

Technical article Ecoclean GmbH / Cleaning of battery housings

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Efficient, needs-based process for cleaning battery cases – Cleaning solutions for ultra-clean battery housings

Whether a purely electrically-powered car or a plug-in hybrid – the drive battery is a highly sensitive and expensive component. Consequently, high demands are placed on the housings that encase the battery cells and modules. In order for the battery boxes to meet these demands, the various components have to be as clean as necessary. Ecoclean offers efficient solutions which are optimally tailored to the respective production step and specified cleanliness requirements.

The housing serves to protect the lithium-ion batteries typically used in electric vehicles and plug-in hybrids from external influences. It also needs to be lightweight because each additional kilo shortens the range. Parts are therefore often made of aluminum alloys. To ensure that its protective function can be optimally fulfilled, the individual parts from which the housing is made have to meet high requirements in terms of mechanical strength, impermeability and cooling capacity.

Especially when it comes to the last two properties, as well as the functional reliability of the electrics, the required level of cleanliness plays a decisive role because metallic particles inside the housing can cause a short circuit. The presence of non-metallic particulate contaminants such as fibers can also be problematic. If they absorb moisture, they can become electrically conductive. During production processes such as sealing and bonding the main section and cover of the housing, the focus is more often on chemical and thin-film contamination.

Different concepts require special cleaning solutions

Due to the vast number of products and manufacturing processes, there are no general specifications for cleanliness levels. Tier 1 suppliers and system integrators are therefore confronted with very different OEM requirements. When designing an adapted cleaning solution, the production phase also has to be considered: Do single parts, such as metal sheets, brackets and struts, need to be cleaned? Do the components have to be passivated for downstream processes such as laser hybrid welding? Is intermediate cleaning necessary to prevent the cooling channels of complex cooling units from clogging up? When battery housings are given a final clean, do part geometries with fluid-trapping recesses and cavities have to be taken into account in order to reliably fulfill the specified cleanliness requirements?

Ecoclean GmbH offers cleaning solutions that are tailored to these different tasks and already in use in series production. Typical contaminants removed by the cleaning systems include residues of coolants and minimum quantity lubricants (MQL), burrs, chips, smoke residue, loose welding beads, dust, fibres and dirt originating from the manufacturing environment.

Effectively cleaning housings with relatively simple geometries

Regardless of whether it's smaller housing for hybrid vehicles or larger ones like those used in fully electrically-powered cars – final cleaning processes for relatively simple battery cases without fluid-trapping recesses and cavities can be effectively carried out using an overhead conveyor system. Thanks to its modular design, the cleaning system can be optimally adapted to the respective cleanliness requirements and cycle time specifications and the modules flexibly combined.

The overhead conveyor is cleverly designed so that the parts placed in it can be tilted forward and slightly to the side during the cleaning process. This ensures that cleaning and rinsing liquids can run out of the drain holes in the housings. In a first process step, the parts are blow-cleaned to remove any loosely adhering impurities. In order to react flexibly to varying and/or higher

requirements, an infeed station can be optionally integrated that is easy to equip as a second blow-cleaning station. After the dry pre-cleaning step, the parts are forwarded to the wet zone. This contains modules which spray-clean the parts with an aqueous medium. The units for the rinsing processes can be designed for different types of water, e.g. town water or demineralized water. After the downstream drying step, the housings pass through a cooling zone so that they leave the system at the right temperature for the next process, e.g. leak test, and are instantly ready for further processing.

The modular cleaning system with overhead conveyor is also used for intermediate cleaning of battery cases featuring integral cooling channels. This step removes chips, burrs and contaminants from the channels before the cross and longitudinal profiles are welded on.

Clean and completely dry complex housings

The globally-active company has designed another modular cleaning system specifically for final cleaning of complex battery casings. This system consists of a series of treatment chambers, some of which are fitted with rotary units, that can be flexibly combined with one another to execute loading and unloading steps in addition to cleaning, rinsing, drying and cooling. The rotary units allow the parts to be rotated through 360 degrees and tilted simultaneously during wet processes, thus ensuring that cleaning and rinsing media are reliably drained from complex geometries and fluid-trapping recesses and cavities. Loading and handling tasks are performed by two robots mounted on a seventh axis, with one handling soiled parts and the other cleaned parts.

In the treatment stations for cleaning and rinsing, fluid is applied to the enclosures on all sides by a spray system with nozzles optimally aligned to the workpiece. Hot air is used for the drying process. Thanks to the attached cooling modules, the parts are instantaneously ready for packaging or further processing. The cleaning systems are capable of meeting cleanliness specifications of no particles larger than 500 micrometers. A positive pressure chamber can be integrated downstream of the unloading station to make sure that parts stay this clean.

Cleaning single parts - with or without passivation

As a rule, single parts such as metal sheets, struts or mounting brackets are cleaned in multi-bath immersion systems like Mega 96W with water-based detergents adapted to the type of soiling to be removed. Passivation baths can also be integrated into these systems. If the focus is on degreasing, solvent systems such as EcoC duty or special systems can be used. To achieve the specified level of cleanliness within a short time, cleaning processes such as ultrasonics, injection flood washing and also the drying process - hot air and/or vacuum - can be individually tailored to the size and shape of the parts to be cleaned.

Dry, partial cleaning process for joining and sealing areas

A decisive criterion when it comes to achieving long-lasting and reliable bonding or sealing results is the cleanliness of the respective component surfaces. For these tasks, a range of essentially dry processes are used to clean or treat the specific areas, such as cleaning with media such as compressed air, CO₂ snow jet, atmospheric pressure plasma, laser or steam, as well as a special pulsated water jet technology.

If fully-assembled battery housings need to be cleaned, prototypes are only rarely available for test purposes. Therefore, whether and how reliably specified cleanliness levels can be met in series production much depends on the experience and expertise of the partner chosen to solve the cleaning task.

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The SBS Ecoclean Group develops, produces and markets forward-looking machinery, systems and services for industrial part cleaning and surface treatment applications. Its globally leading solutions help companies around the world in conducting efficient and sustainable manufacturing to high quality

standards. The client base comes from the automotive industry and its suppliers in addition to a broad range of market sectors ranging from medical equipment, micro technology and precision devices through mechanical and optical engineering to power systems and aircraft industry. Ecoclean's success is based on innovation, cutting-edge technology, sustainability, closeness to the customer, diversity and respect. The Group employs a workforce of more than 900 at its twelve sites in nine countries worldwide.

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