components and functions to be integrated into one element. The limited amount of space available resulting from the highly compact installation of aggregates can thus be optimized. With Elrotherm®, ElringKlinger provides progressive shielding systems, in which numerous build-on parts and additional functions can be integrated. The possibilities include:

- Gasket
- Intake air pre-heater
- Isolating elements
- Cable clips
- Sliding seats
- Fastening and connecting elements
- Brackets for adjacent components
- Bolts
- Thread inserts
- Labeling (barcodes, imprints)

**The advantages**

- Reduction of development times and costs by means of simultaneous engineering of all components
- 100% function and quality controls
- Simplified logistics due to reduced number of parts
- Economy of time during assembly

*Multifunctional shielding of the manifold and turbo area.*
**Thermal shielding.**
The solution for “hot” tasks.

The high thermal insulating effect of Elrotherm® is the result of the low heat transition, the maximum permissible temperature range of operation, and the heat reflection by the shiny metallic component surfaces. As can be seen in the adjoining figure, Elrotherm® ML (multiple metal layers, sandwich design) helps improve the heat insulation by approximately 65% compared to Elrotherm® SL (single metal layer). This means that the heat source can be about 200°C hotter and the surrounding components can still maintain the same temperature level.

If required, the actual area situation is reproduced in the development phase on a project-by-project basis.

**Heat conductivity**

Heat conductivity $\lambda \ (W/m\cdot K)$ is an equivalent measure of heat transition. Compared to pure sheet metal, Elrotherm® ML is 160 times more effective in this regard.

**Surface temperatures**

Depending on the required temperature resistance, various metal covers are used for Elrotherm® shielding systems. At 1100°C, stainless steel offers the maximum value and is therefore used in particularly compact installation areas, e.g., in heat shields for exhaust manifolds.
Acoustic shielding. Silently good.

In addition to providing thermal protection, an essential task of shielding systems involves the reduction of noise emissions, thus further enhancing driving comfort as well contributing actively toward environmental protection. An important criterion in this context constitutes the development of the shielding part such that it is able to absorb airborne sound generated by other components, without causing any noises of its own. In addition to Elrotherm® ML in sandwich design comprising a soundproofing insulation layer, Elrotherm® Acoustic also ensures excellent silencing by means of a special, high-temperature resistant, and acoustically highly effective intermediate layer. Due to the surface coating of the needle-punched nonwoven, Elrotherm® D can even come in direct contact with the component to be shielded without turning into a sound source itself.

Absorption coefficient

The absorption coefficient $\alpha$ is an important factor for evaluating the acoustic properties of a shielding part. It indicates the ratio of the sound energy absorbed by a material to the occurring sound energy. Elrotherm® Acoustic makes it possible to achieve an absorption coefficient of 0.9 and thus absorb 90% of the occurring sound energy.

Loss factor/material damping value

The loss factor $\delta$ describes the damping value specific to materials. It is a parameter for the absorption of structure-borne noise and vibrations in materials and components. Elrotherm® Acoustic makes it possible to achieve damping values that are 2.5 times higher than those achieved with Elrotherm® ML and even 400 times higher than those achieved with Elrotherm® SL.
Engineering. Thinking ahead.

The pace is increasing and so are the challenges. We therefore rely on direct channels and combine our development expertise in the area of shielding technology. Product managers, product designers, tool engineering, and quality management work hand in hand as a project team. Just as is intended in the APQP process. The production process is carried out in a number of locations throughout the world. Here too, we can cater to customer requirements specifically. The advantages: clear responsibilities, promptness, flexibility, the best quality, and all-around service.

Our specialists are constantly working on new technologies and innovative product solutions for the vehicle generations of tomorrow. In close consultation with our customers. Around the globe. Thanks to the collaboration with the central R&D services of the ElringKlinger Group, we can make use of synergies, profiting from the engineering expertise and the know-how that extends across many fields.
Knowing in advance what will happen later.

Even before prototype manufacturing, we take into account all conditions, which can occur on the actual shielding system and its surroundings. The resonance frequencies and their modes, and the acoustic behavior are simulated. The latter includes the calculation of acoustic pressure distribution and acoustic power, the aerodynamics of the shielding part, and the temperature distribution on the surrounding components as well as the pressure generated by the airstream on the individual components.
Developing success. Step by step.

Product design to meet customer specifications
The exact description of the individual parameters (temperature range of operation, static or dynamic stress) enables us to choose the best solution and the best materials to be used.

Product development
• Product design using UG, Ideas, ProE, and Catia
  The same CAD systems are used for the design process as are used by the customers. In this way, delays caused by interfaces are avoided, thus enhancing efficiency. Data transfer is carried out online.
• FEM calculations
  Modal analysis, tension analysis (as an answer to forced vibrations), and optimization of topography are carried out.
• NVH calculations
  The modal analysis and modal-based frequency response analysis are performed. Structurally dictated noise emission is determined with the help of the indirect boundary element method (iBEM). The optimization of topography is carried out as well.
• CFD calculations
  The aerodynamics of the shielding part in its surroundings, and its position within the air flow, are simulated. We also calculate the expected temperature distribution on each surrounding component.
• Rapid prototyping
  Plastic prototype parts based on CAD data are manufactured without using any tools for the cost-effective, short-term inspection of the dimensional fitting accuracy.

Manufacturing of functional prototypes
Manufacturing of close-to-production prototype parts using prototype tools.

Testing on test benches
Durability testing of prototype and series production parts on dynamic shaker test benches.
**Expertise and responsibility.**
For the entire system.

For ElringKlinger, delivery expertise means: We take on system responsibility and are a one-stop source for reliable solutions. From development through production and pre-assembly of build-on components, to the automated function and quality control and the just-in-sequence delivery of ready-to-install shielding systems, to the production line of the customer.

In the development phase, we work using state-of-the-art tools such as FEM analyses, 3D CAD systems, various testing and simulation methods—e.g., using hot gas generator or shaker—as well as rapid prototyping. All of this reduces the development times and costs.

Elrotherm® shielding systems are produced in state-of-the-art assembly cells and manufacturing centers—rapidly, at minimum costs, and with the best possible quality. Fully-automated press lines ensure that the production process is exceptionally efficient, both for large and small-scale production. Quality is controlled online directly during the production process via a camera system.

**Experience mobility.**

Top quality and active environmental protection are the prerequisites for the sustainable success of ElringKlinger on the market. This is based on our quality and environmental management system, certified in accordance with ISO TS 16949:2002 and DIN EN ISO 14001. We strive to help make mobility as efficient, safe, comfortable, and environmentally-friendly as possible.
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