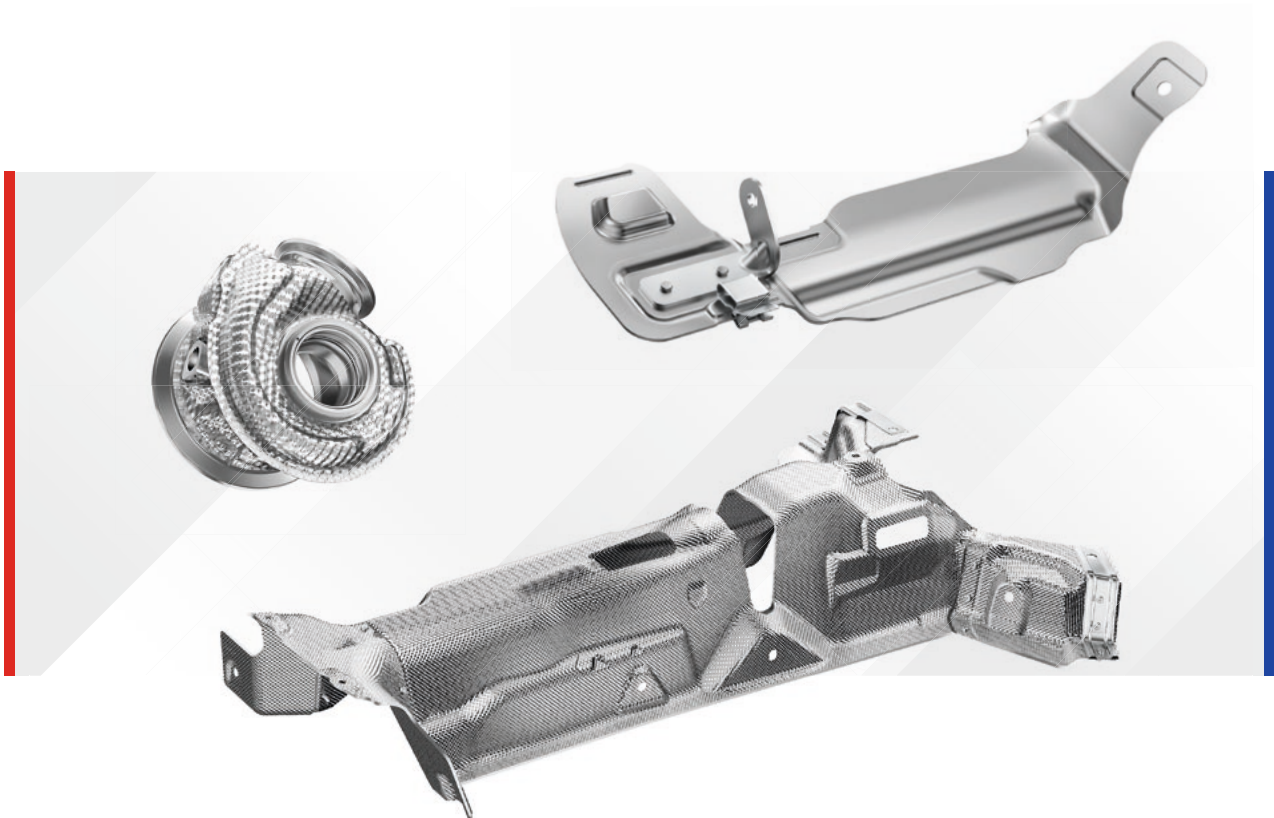


EXPERIENCE MOBILITY

ELROSHIELD™ SHIELDING SYSTEMS.

THERMAL AND ACOUSTIC MANAGEMENT FOR THE ENTIRE VEHICLE.



SYSTEM PARTNER. PROBLEM SOLVER. PIONEER.

SHAPING THE FUTURE. WITH ELRINGKLINGER.

For us, system expertise means being a pioneer, creating freedom and reaching goals faster. With our portfolio, we offer groundbreaking solutions for all vehicles, whether traditional, hybrid or pure electric.

Proximity to the customer, developing visions, overcoming challenges and driving forward innovations: Those are our key strengths, that's what has made us what we are today.

YEARS LEADING THE WAY



140

Nothing can replace experience combined with innovative spirit. ElringKlinger has plenty of both. In 1879, Paul Lechler founded a trading company for technical products, which would later become ElringKlinger AG. Today, we are a global player offering future-proof solutions for all drive types in all product areas. We also demonstrate our strengths in other industrial sectors. Proximity to the customer, developing visions and overcoming challenges are some of our key strengths. For over 140 years.

4

STRATEGIC
KEY AREAS

Alternative drive technologies, lightweight engineering concepts, new forms of mobility, sustainability and climate protection: The transformation process in the automotive industry is in full swing. The agenda for the future is clear. We are also working every day to play our part and push the limits of what is possible. We are focusing on four strategic fields: Electromobility, lightweight construction for all drive types, traditional mobility and non-automotive. Together with our customers, we are already finding answers to the questions of the future. And successfully driving forward innovations.

10,000

EMPLOYEES AS PARTNERS

For our customers, we are a strong and reliable development partner and series supplier with unique expertise. We are a pioneer and companion. From the idea to the finished product. Whether electromobility, lightweight engineering, gasket and shielding technology, tool technology or engineering services – ElringKlinger impresses with the highest quality, reliability and performance. Around 10,000 employees are committed to achieving this at 45 sites worldwide.

SHIELDING SYSTEMS

ELROSHIELD™ SHIELDING SYSTEMS KEEP HEAT AWAY AND ABSORB SOUND.

Space is limited in the engine compartment of modern vehicles. Tightly packed assemblies, engine encapsulation, catalytic converter technology, and turbochargers lead to high temperatures. Minimal cooling air flows do not help to significantly reduce temperatures in the engine compartment, the underbody area, or the exhaust system.

GREATER DEMANDS ON SHIELDING SYSTEMS

Smart temperature management. That's what it's all about. The focus is on intelligent solutions designed to ensure that all engine and exhaust systems operate reliably, other temperature-sensitive components are protected from heat, and increasingly stringent noise protection requirements are met to the greatest extent possible. ElringKlinger shielding systems are engineered to deliver on all counts. At the same time, they contribute to increased comfort and environmental protection.

Shielding system for the underbody



Completely recyclable underbody shielding, microperforated



Underbody shielding with multilayer insulation package



Shielding system for the underbody, length 1.50 m



STATE-OF-THE-ART SHIELDING FROM ELRINGKLINGER

As a technology leader and a key manufacturer of shielding parts, ElringKlinger can offer the right solution for a wide application temperature range. We develop high-quality shielding systems that meet the increasingly stringent statutory specifications around the globe.

ENGINE ENCAPSULATION

GOOD WORK CLIMATE GUARANTEED.

It sounds contradictory: temperature-sensitive components have to be protected from high temperatures, while the exhaust gas temperature also has to be prevented from dropping too sharply. By sheathing components with ElroShield™ shielding systems, this dual thermal management requirement can be met in full.

OPTIMUM EXHAUST AFTERTREATMENT ENSURED

Thanks to an ingenious material combination and a design tailored to the application, ElroShield™ direct shielding systems efficiently and reliably handle every aspect of thermal management – besides reducing noise. They ensure the best possible temperature for efficient exhaust aftertreatment. Cold start phases are also shortened, so the components reach their ideal operating temperature faster. That saves fuel and additionally reduces emissions. Therefore, our systems make a measurable contribution to environmentally friendly driving.

Direct shielding for oxidation catalytic converters



CATALYTIC CONVERTER ENCAPSULATION WITH ELROSHIELD™ D



LIGHTWEIGHTING

EFFICIENT SOLUTIONS, LIGHTWEIGHT DESIGN.

One of ElringKlinger's focuses is on lightweight constructions for exhaust systems, underbodies, and underhood protection systems. By specifically using materials of low density and thickness, we actively contribute to the sparing use of resources and to environmental protection.

INTELLIGENT RAW MATERIAL SAVINGS

The weight of components can be reduced through specific material selection – making vehicles lighter and therefore improving their fuel economy. This leads to highly efficient lightweight design solutions for all applications across the entire ElringKlinger shielding technology product portfolio. Even when things get really hot, we consume fewer raw materials during production. Shedding weight leads to lower fuel consumption and consequently reduces pollutant emissions.

ACOUSTICS

RELIABLE MULTITASKING IN TERMS OF HEAT AND NOISE.

Shielding heat and absorbing noises. Combined systems that deal with both aspects at the same time are increasingly in demand in modern exhaust systems and vehicle underbodies: ElroShield™ shielding systems fulfill these tasks effortlessly.

SHIELDING PARTS ALSO ABSORB SOUND

ElringKlinger ElroShield™ M and ElroShield™ D shielding parts for manifolds and turbochargers are a prime example: they reduce heat loss and therefore ensure that the catalytic converter's optimum operating temperature range is reached as quickly as possible in the exhaust system. At the same time, they protect surrounding temperature-sensitive components from excessive thermal loads and absorb the sound produced by add-on assembly vibrations. Shielding systems therefore contribute extensively to improving the vehicle's acoustic emissions as a whole.

Highly efficient underbody shielding



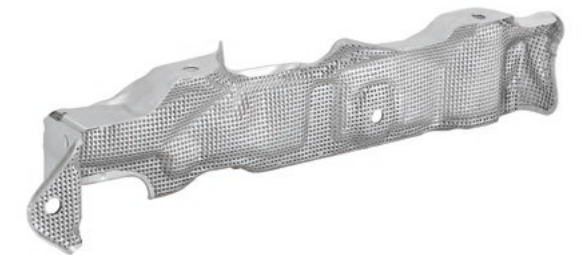
Lightweight underbody shielding with optimized material thickness



Underbody shielding with highly effective absorber system



Acoustically effective exhaust manifold shielding



ELROSHIELD™ D SHIELDING SYSTEMS

EXACTING STANDARDS FOR DIRECT-CONTACT SOLUTIONS.

The ElroShield™ D series is used whenever particularly high demands are placed on thermal and acoustic management. These direct shielding systems consist of a flexible insulating layer with direct contact to the component requiring protection.

FOR A CONSISTENTLY HIGH EXHAUST GAS TEMPERATURE

Glass and silicate fiber nonwoven materials are used here, for example, depending on application temperature. This is encompassed by a metallic outer layer whose surface structure is adapted to the customer's requirements.

Besides directly protecting the component, this also maintains the enthalpy in the system. Directly shielding the manifold, turbocharger, and catalytic converter therefore helps to consistently achieve and maintain the optimum exhaust gas temperature required for catalysis.

COMPONENT SOUNDPROOFING INCLUDED

Another advantage is the additional soundproofing of the components that are exposed to high temperatures as well as the absorption of the noise caused by add-on assembly vibrations.

ElroShield™ D series shielding systems therefore offer optimum shielding solutions for the vehicle's entire exhaust system.



ELROSHIELD™ D

ADVANTAGES:

- + High noise reduction in the near-field area of the sound source and of ambient noises
- + No generation of inherent noise even in the event of direct contact
- + High thermal and acoustic insulation
- + Low specific weight

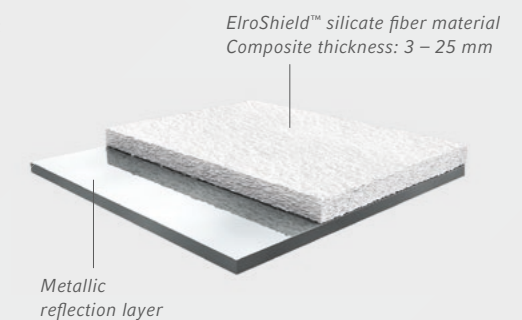


APPLICATION AREAS:

Wherever the demands placed on thermal and acoustic management are high and in areas in which consistent system temperatures are needed.

MATERIAL STRUCTURE:

ElroShield™ D
(D = direct shielding)



ELROSHIELD™ D EXHAUST GAS SYSTEM WITH DIRECT INSULATION



ELROSHIELD™ M SHIELDING SYSTEMS

TAILORED FOR RELIABLE SHIELDING.

The ElroShield™ M series from ElringKlinger is not only applied in the automotive sector. The variability of these products enables us to accommodate individual customer wishes and offer solutions for a wide range of industries.

FOR APPLICATIONS IN DIVERSE TEMPERATURE RANGES

The use of different materials provides the basis for applications in high and low temperature areas. Insulation materials such as silicate fiber nonwovens or specially developed ElroTherm™ (Eco & Pro) insulating layers can be selected depending on the field of application. The folding over of the outer layer, referred to as flanging or crimping, leads to a safety edge and closes the multilayer system so that the insulating layer placed between the materials is fixed in position.

MATERIAL COMBINATIONS CONTRIBUTE TO WEIGHT REDUCTION

By specifically selecting light metals, a material combination resulting in reduced vehicle weight thanks to its lower mass can be defined in cooperation with the OEM, thus achieving a positive effect in terms of consumption and exhaust emissions.

INDIVIDUAL SOLUTIONS FOR INDIVIDUAL ACOUSTIC REQUIREMENTS

To meet ever increasing specialist requirements in the field of acoustics, ElringKlinger will define – in coordination with the customer – a tailor-made material combination that ensures maximum sound absorption. Options for this include the use of various perforations – over the entire surface or in specific areas – through which the sound enters and is then absorbed in the underlying insulation layer. Dimpled material layers can also help to specifically reduce the noises that occur.

ELROSHIELD™ M WITH DIMPLED STRUCTURE



ELROSHIELD™ M

ADVANTAGES:

- + Connection of the materials by folding over the edges (flanging)
- + Very good sound absorption and structure-borne sound insulation
- + Combines good thermal insulation with highly effective acoustic shielding
- + For new and further developments, the acoustic behavior of shielding parts can be simulated and tested for innovative solutions on request
- + Defined effective frequency range adjustable
- + Absorber material freely selectable depending on thermal requirement,
- + e.g. ElroTherm™ V (nonwoven) or ElroTherm™ Eco / ElroTherm™ Pro (insulating paper)
- + Dirt and moisture ingress is prevented by integrating the additional membrane film

APPLICATION AREAS:

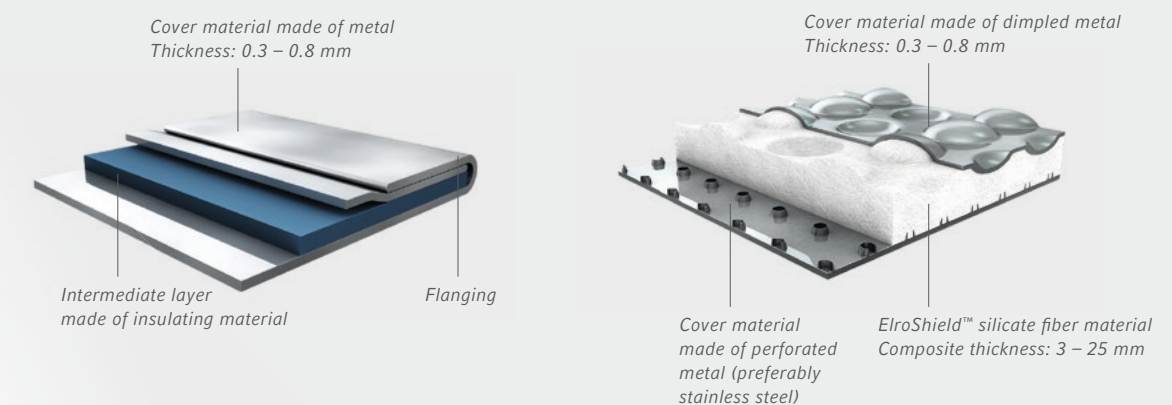
For stringent requirements relating to heat and noise management, specially developed for the area around the engine.

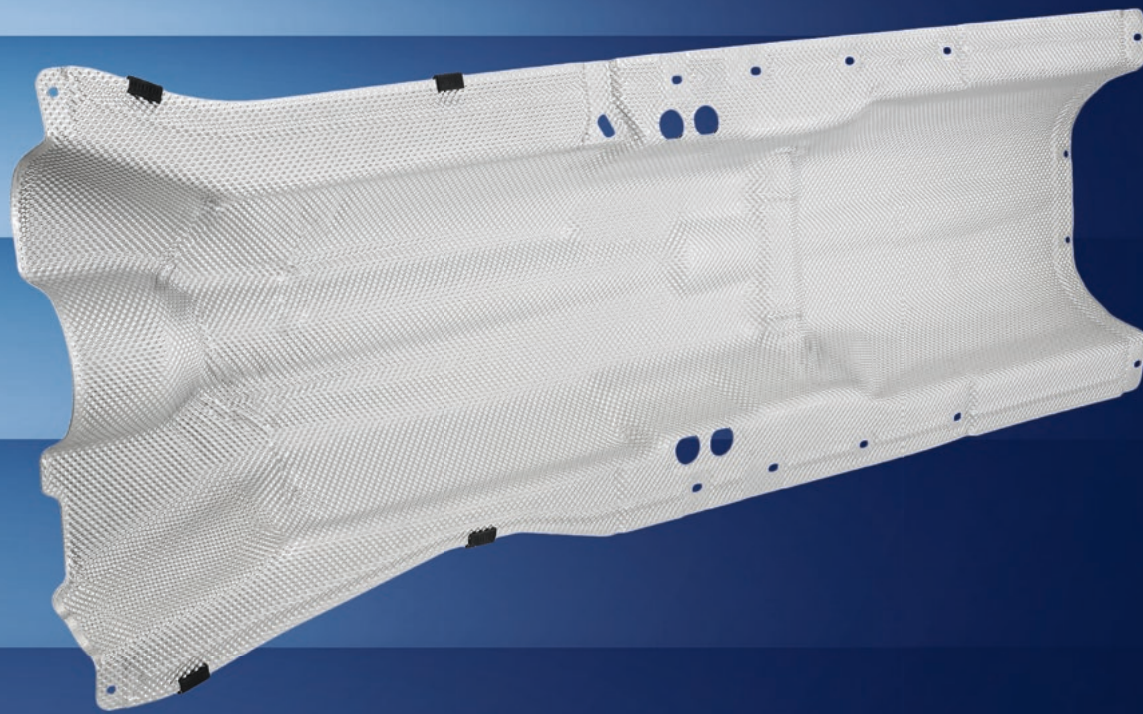
MATERIAL STRUCTURE:

Multilayer, with dimpled inner or outer layer, perforated inner layer and optimized structure. Additionally: possible integration of a micro-perforated aluminium membrane film around the insulating material.

MATERIAL STRUCTURE:

ElroShield™ M





ELROSHIELD™ S
AS WI TUNNEL IN THE UNDERBODY

ELROSHIELD™ S SHIELDING SYSTEMS

WHEN THINGS ARE A LITTLE LESS HEATED.

ElroShield™ S series shielding systems are primarily used in applications with lower thermal shielding requirements.

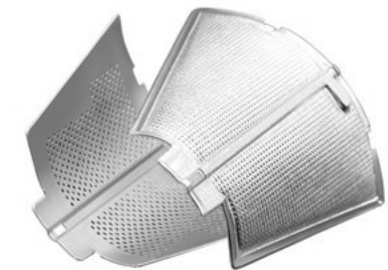
SPECIAL DIMPLED STRUCTURE ENSURES ADDED VALUE

As a single-layer design, the used raw materials are usually embossed before being formed in the tooling. This firstly increases the component's stiffness, enabling weight reduction via using thinner materials, and secondly, it reduces the tendency for structure-borne noise. Further possible variants include flanging as a safety edge, perforation of the material, and the assembly of additional add-on components.



GOOD SERVICE NOT ONLY ALONG THE UNDERBODY

ElroShield™ S is typically used in the underbody area, partly in underhood applications, but also for electromagnetic shielding.



ELROSHIELD™ S

ADVANTAGES:

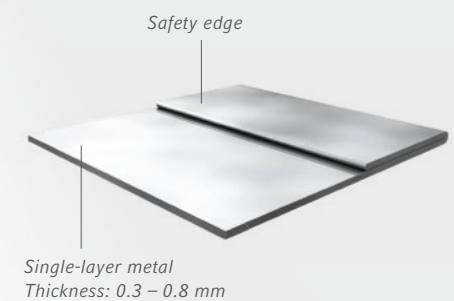
- + Special dimpled structure of the raw material minimizes the tendency for structure-borne noise and increases component stiffness, i.e. weight reduction is possible because less material is used
- + With safety edge
- + Low production costs

APPLICATION AREAS:

Used primarily in areas with lower thermal requirements, e.g., in the underbody area.

MATERIAL STRUCTURE:

ElroShield™ S
Single layer



SHIELDING SYSTEMS WITH ADDITIONAL FUNCTIONS

SHIELDING SYSTEMS WITH ADDED VALUE.

Installation space is limited. Things are not only becoming increasingly tighter in the engine compartment. The high packing density of assemblies and similar units necessitates a new approach in order to make the best possible use of the available space: the combination of various individual parts and functions in a single component.

MORE THAN THE SUM OF ALL PARTS

ElringKlinger offers innovative shielding systems that enable the integration of numerous additional functions. For instance gaskets, cable clips, fasteners, and connectors can be integrated into compact functional units.



ADVANTAGES:

- + Integration of individual components into one system
- + Reduced development times and costs thanks to simultaneous engineering for all components
- + Simplified logistics due to the reduced number of add-on parts
- + Time saving during assembly
- + High cost effectiveness

Shielding part with integrated fasteners for an air cooler module



Turbocharger shielding with integrated gasket



Spare wheel shielding with integrated bracket



Catalytic converter shielding from the engine block with integrated gasket



Shielding with integrated vibration decoupling elements



Shielding with integrated cable routing



SHIELDING SYSTEM ENGINEERING

THINKING AHEAD IN CLOSE DIALOG.

Challenges in automotive development are increasing. Development cycles are becoming shorter. Increasingly complex correlations making integrated developments more important. ElringKlinger has a proven track record of implementing direct ways of communication and integrated processes.

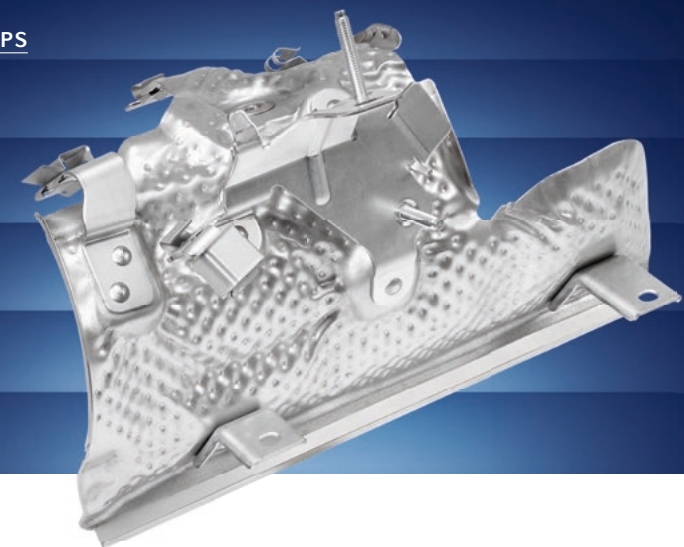
EXPERIENCE THAT PAYS OFF

The ElringKlinger center of excellence for thermal and acoustic shielding technology has acquired valuable experience over a number of years. Today, we are therefore able to offer integrated system solutions that are precisely tailored to a specific requirement profile in technical, commercial, and ecological terms. In doing so, we always keep sight of the big picture. From conception to testing. From the prototype to the start of production.

OPTIMUM USE OF SYNERGY EFFECTS

Equipped with the latest development tools, our specialists are constantly developing new technologies and innovative product solutions for the vehicle generations of the future in close dialog with our customers around the globe. By collaborating with the ElringKlinger Group's central R&D services, we use synergy effects and benefit from technological expertise and multi disciplinary know-how.

ELROSHIELD™ M COMPLETED WITH TEMPLES AND CLIPS



SOUND DESIGN OF SHIELDING SYSTEMS

OPTIMIZATION POTENTIAL THAT ATTRACTS ATTENTION.

Thermal shielding parts pass their first stress test during the early phase of development. The very first design draft is checked regarding its applicability and our experts conduct extensive noise, vibration, and harshness (NVH) tests.

SOUND DESIGN IMPROVES PRODUCT QUALITY

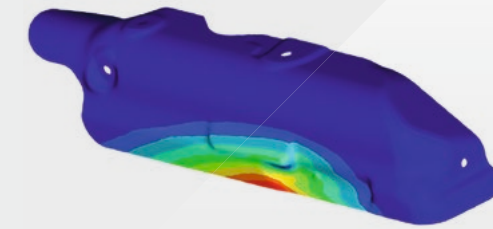
The NVH behavior of the engine and the vehicle as a whole is an important criterion in the development of automotive components. Based on the FEM calculation for the component (see "Good to know"), its NVH behavior can also be analyzed and improvement potential determined during the development phase. This pays off because the acoustically effective materials and designs used in vehicles have a significant influence on comfort and the product quality perceived by the customer.

SHIELDING SYSTEM WITH ACOUSTIC EFFECTIVENESS

On request, our shielding technology experts give consideration to all of the conditions that can occur within the real shielding system and in its environment prior to prototype production. For instance, the resonant frequency and its modes are simulated and the shielding part's beading is optimized based on the ERP method used to determine the maximum emitted sound power. After testing and optimizing other important factors, this leads via acoustic simulation to a tailor-made shielding system meeting the customers requirements and reducing sound emissions as an additional function.

GOOD TO KNOW

The finite element method (FEM) is used for computer-aided simulation of the subsequent operation and to analyze the points at which the component is particularly stressed. Based on the results, the shape, surface topography, and connection are optimized and implemented in the CAD model.

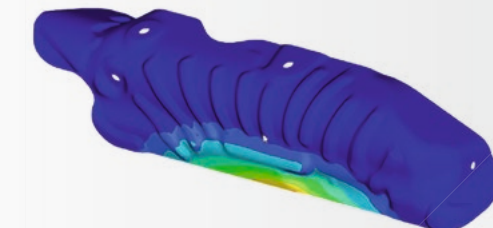


Basic design

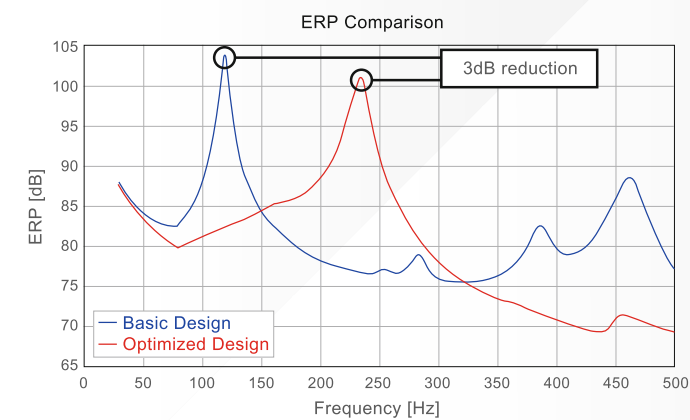


SOUND DESIGN

MATERIAL OPTIMIZATION
+
GEOMETRY OPTIMIZATION
=
ACOUSTICALLY OPTIMIZED COMPONENT



Design after bead optimization



The amplitude of the natural frequency is reduced in the bead optimized model, as a result of which the sound pressure level is also lower (see figure).

DECOUPLING ELEMENTS

VIBRATIONS ON THE TEST BENCH.

The vibration behavior of vehicle components is a central part of the development work in the automotive industry. In the vehicle environment, vibrations are caused by the engine or the road surface, for instance.

INCREASING LIFETIME WITH LESS NOISES

The transmission of vibrations to the shielding system via the vehicle structure can lead to mechanical component failure due to cracking, for example, or to noise emissions. The classic shielding system is usually joined to other components using rigid threaded connections. As a result the entire structure-borne sound energy is transmitted. To reduce vibrations, ElringKlinger uses decoupling elements for passive and elastic mounting of the shielding system.

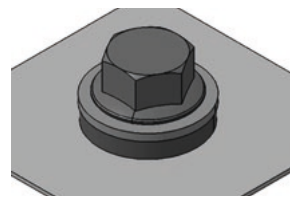
ELASTIC AND DAMPING ELEMENTS

Essentially, decoupling elements are spring/damper systems that are comparable with a vehicle's shock absorbers. These are also equipped with elastic and damping components that isolate the shielding system from any excitation. As a result of this, decoupling elements reduce the stresses in the shielding part, thus enabling a weight- and cost-optimized metal sheet thickness. This reduced structure-borne sound transmission also results in less air-borne sound emission, thus improving acoustics.

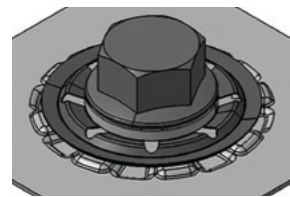
MODAL AND FREQUENCY RESPONSE ANALYSIS

To characterize the decoupling elements, ElringKlinger's shielding technology experts determine the elementary technical parameters at component level on an experimental test bench. These are implemented at system level in the simulation model for modal and frequency response analysis. Just before the first prototypes are being produced, the critical areas with high loads in the shielding systems are identified based on the calculation of vibration and stress amplitudes, Accordingly the design will be optimized.

Wire mesh decoupling element



Spring washer decoupling element

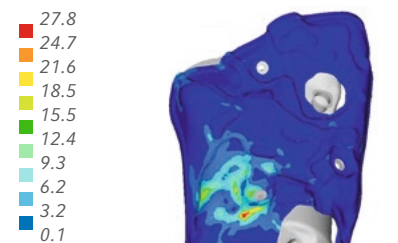


GOOD TO KNOW

ElringKlinger offers individual solutions for improving the NVH behavior and offers various patented concepts relating to decoupling elements.

Calculation of stresses

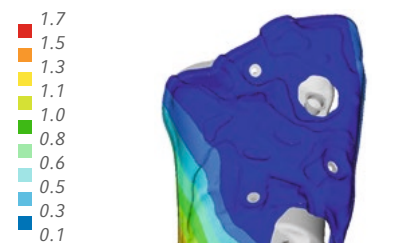
Contour Plot Element Stresses (2D)
(Von Mises Stress) Simple Average



Local Max = 27.8
Grids 80095
Local Min = 0.1
Grids 74314

Calculation of vibration amplitudes

Contour Plot Displacement (Mag)
Analysis system



Local Max = 1.7
Grids 73681
Local Min = 0.1
Grids 82337

AIR FLOW AND TEMPERATURE SIMULATION

THERMAL INSULATION – MORE THAN JUST HOT AIR.

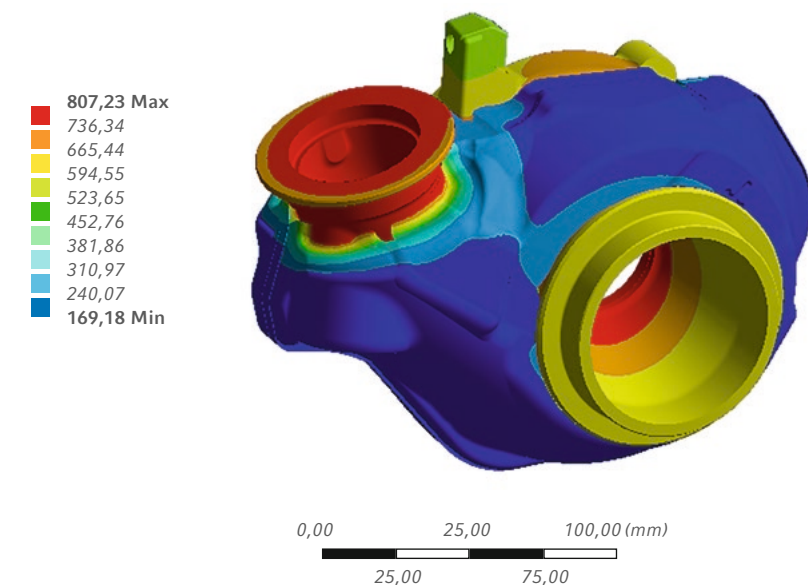
The shielding part achieves good thermal insulation by reflecting as much heat as possible and letting pass as little heat as possible. The selection and use of suitable materials play a major role in achieving these aims. However, the thermal circumstances of the overall system is even more crucial to the insulation effect.

AIR FLOW IS ANALYZED VERY PRECISELY

The air flows of the heat source and shielding parts influence each other. It is crucial to understand this interaction and implement it into the design. On request, ElringKlinger simulates the air flow around all shielding system components – in each phase of development.

Flow simulation software allowing us to precisely analyze the air flow.

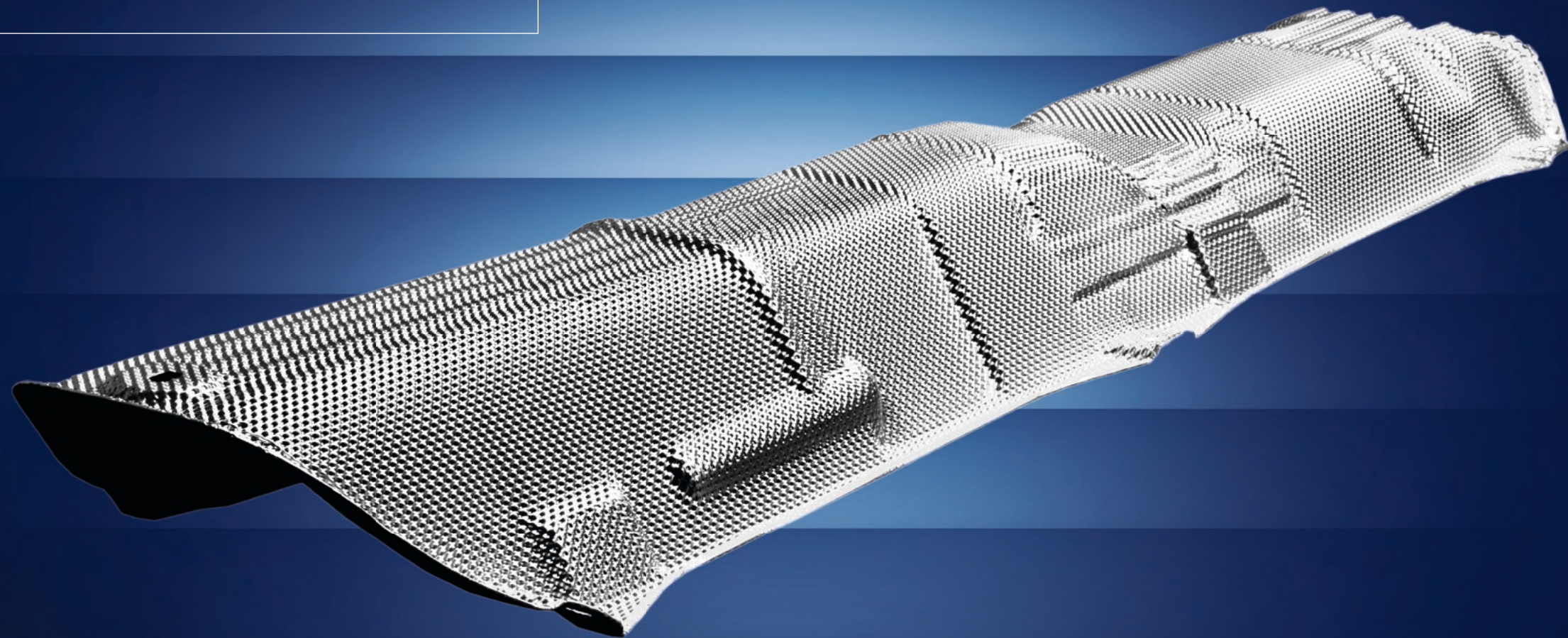
Temperature plot: turbocharger with direct shielding – effective shielding of the hot component to protect the surrounding components.





“Our shielding systems help to ensure that engine and exhaust systems function safely and reliably.”

Peter Walker,
Vice President Shielding Technology



EXPERT PARTNERS

RELIABLE PARTNERSHIP FROM A TO Z.

For ElringKlinger, supply expertise means reliability from a single source. From the development, production, and preassembly of add-on components up to automated function checks and quality control are carried out. Including 'just-in-sequence' delivery of ready-to-install shielding systems to the assembly line.

STATE-OF-THE-ART PRODUCTION PROCESSES

Our ElroShield™ shielding systems are produced in modern factories with state-of-the-art assembly lines – fast, costeffective and in high quality. Fully automated press lines and robot-aided processes allow high efficient production of both high volumes and small series. Online quality inspection is performed using camera systems during the production process itself.

DIRECT COORDINATION

Production is carried out around the world at numerous plants that are certified to ISO/ TS 16949, ISO 14001 and ISO 9001. We can meet customers wishes directly on production site. The advantages: clear responsibilities, speed, flexibility, maximum quality, and full service. Worldwide.



OUR PORTFOLIO. FOR YOUR SUCCESS:

- + Battery technology
- + Fuel cell technology
- + Electric drive units
- + E-mobility components
- + Lightweight and elastomer technology
- + Sealing systems
- + Shielding systems
- + Components from high-performance plastics
- + Dynamic precision parts
- + Tooling technology
- + Engine development services
- + Aftermarket

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