

# OVERCOMING ELECTRIC VEHICLE INDUSTRY CHALLENGES



Armstrong's Innovative Solutions  
in Noise, Vibration, Heat and  
Safety Management



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# Electric Vehicle INDUSTRY CHALLENGES



## Crash Safety and Energy Absorption

In collisions, ensuring battery protection and passenger safety is paramount. To achieve this, EV designs must integrate advanced crash structures that are not only effective but also lightweight to shield both passengers and the battery pack from impacts while preserving the vehicle's integrity.

## Acoustic Comfort and NVH Control

Electric vehicles (EVs) are quieter than traditional vehicles, making even minor noises such as road noise and drivetrain hum more noticeable. This increased sensitivity to sound necessitates advanced noise, vibration, and harshness (NVH) control measures to ensure a comfortable driving experience.



## Lightweighting

Weight reduction plays a vital role in enhancing the range and efficiency of electric vehicles (EVs). Lighter vehicles require less energy to operate, allowing them to travel further on a single charge. This improvement in efficiency also leads to better overall performance and a more sustainable driving experience.



The electric vehicle (EV) industry is transforming transportation, paving the way for a cleaner and more sustainable future. However, this rapidly growing sector also encounters distinct challenges that demand creative and cutting-edge solutions.

Here are some of the key challenges faced by the EV industry:

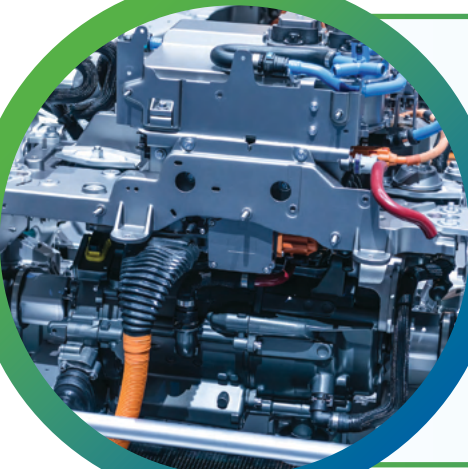


### Sealing and Environmental Protection

EV components, particularly batteries and electronic systems, require robust protection against water, dust, and debris ingress. For long-term reliability, sealing solutions must withstand thermal cycling and exposure to harsh environmental conditions.

### Battery Efficiency and Thermal Management

EV batteries generate significant heat during operation, necessitating effective thermal management systems to ensure safety, performance, and longevity. These systems are crucial for maintaining an optimal temperature to prevent thermal runaway, which can compromise safety and shorten battery life. However, they can also add complexity and weight to the vehicle, reducing overall efficiency.



### Thermal and Electrical Insulation

EV systems, especially motors, batteries, and inverters, need high-performance thermal and electrical insulation to prevent overheating and electrical faults. These materials must withstand high temperatures and resist chemical degradation to ensure long-term reliability. As EVs operate at higher voltages, insulation materials must also endure both thermal and electrical stress.

# OUR SOLUTIONS

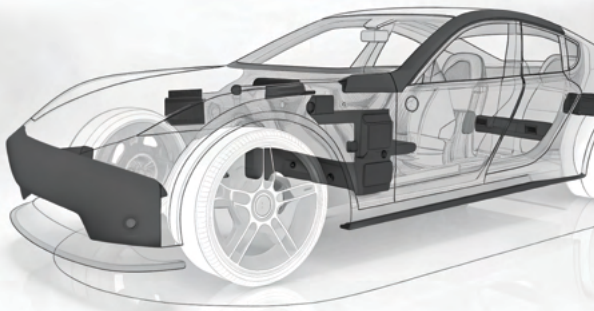
Armstrong leverages cutting-edge material science and advanced manufacturing to overcome challenges in the EV industry, driving growth by enhancing vehicle safety, efficiency, reliability, and comfort. By offering a comprehensive range of material conversion parts and custom solutions, Armstrong plays a key role in improving the performance of electric vehicles.



## Shock & Impact Protection Solutions

Impact protection solutions are extremely important for electric vehicles (EVs) as they play a crucial role in ensuring the safety of the vehicle occupants and preserving the integrity of the vehicle itself. They absorb and distribute collision forces, reducing the risk of injury to passengers. Additionally, these solutions protect the expensive battery pack from damage, help maintain structural integrity, and comply with safety standards, fostering consumer confidence in EVs and promoting their wider adoption.

### Impact Protection Components



Vehicle Impact Protection Components

Particle foams are typically used in parts related to passive protection of occupants and the chassis of vehicles. These foams are commonly used as impact absorbers in various parts, including side panels, steering columns, headrests, and bumpers. They are distinguished by their exceptional durability, lightweight construction, and remarkable shock absorption capabilities.

**Materials:** High-performance Expanded Polypropylene (EPP) Foams

**Benefits:** EPP foams have exceptional durability, lightweight construction, and remarkable shock absorption. Particle foaming moulding process can also include optional metal or plastic inserts for enhanced functionality.

**Process:** Advanced Particle Foam Moulding with optional insert moulding

### Battery Module Spacers & Compression Pads

Battery cell spacers and compression pads are designed to provide essential support and cushioning within battery packs. They provide structural integrity, evenly distribute loads, and protect cells from mechanical stresses during operation or impacts. Firm yet flexible, they accommodate cell expansion, ensure long-term performance under extreme conditions, act as electrical insulators, and aid in thermal management for efficient heat dissipation.

**Materials:** High-performance materials such as Microcellular PU foams, Silicone foams, and Aerogel sheets

**Benefits:** These materials have the ability to adapt to cell expansion and contraction while maintaining stability and compression. They are able to perform reliably under extreme conditions, acting as electrical insulators to prevent short circuits and improve thermal management by evenly distributing and dissipating heat.

**Process:** Precision Die-cut, with optional pressure sensitive adhesive (PSA) backing



Battery Cells Spacers & Compression Pads



## Noise, Vibration & Harshness (NVH) Solutions

Although Electric vehicles (EVs) are generally quieter than the internal combustion engine (ICE) cars, they encounter distinctive noise challenges of their own. At higher speeds, road and wind noise become more noticeable in EVs, given the reduced masking effect of engine sounds. Additionally, noise from electrical components like motors, cooling systems, and regenerative braking systems becomes more apparent in the absence of engine noise. Addressing these unique noise challenges is crucial to enhancing the overall acoustic comfort and driving experience of electric vehicles

### Vehicle Structure and Body NVH Insulation Parts

The doors, trunk, underbody and wheel arches are some of the primary interfaces between the vehicle's interior and the external environment. Effective NVH insulation helps minimize exterior noise, vibration, and harshness from entering the cabin. This ensures a quieter cabin, providing a more comfortable and enjoyable driving experience for the occupants.



Door / Trunk Trim & Panel Shield



Padding / Inserts For Doors, Trunk, Pillars, Fender

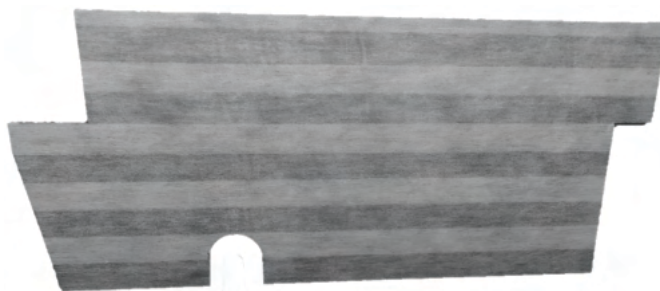
**Materials:** Polyethylene (PE) Foam with or without PET Film, PUR

**Benefits:** PE foams have excellent sound absorption and vibration damping properties. They are also lightweight, durable, cost-effective, and have excellent thermal, moisture resistance and chemical durability.

**Process:** Precision Die-cut, Heat Press, Vacuum Forming, with optional pressure sensitive adhesive (PSA) backing



Wheel Housing Padding



Underfloor Padding

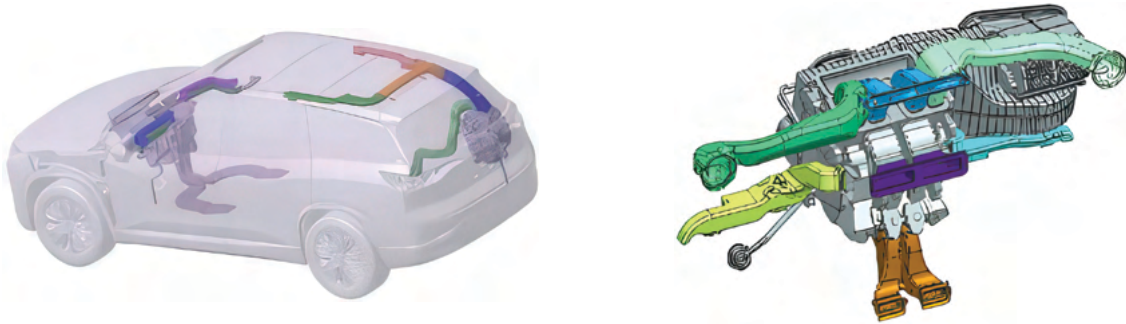
**Materials:** Sandwich materials (Nonwoven + foam)

**Benefits:** Sandwich materials offer superior noise and vibration control, impact resistance, and durability, enhancing overall vehicle comfort. Additionally, they are lightweight, moisture-resistant, and provide thermal insulation.

**Process:** Precision Die-cut, Heat Press, Vacuum Forming, with optional pressure sensitive adhesive (PSA) backing

## HVAC Airduct System

In EVs, the HVAC (Heating, Ventilation, and Air Conditioning) air duct system can contribute significantly to noise due to airflow and components such as fans and vents. Since EVs are much quieter than conventional vehicles, even subtle sounds from the HVAC system become more apparent, highlighting the need for noise reduction solutions.



Twin-sheet thermoformed HVAC Air Ducts

**Materials:** PE foam, Nonwoven PET

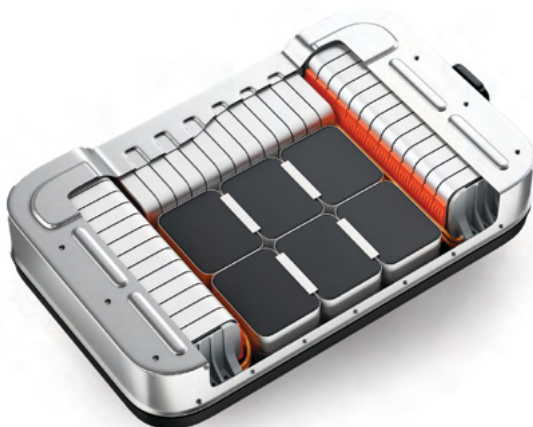
**Benefits:** PE foam and nonwoven materials provide lightweight, durable, and flexible solutions for HVAC air ducts in electric vehicles, preventing condensation, reducing noise, and improving energy efficiency. They offer excellent sound absorption, are easy to install and shape, and can be tailored to specific designs.

**Process:** Die-cut, Twin-sheet thermoforming



## Sealing & Gasketing Solutions

In electric vehicles (EVs), seals and gaskets play crucial roles in ensuring the proper functioning and safety of various components. They serve as barriers, preventing the entry of contaminants and fluids into sensitive components such as batteries, electric motors, power electronics, and the HVAC system.



Battery Pack Cover Gasket

## Battery Pack Gaskets

Battery pack gaskets are important for EVs because they provide crucial sealing, ensuring the battery pack remains protected from water, dust, and contaminants. They also help prevent leakage of chemicals, and reduce the risk of short circuits or damage. By ensuring proper sealing and insulation, gaskets enhance the safety, performance, and longevity of the battery pack, which is essential for the overall reliability of the electric vehicle.

**Materials:** Silicone rubber

**Benefits:** Silicone rubber provides exceptional temperature resistance, sealing performance, and flexibility for reliable, long-lasting seals. Its durability and resistance to chemicals, UV radiation, and weathering make it ideal for protecting battery packs in harsh environments.

**Process:** Precision Die-cut or Elastomer Moulding, with optional pressure sensitive adhesive (PSA) backing

## Charging Port Seals



Charging Door & Port Seal

Charging port seals in electric vehicles must ensure safety, reliability, and efficient energy transfer. They require excellent water and dust resistance, temperature and chemical durability, flexibility for frequent use, and robust electrical insulation with effective heat dissipation.

**Materials:** Silicone rubber

**Benefits:** Silicone rubber is durable with a wide range of temperature resistance, and ability to provide reliable waterproof, dustproof, and weatherproof sealing. It maintains flexibility over time, resists aging, chemicals, and UV exposure, and offers excellent electrical insulation for safe, long-term performance.

**Process:** Precision Die-cut or Elastomer Moulding, with optional pressure sensitive adhesive (PSA) backing and insert moulding

## HVAC System Seals & Gaskets

HVAC system seals and gaskets in electric vehicles ensure efficient operation by creating airtight seals to channel conditioned air and prevent leaks. They must withstand temperature, pressure, and chemical exposure while maintaining durability. Additionally, they dampen vibration and noise, enhancing cabin comfort.

**Materials:** PE foam, EPDM foam

**Benefits:** PE foam provides lightweight, cost-effective and reliable sealing solutions with excellent thermal and acoustic insulation, moisture resistance, and chemical durability, while EPDM foam offers superior weather resistance, elasticity, and durability for reliable sealing under extreme conditions.

**Process:** Precision Die-cut, with optional pressure sensitive adhesive (PSA) backing



Air Vent Gasket

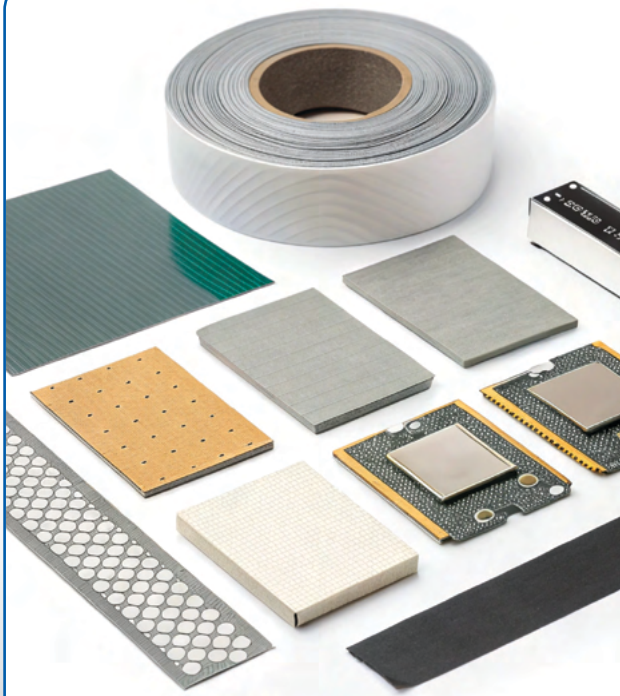




## Thermal Management Solutions

Effective thermal management is critical in electric vehicles (EVs). By maintaining the optimal temperature range for key components such as the electric motor, power electronics, and battery, EVs can achieve peak performance and efficiency. Effective thermal management help regulates the heat generated during vehicle operation, maximizing energy efficiency, extending driving ranges, and ensuring the overall reliability and longevity of these components.

### Thermal Interface Components



Thermal interface components are essential in electric vehicles (EVs) for managing and optimizing heat dissipation. They are used across a range of critical areas, including battery packs, power electronics, electric motors, onboard charging systems, vehicle control units (VCUs), displays, infotainment systems, LED lighting, and more.

**Materials:** Thermal interface materials made from advanced materials such as thermally conductive pads, graphite sheets, adhesive tapes, elastomers, aluminum oxide films, thermal gap fillers, adhesive films, and metallized polyimide films.

**Benefits:** Thermal interface materials enhance heat dissipation by improving heat transfer and ensuring uniform temperature distribution. This helps prevent overheating, maintain safe operating temperatures for critical components, and optimize the performance, efficiency, and reliability of EV systems.

**Process:** Precision Die-cut





## Dielectric Barrier & Insulation Solutions



Dielectric barrier and insulation solutions are essential for the safe and reliable operation of electric vehicles. They ensure electrical safety by preventing shocks, electrical leakage, and high-voltage issues such as arcing and short circuits. These solutions not only optimize EV performance and efficiency but also adhere to environmental safety standards. Additionally, they act as thermal barriers between battery cells, modules, and packs, helping to contain potential thermal events and significantly reducing the risk of propagation or thermal runaway.

### Electrical Insulators

**Materials:** Plastic films (polyimide, PET, PP, etc.) rubber (silicone, neoprene, etc.), fibers, and papers

**Benefits:** These materials are ultra-thin and lightweight materials. They have excellent electrically insulating properties, flame retardant, extreme temperature resistance, moisture and chemical resistance, and more.

**Process:** Precision Die-cut, with optional pressure sensitive adhesive (PSA) backing

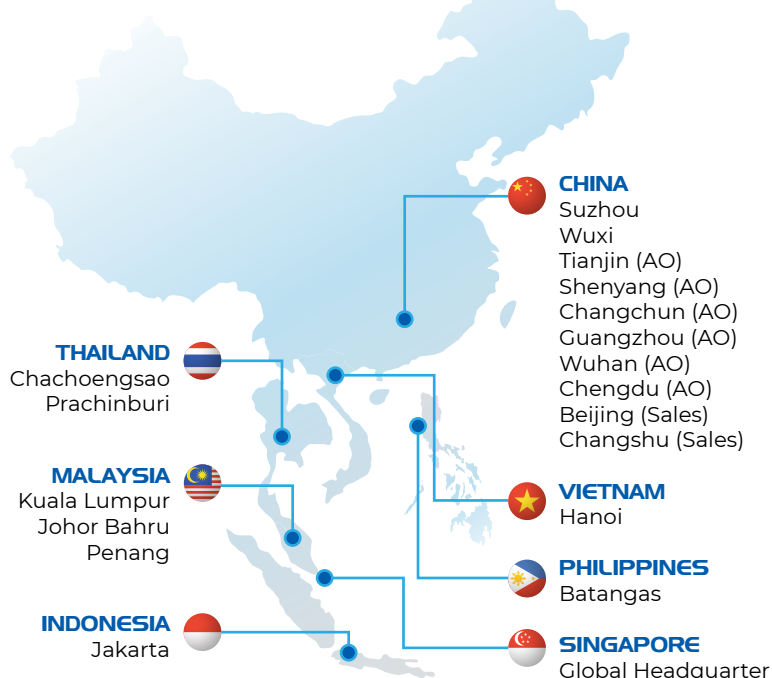


## Who We Are

Armstrong Industrial Corporation (Armstrong) is Asia's trusted partner in innovative foam, film and elastomer solutions for Noise, Vibration, Heat and Safety Management. Established in 1974, Armstrong today has a strategic, consolidated presence in seven countries in Asia.

Our extensive network of global partners provides us access to a comprehensive range of innovative materials and solutions, providing our customers more choice and better cost control.

Our key sites are ISO & IATF certified, underscoring our commitment to ensuring that the products we manufacture meet your highest quality standards.



9001: 2015 | 14001:2015 | 22301:2012 | 13485:2016  
45001:2018 | 14064-1:2018 | IATF 16949:2016

## Key Highlights

**Core Expertise:** We are the only fabricator in Asia offering over 12 core precision engineering technologies to design and manufacture 2D and 3D foam, film, and elastomer products for dampening, insulating, sealing, and cushioning.

**Regional Presence:** Our 16 factories and 2 sales offices across seven countries in Asia ensure close proximity to major production hubs, allowing us to mitigate long-term geographic risks and serve customers efficiently.

**Supply Chain & Collaboration:** With over 50 years of experience, we have established a global network of more than 300 suppliers and access to over 4,000 material types, enabling us to meet a broad range of application needs while maintaining strong partnerships with international partners in Europe, the USA, and Asia

**Customer Commitment:** We are dedicated to being a collaborative and innovative partner, providing quieter, cooler, lighter, and safer solutions that meet the evolving technical and business needs of our customers.



# Manufacturing Capabilities

Armstrong is a leading material converter, specializing in films, foams, and elastomers, serving global OEM customers across a wide range of industries. Armed with advanced processing technologies, we specialize in precision die-cutting, elastomer moulding, foam thermoforming, particle foam moulding, reaction injection moulding, and functional printing to produce custom 2D and 3D foam, film, and elastomer products. Our precision engineering technologies enable us to customise solutions and products for dampening, insulating, sealing, and cushioning, addressing challenges related to noise, vibration, heat, and safety management.

## Our Automotive OEM Customers



## Our Lifestyle, Industrial & Medical OEM Customers



## Armstrong Global Footprint & Technology Partners



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