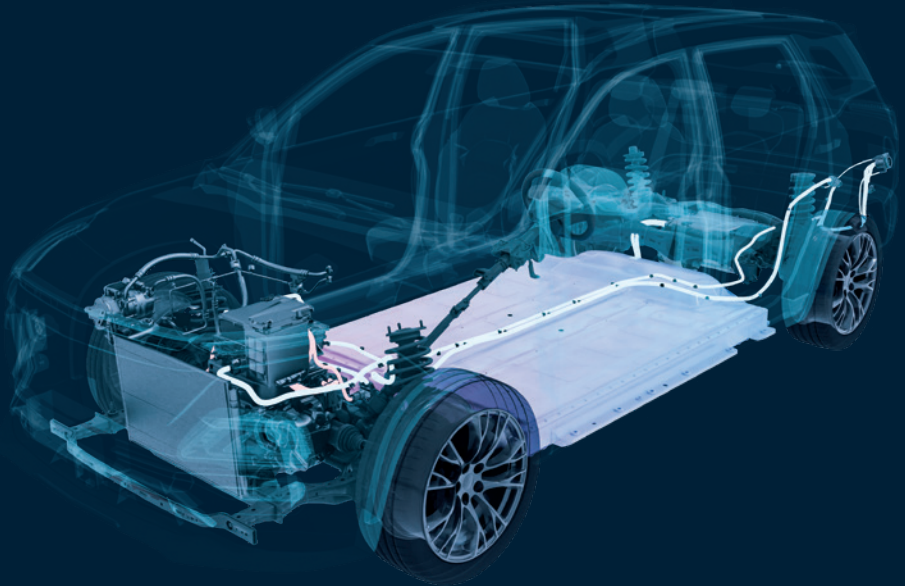


# Overview Advanced Fastening Solutions

**EV powertrains and high-voltage battery packs**



This "INNOVATION PAPER" contains detailed information about advanced fastening solutions. It includes comprehensive insights into the products offered, their various applications across different industries, and the capabilities these solutions bring to enhance efficiency, durability, and performance. This folder is meant to provide a thorough understanding of the latest innovations and technological advancements in fastening solutions, serving as a valuable resource for partners, suppliers, and stakeholders interested in collaborative innovation and cutting-edge developments in this field.

# metFlow® SELF-PIERCING AND THREADFORMING SCREW

Connect sheet metal without drilling or threading, preserving quality.

Nederschroef's metFlow (flowdrill) screw is an innovative fastening solution designed for sheet metal, eliminating the need for drilling or threading. Utilizing a specially-designed tip and the advanced Nedtite ES thread-forming solution, it securely joins a variety of alloys and materials. This smart technology forms its own hole and thread through thermal impact induced by its unique point geometry, rotational speed, downforce, and friction. Ideal for automotive EV powertrain and battery applications.

## Application areas

- High-profile automotive applications.
- Various materials – e.g. steel, aluminum.
- Electromobility and Body-in-white applications
- One-sided accessible connections.
- For different alloys, materials, sheet metals.
- Single sided applications and for multi material joining.
- Optimizing connections with customers' original sheet metals.



## Properties

- Connect sheet metal with retightening screw.
- Penetrates steel sheets up to 1.8 mm up to 1000MPa tensile strength, aluminum sheets up to 4,5mm (others on demand).
- Optimized thread at last pitches.
- Very low thread forming torque.
- High overload torque.

## Benefits

Provides a versatile solution for diverse applications.

- **Sustainability:** Facilitates weight reduction, improving the ecological footprint.
- **Enhanced working environment:** Saves energy, materials, and equipment by streamlining production processes.
- **Custom-made solutions:** Crafted to meet the most demanding requirements.
- **Expert collaboration:** Experienced engineers collaborate to select the optimal metFlow solution.

- **Industrial expertise:** Specializes in joint assemblies.
- **Advanced R&D:** Benefits from a dedicated R&D center and collaboration with experienced partners like Atlas Copco.

## Functionality advantages

Eliminates the need for drilling, providing neat, extremely reliable, and durable connections. Optimized for integration with customer sheet metals, coatings can be tailored for post-fitting, and the system ensures very fast connections.

## Dimensions

- Generally used with a 4mm - 6mm thread diameter.
- Screw length without head is normally 14mm - 22mm, according to sheet metal thicknesses.
- All normal materials for screws can be used, depending on the application and customer.

For more information you can contact:  
[metflow@ned Schroef.com](mailto:metflow@ned Schroef.com)

# Technical cleanliness

## Technical cleanliness of fastening parts for EV powertrain and battery packs in the automotive industry.

In the context of electric vehicle (EV) powertrains and battery packs, technical cleanliness of fastening parts is crucial. Contaminants can affect the performance, reliability, and longevity of these critical components. Ensuring technical cleanliness helps prevent electrical shorts, mechanical wear, and chemical degradation, ultimately contributing to the overall efficiency and safety of EV systems.

### In-House testing equipment

To maintain high standards of cleanliness, in-house testing equipment and methodologies are employed:

- **Laboratory facilities:** Equipped with internal testing equipment and knowledge in accordance with VDA19.1 and ISO 16232 standards.
- **Standards compliance:** Capable of meeting the cleanliness standards set by major automotive manufacturers, such as Daimler DBL6515, Scania TB4189, ZF ZFN1132, and Bosch FO3ZY000WE.
- **Collection methods and analysis Techniques** are state of the art.

### In-House cleaning processes

Effective in-house cleaning processes are essential for preparing fastening parts for use in EV powertrains and battery packs:

- **Phosphated and/or oiled parts:** These parts undergo specialized cleaning processes to remove metallic particles such as ultrasonic cleaning to remove oils, phosphates, and other residues.
- **Parts with topcoat:** Additional cleaning steps are implemented for parts coated with protective topcoats to ensure their surfaces are free from contaminants.
- **Residual magnetism:** on demand, tailored to specific requirements.

### Cleanliness levels

Different types of parts require adherence to specific cleanliness levels to ensure optimal performance:

- **Phosphated and/or oiled Parts:** Cleanliness level  $x=400\mu\text{m}$ .
- **Zinc nickel parts with topcoat:**
  - metallic particles M: Cleanliness level  $x=400\mu\text{m}$ .
  - non metallic particles NM: Cleanliness level  $x=600\mu\text{m}$ .
- **Parts with patch or zinc flakes:** Cleanliness levels are determined on demand, tailored to specific requirements.

### Packaging solutions

Proper packaging is crucial to maintain the cleanliness of fastening parts until they are ready for use:

- **Plastic & VCI bags:** offer protection against corrosion and contamination during storage and transport.
- **Vacuum bags:** Provide an airtight environment to preserve abrasion during transport, on top to preservation against contamination and corrosion.
- **ESD bags:** These bags offer the security against electrostatic discharge in ESD free assembling area.

For more information you can contact:  
[joseph.egele@nedschroef.com](mailto:joseph.egele@nedschroef.com)

# Inserts for EV powertrain

Insert solutions, also known as threaded inserts, are robust fasteners utilized to establish enduring threads in materials like metal, plastic, or composite. They find extensive use in EV powertrains for a range of applications provide a sturdy and dependable anchoring mechanism for securing components within the electric vehicle (EV) powertrain and battery packs.

## Application areas

- **Perfect for plastic components:** Suitable for plastic castings, housings, and parts, enabling the creation of durable metal threads.
- **Secure in softer materials:** Provides a strong grip in softer materials, enhancing overall stability.
- **Reinforces thin materials:** Allows the addition of protruding threads to thin materials, reinforcing attachment points.
- **Simplifies assembly:** Streamlines the transition between different thread types, making assembly processes more efficient.

## Benefits & functionality

- **In-house expertise:** Leverage engineering and manufacturing capabilities for optimized insert design and production.
- **Metal forming versatility:** Offer a wide range of metal forming techniques to meet diverse application needs.
- **Complex geometries:** Accommodate intricate insert designs to suit specific EV component configurations.
- **High-precision quality:** Deliver inserts with precise dimensions and reliable performance for critical EV applications.
- **Clean room standards:** Provide inserts manufactured to stringent cleanliness standards for contamination-sensitive environments.

## Dimensions

Inserts are available in various sizes to accommodate different thread diameters



and lengths, tailored to specific application requirements within EV powertrains and battery packs.

- Nominal Diameter:  $\varnothing 10$  -  $\varnothing 40$  mm.
- Internal Thread: M5 – M20.
- External Thread: M10 – M40.
- Length: 5 – 70 mm (Other dimensions on request).

## Types of inserts (geometry)

- **Self-tapping inserts:** Create their own threads when installed into a material, eliminating the need for pre-tapped holes.
- **Molded-in inserts:** Molded directly into plastic components during manufacturing, providing threaded inserts without secondary assembly steps.
- **Knurled inserts:** fastening solution for soft materials. They provide enhanced grip when installed into a substrate.
  - Iso metric thread: Standard metric thread sizes and pitch (max 1,75mm).
  - Variables on knurling: Specific types of inserts with unique geometrical features or characteristics.
    - RAA, straight knurl.
    - RBL/RBR, left spiral knurl.
    - RGE: cross knurl with points up.
    - RKV: cross knurl with impressed points.

For more information you can contact:  
[jose.gonzalez@nedschroef.com](mailto:jose.gonzalez@nedschroef.com)

# Sealing fasteners

## Screws, nuts and bolts.

Sealing fasteners are specialized components designed to provide both mechanical fastening and environmental sealing. These fasteners typically incorporate integrated sealing elements, such as O-rings or gaskets, which create a tight barrier against contaminants like dust, moisture, and fluids. They are engineered to maintain their sealing integrity under various conditions, including high pressure, temperature fluctuations, and vibrations.

### Application area

In all industrial sectors where protection of the systems must be ensured.

- EV powertrains: Motor housings and transmission systems.
- Battery packs: Battery enclosures and cooling systems.

### Benefits & functionality

- **Custom-engineered solutions:** Tailored insulation solutions designed to meet specific application requirements.
- **Comprehensive implementation:** Seamless process from initial concept through prototyping and testing to final serial production, all managed by a single source.
- **Custom-made & ready for assembly:** Tailored solutions that are prepped for immediate use.
- **Reduced assembly time (EHPV):** Integrated sealing elements streamline the assembly process, saving time.
- **Releasable and re-usable:** Ideal for maintenance or repair.
- **According to standards:** Compliant with all known automotive and industrial standards, ensuring reliability and safety.
- **Expertise and versatile application:** Utilizes advanced technologies, including assembled washers, coatings, and form closures, ensuring optimal sealing performance for EV powertrain and battery packs.



### Sealing types

- Sealing bolts and screws.
- Sealing washers.
- Self-sealing nuts.

Sealing fasteners are essential components in the construction and maintenance of EV powertrains and high-voltage battery packs. Their ability to provide both mechanical fastening and environmental sealing ensures the reliability, safety, and longevity of critical EV components. As the EV industry continues to grow, the demand for high-performance sealing fasteners will remain a key factor in advancing vehicle technology.

*For more information you can contact:  
[sealingandinsulation@nedschroef.com](mailto:sealingandinsulation@nedschroef.com)*

# Insulation fasteners

Insulation fasteners are designed to anchor insulating materials within EV powertrains and battery packs, protecting against unwanted electrical currents and other electrical hazards. These fasteners prevent electrical shorts and boost overall safety, ensuring the integrity and functionality of essential vehicle systems.

## Application area

Insulation fasteners are crucial in industries requiring robust system protection. They play a key role in ensuring that electrical conductivity is effectively managed within components and across the environment, thus preventing short circuits and electric shocks.

- **EV powertrains:** These fasteners are used for motor insulation and securing power electronics, critical for maintaining system integrity.
- **Battery packs:** Applied in cell insulation and battery enclosures, they safeguard against electrical failures and enhance the overall safety of the battery systems (e.g. busbar fixation).

## Benefits & functionality

- **Custom-engineered solutions:** Tailored insulation solutions designed to meet specific application requirements.
- **Comprehensive implementation:** Seamless process from initial concept through prototyping and testing to final serial production, all managed by a single source.
- **Custom-made & ready for assembly:** Tailored and prepped for use.
- **Easy installation:** Reduce assembly time (EHPV).
- **Releasable and re-usable:** Ideal for maintenance or repair.
- **According to standards:** Ensure reliability and safety with compliance, according to the automotive and industrial standards.



## Insulation types

- Insulation coatings, e.g. Eloxal.
- Overmoulding, e.g. plastic.
- Multi material washers, made of rubber, caoutchouc or synthetic material.
- Patches e.g. Nycote.

These fasteners are crucial for reliable and safe EV operations.

(Insulation fasteners are vital for the safe and efficient operation of EV powertrains and high-voltage battery packs. By securely fastening insulating materials, they help prevent electrical faults, enhance thermal management, and ensure long-term durability. As the EV industry advances, the role of high-quality insulation fasteners will continue to be crucial in developing reliable and safe electric vehicles.)

*For more information you can contact:  
[sealingandinsulation@nedschroef.com](mailto:sealingandinsulation@nedschroef.com)*

# Nedlite aluminum fasteners

## Aluminum fasteners and high strength aluminum fasteners for EV powertrains and battery packs.

Nedlite aluminum fasteners are designed to meet the automotive industry's need for reducing CO<sub>2</sub> emissions by using lightweight materials without compromising safety and reliability. These fasteners are particularly beneficial in the construction and economy of EV powertrains and battery packs.

### Advantages

- **Weight reduction.**
- **Thermal compatibility.**
- **Corrosion resistance.**
- **Economic efficiency.**
- **Design freedom.**
- **Mechanical properties.**

### Field of application

Nedlite fasteners are commonly used in:

- Gearbox applications.
- Magnesium cylinder head covers.
- Magnesium gearbox housings to engine connections.

These fasteners are available in various forms, including sleeves, washers, nuts, and bolts, with different internal and external drives. They are typically lubricated with DF905 or coated with Oxsilan-Xylan for corrosion protection.

### Bolt properties

- Material: EN AW 6056.
- Diameter range: M6 to M12.
- Length range: ≤ 100 mm.
- Tensile strength:  $R_m \geq 400 \text{ N/mm}^2$ .
- Yield strength:  $R_{p0.2} \geq 350 \text{ N/mm}^2$ .
- Elongation:  $A \geq 8\%$ .
- Temperature resistance: Up to 150°C (temporary up to 180°C).
- Thermal expansion:  $21 \cdot 10^{-6} \text{ K}^{-1}$ .

### Nut properties

- Material\*: EN AW 5052 AlMg2,5.
- Hardness\*: 97 HV5.

### NedLite®700

#### High strength aluminum fasteners

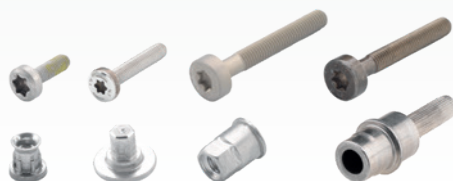
NedLite®700 fasteners are the strongest aluminum alloy fasteners available for cold forming. They combine the lightweight nature of aluminum with the high tensile strength comparable to steel, making them suitable for applications that require both lightness and strength.

### Advantages

- **High tensile strength:** Up to 700 MPa, comparable to 8.8 class steel bolts.
- **Weight efficiency:** Maintains the benefits of low weight inherent to aluminum.
- **Temperature stability:** Minimal strength loss (<10%) under prolonged exposure to 100°C.
- **Versatility:** Suitable for a range of applications including bolts, screws, automotive castings, electrical components, and complex parts requiring secondary operations like drilling, milling, and turning.

### Technical specifications

- Diameter range: M5 – M12.
- Length range: 16 – 80 mm.
- Strength: 680 – 720 MPa.
- Yield strength: ~640 MPa.
- Fatigue strength:  $\sigma_{a50} \geq 25 \text{ MPa}$ .
- Improved elongation: Enhanced elongation at lower preload compared to steel (5-10% depending on application).



For more information you can contact:  
[nedlite700@nedschroef.com](mailto:nedlite700@nedschroef.com)

# Conductivity

## Electrically conductive bolted connections.

Electrically conductive bolted connections are specialized fasteners designed to establish and maintain a stable electrical path between different components in an EV's powertrain and battery system ensuring efficient and reliable electrical conductivity. These connections often feature materials with high electrical conductivity, such as copper or aluminum, and are engineered to withstand the electrical and mechanical stresses encountered in automotive applications.

### Key elements

- **Conductive materials:** Metals like copper, aluminum, and their alloys are commonly used for their excellent electrical conductivity.
- **Screw realization:** The electrical connection is essentially realized by the screw itself.

### Benefits

Electrically conductive bolted connections offer several benefits in EV applications:

- **High conductivity:** Ensures minimal electrical resistance and efficient power transfer, reducing energy losses.
- **Testing capabilities:** Extensive experience with conductivity testing of fastener coatings, topcoats, and lubricants.
- **In-House testing:** Availability of in-house testing equipment (micro-ohmmeter) to measure electrical resistance between any point in the circuit.
- **Customer specifications:** Testing can be conducted according to specific customer requirements.

- **Engineering support:** Application engineers and R&D teams provide engineering support.
- **Cost-effective:** Compared to welded or soldered connections, bolted joints can be more economical and easier to implement in mass production.

### Functionality

The functionality of electrically conductive bolted connections in EV powertrains and battery packs including Improved conductivity, e.g. paint scraping features can be employed to enhance the electrical conductivity of the thread.

In conclusion, electrically conductive bolted connections are vital for the performance and reliability of EV powertrains and battery packs. Their design and material choices are critical to ensuring efficient power transfer, mechanical robustness, and ease of maintenance, which are essential for the overall effectiveness of electric vehicles.

*For more information you can contact:  
[rene.hop@nedschroef.com](mailto:rene.hop@nedschroef.com)*