



SikaDamp[®] Silent Precision, Seamless Integration

Moving E-mobility Forward
with SikaDamp[®] Inverter Solutions



Quieter Inverters. Faster Rollout

Electric vehicle acoustics are becoming increasingly important as traditional powertrain noise disappears. Inverter covers can become prominent radiating surfaces, making targeted damping essential to interior sound quality. Sika helps turn complex NVH findings into practical SikaDamp® concepts designed around the inverter geometry, acoustic targets and manufacturing requirements. From the first acoustic assessment to a series of ready application concepts, Sika supports the path toward quieter electric drive units.

NVH Phenomena in Electric Drive Units

As core elements of Battery Electric Vehicles, modern Electric Drive Units (EDUs) offer high power density, delivering significant power output and torque. These units are typically fully integrated systems, combining the electric motor, reduction gearbox, and high-performance power electronics (inverter) into a single assembly.

The high power output of these EDUs can trigger various noise generation phenomena that interact within the system. Key excitation sources include:

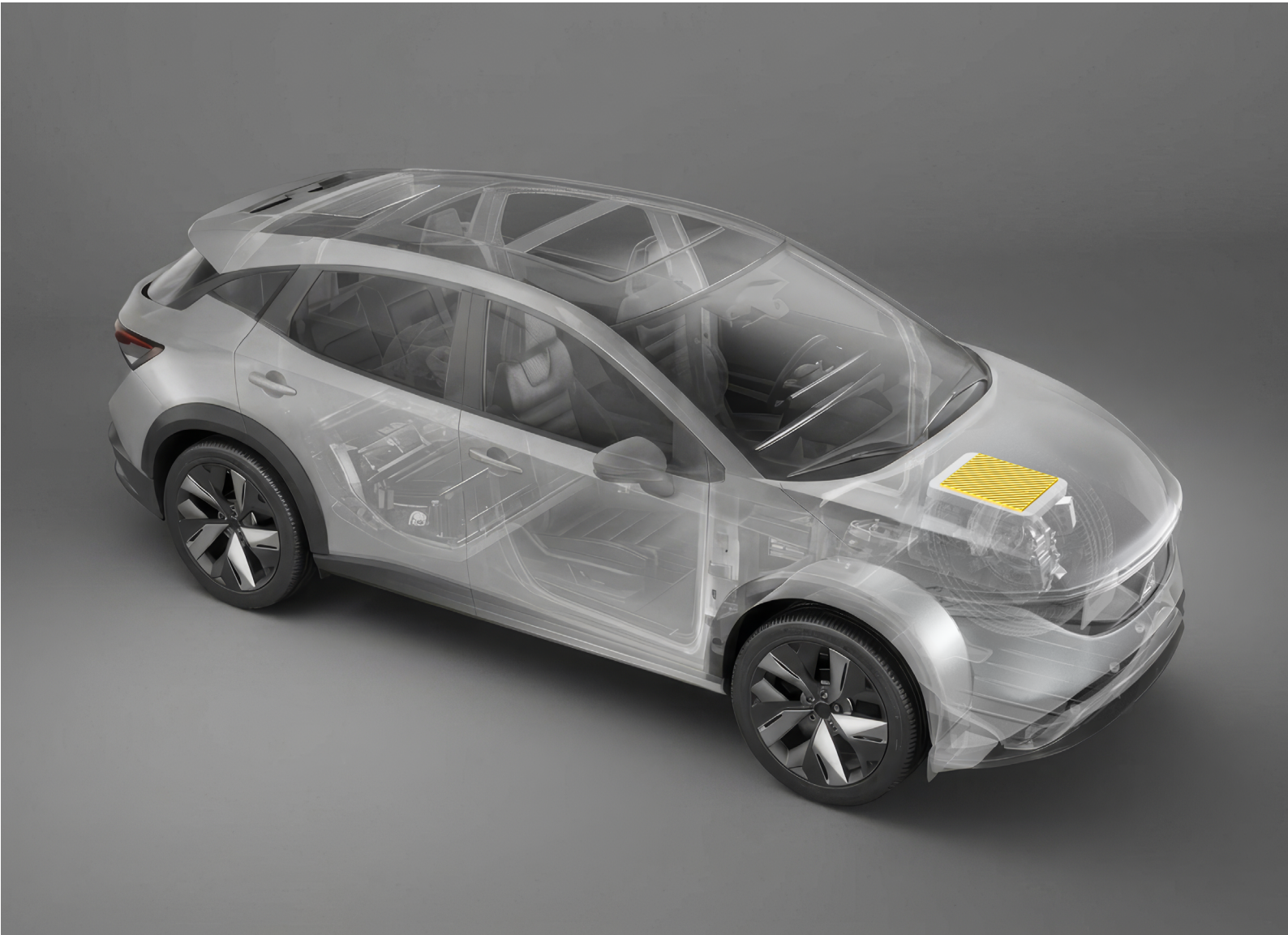
- Radial forces acting on the stator.
- Unbalanced magnetic pull within the rotor/stator system.
- Torque ripple and electromagnetic harmonics.
- Gear whine and rattle originating from the transmission.
- Excitations from pulse width modulation frequencies.

These structural excitations propagate through the entire EDU and are emitted as airborne noise, primarily via the inverter cover, which acts as an efficient radiator. This radiated noise is often high-frequency in nature and is perceived as particularly intrusive by vehicle occupants. Consequently, the optimized design of the inverter cover and the effective damping of structural vibrations are critical factors in developing a low-noise powertrain.

The Sika Solution: SikaDamp®

With its established SikaDamp® technology, Sika offers a highly efficient solution for reducing vibration amplitudes on inverter covers and other critical radiating surfaces of the EDU. By mitigating noise directly at the source, this approach represents the most effective strategy, significantly reducing the need for costly and heavy secondary insulation measures within the vehicle.

SikaDamp® solutions comprise a broad family of sound deadeners based on elastomers or bitumen, which can also be coupled with a constraining layer. SikaDamp® can be applied at any point during vehicle assembly or be installed at the stamping location. SikaDamp® is versatile in application as a self-adhesive or hotmelt adhesive product with or without magnetic support in custom shapes.



Benefits of SikaDamp® Technology

-  Enhanced Performance: SikaDamp® inverter applications combine excellent broad frequency range vibration damping and effective reduction of noise radiation from the inverter.
-  Reduced Noise: By effectively dampening vibrations and minimizing noise, SikaDamp® elevates the comfort of electric vehicle interiors.
-  Improved Driving Experience: Experience the future of mobility with SikaDamp®, where silence and performance coexist seamlessly, setting a new standard for electric vehicle excellence.
-  Tailored Solution for E-Vehicles: SikaDamp® stands out with best-in-class weight-to-performance ratios. This not only contributes to overall vehicle efficiency but ensures that the specific demands of e-mobility are met with precision and excellence.
-  Application Versatility: The pressure sensitive adhesive system can be applied by hand or in an automated process and withstands process temperatures up to 160°C.
-  Laser-Vibrometry-Analysis: This advanced technique allows for the tuning of placement and shape, ensuring that every application is targeted and cost-efficient. The result is maximum damping effect, elevating the driving experience.
-  Sustainable Solution: SikaDamp® inverter damping products come with improved sustainability and enable customers to reach their sustainability goals by optimizing energy consumption during assembly and optimized logistic concepts.
-  Well-known OEMs already rely on SikaDamp® as an effective acoustic measure on inverter housings.

Targeted Damping, Designed Around Your Inverter

Every inverter design brings a different combination of geometry, excitation behavior, acoustic targets and production constraints. SikaDamp® solutions can be tailored in material construction, shape, placement and application method to focus damping where it delivers the greatest value.

Acoustic Performance of SikaDamp® Materials

To demonstrate the acoustic efficiency of SikaDamp® technology on electric drive powertrain components, structural vibration levels and dynamic responses were evaluated across representative inverter cover structures. Through experimental scanning laser vibrometry, the operational deflection shapes and transfer functions of bare metal covers were benchmarked directly against SikaDamp®-treated assemblies. The presented test results and simulation validations below highlight the material’s capacity to suppress structural resonance, optimize dynamic loss factors, and significantly reduce radiated sound power across critical high-frequency operational ranges.

Figure 1 illustrates the forced response of bare versus damped inverter covers, evaluated via point force shaker excitation and laser scanning vibrometry. This study features an aluminum casting inverter cover equipped with a SikaDamp® aluminum-butyl constrained layer sandwich damper. Comparison of the averaged vibrational transfer functions demonstrates that SikaDamp® technology reduces total vibration levels by **12 dB—representing a 75% reduction** over the baseline initial values across the analyzed frequency range.

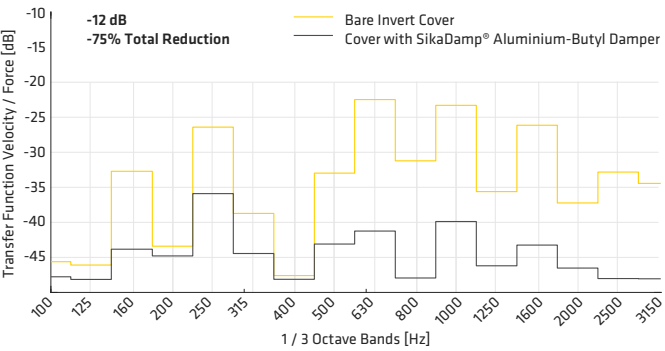


Figure 1: Comparison of the measured laser scanning vibrometer response of the panel structure with and without SikaDamp® aluminum-butyl damper

The significant impact of SikaDamp® treatments on vibration levels in inverter cover are additionally demonstrated in Figure 2 using the measured operational deflection shapes of the inverter cover at various frequencies.

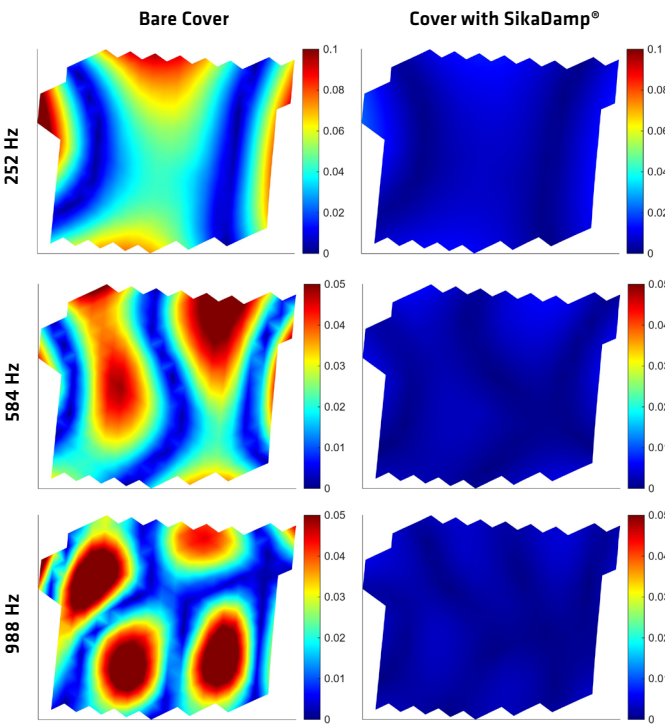


Figure 2: Comparison of damped and undamped operational deflection shapes of the inverter cover at various excitation frequencies

The overall impact of SikaDamp® is shown in Figure 3 illustrating the distribution of vibration energy over the surface of the cover, averaged over the considered frequency range between 100 and 3200 Hz. It is clearly seen that vibration levels are significantly reduced by application of SikaDamp® technology.

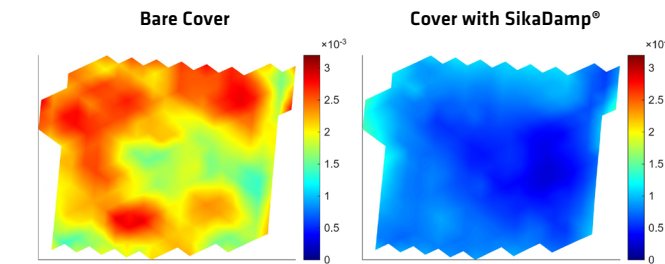


Figure 3: Comparison of damped and undamped averaged vibration levels of inverter cover in the frequency range between 100 and 3200 Hz.

CAE-Based NVH Optimization: Sika’s Support for Inverter Noise Mitigation in Early Design Stages

To implement efficient countermeasures against inverter noise, vibroacoustic models of EDU have become standard practice in the OEM/OES development process. Based on these models, relevant NVH phenomena are simulated. This simulation facilitates the early detection of potential issues during the concept and design phase, enabling the definition of efficient countermeasures. Sika supports this process by providing a validated dataset of material properties for the SikaDamp® product family, specifically tailored for acoustic simulation and assessing countermeasure effectiveness.

Figure 4 demonstrates the expected accuracy of the SikaDamp® material data using the example of an FEM simulation of a damped steel panel, comparing it with the laser vibrometry test result.

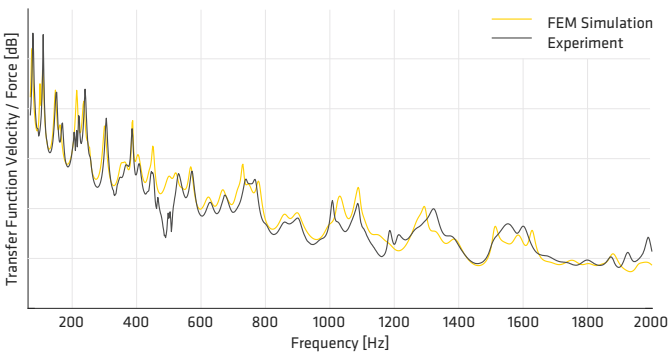


Figure 4: Comparison of simulated and measured response of the panel structure with SikaDamp® aluminum-butyl damper

Based on this input, engineers can determine whether a cost-effective stamped component or a more complex die-cast aluminum part is required for the inverter cover. This approach allows for significant savings in cost and weight while ensuring all NVH targets are met.

Sika Acoustic Centers: Support for Our Customers

To assess the effectiveness of the acoustic systems in support of customer product development and to optimize the application of Sika's acoustic products, a variety of methods (loss factor measurements, sound absorption/insulation tests, laser vibrometry, transfer

path analysis, psychoacoustic evaluation) is used. These capabilities are further enhanced by dedicated material property data that can be integrated into CAE simulations for EDU acoustic studies.

Material Level ▶	Component Level ▶	Subsystem Level ▶	System Level
Oberst-Test	Laser Vibrometry Tests	Laser Vibrometry Study	Vehicle Tear Down
Optical Determination of Loss Factor (OLF)	Transfer Function Measurement	Damping Package Optimization	Laser Vibrometry Study
Center Impedance	Insertion / Transmission Loss	Vibration Transfer Function	Roller-Test-Bench Evaluation
Test Impedance Tube (Sound Absorption, Transmission Loss)	Tapping Machine Tests	Acoustic Transfer Functions in Components (e.g. pillars)	Road-Tests
Dynamic Mechanical Analysis	Rain Drop / Stone Chip Tests	Transfer-Path-Analysis	Psychoacoustic Evaluation
	Oil-Canning	Body-Leakage-Test	White Goods Acoustics
			Energy Evaluation



Partner with Sika for Your Inverter Damping Solution

Whether the challenge appears during concept development, component validation, or late in the vehicle program, Sika can help identify a focused path forward. By targeting vibration at the source, SikaDamp® supports quieter EDU performance without introducing unnecessary complexity.

Partner with Sika to evaluate your inverter geometry, acoustic requirements and manufacturing constraints. Together, we can develop a SikaDamp® solution tailored to your application and designed for seamless integration into series production.



A Global Company But Local Partner

We are Sika

Sika is a specialty chemicals company with a leading position in the development and production of systems and products for bonding, sealing, damping, reinforcing and protecting in the building sector and the motor vehicle industry. Sika's product lines feature concrete admixtures, mortars, sealants and adhesives, structural strengthening systems, industrial flooring as well as roofing and waterproofing systems.

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