

Technical article Ecoclean GmbH / Dry cleaning of parts for e-mobility applications

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New solutions to new demands in automotive manufacturing – Dry cleaning of parts for E-mobility applications

Increasing powertrain electrification and innovative driver assistance systems all the way to autonomous vehicle solutions impose new tasks in industrial part cleaning as well. Mechatronic assemblies, for instance, can often be cleaned by dry processes only. To this end, Ecoclean provides an extensive 'toolkit'.

Part cleaning in automotive manufacturing in recent decades revolved mainly around the removal of particles from components related directly or indirectly to the powertrain of internal combustion engines. OEMs and their suppliers manage these tasks with the aid of diverse wet-chemical cleaning systems.

Cleaning solutions for new mobility concepts

As mobility comes to rely increasingly on electric powertrain technology, change affects not only the parts to be cleaned but also the relevant cleanliness specifications and cleaning requirements. Consequently, cleanliness levels play an increasingly important role in electric-motor assembly lines. Particles are produced, e.g., in the 'hairpin' forming and processing techniques involved in the manufacture of stators. This foreign matter may cause short circuits or impair an electric drive motor's performance in subsequent operation. Particulate cleanliness standards for non-metallic contaminants are likewise becoming more stringent. Even fibres may become electrically conductive by absorbing moisture later on in service.

It follows that, for understandable reasons, wet-chemical cleaning processes are often no longer the method of choice. Moreover, current product and process developments call for cleaning solutions that are easy and inexpensive to integrate into production and assembly lines. In other words, they must be able to ensure effective automated parts cleaning within programmed cycle times to defined cleanliness specifications, and they must do so reliably and at minimum cost and effort. A dry cleaning system can fulfil all of these demands.

Combining distinct processes as needed

Based on the altered requirements in automotive manufacturing and the associated supplier industries, Ecoclean has developed a dry cleaning 'toolkit'. Supporting the implementation of technically and economically optimal machine designs for diverse requirements in accordance with customer specifications, the various tools such as compressed air, vibration, CO₂ snow blasting, atmospheric-pressure plasma and laser cleaning can be employed either individually or in combination with one another.

The starting point for elaborating a reliable cleaning concept is an understanding of the customer's overall production and assembly workflow. This is followed by process development and validation based on cleaning trials with original parts at the equipment manufacturer's Technology Centre. The aim is to provide a solution that is precisely tailored to given production conditions. To this end, input criteria include the part weight, the requisite flexibility in terms of motion sequence and part diversity, cycle time specifications and, last but not least, the available floorspace and automation systems.

Furthermore, customers are supported in performing the cleanliness analysis according to VDA 19. The special challenge with parts of this type lies, on the one hand, in conducting a non-destructive analysis based on a dry extraction technique. On the other hand, rinsing methods and test specifications must be developed for quality assurance purposes.

The removal of film-type contaminants is likewise shifting increasingly into the focus. With electronic components, this task is no longer performed by wet chemical technology either; instead, methods such as, e.g., CO₂ blasting, laser

applications or atmospheric plasma cleaning are employed, whether individually or in combination.

Selective part cleaning – "washing without wetting"

On many parts, high-quality cleaning of critical part areas is quite sufficient. Such areas include, e.g., the sealing surfaces of a transmission or battery housing to ensure the adhesive strength of a liquid gasket. The removal of particles produced in ultrasonic welding of power electronics components, among other operations, is likewise a classic job for a dry selective cleaning process, e.g., based on a combination of filtered compressed air and vacuum technology. For an optimum airflow management and hence, maximum cleaning effect, an interior flow simulation for the envisaged nozzles can be carried out ahead of the cleaning tests. Based on the results, an adapted nozzle body meeting different nozzle functions will be designed for additive manufacturing.

Another major aspect in designing the various tailor-made equipment solutions consists in avoiding recontamination of the cleaned parts by stray particles in the cleaning chamber.

From the above exemplary applications, it is evident that optimally adapted, effective and economically efficient solutions are available to address today's altered part cleaning needs resulting from new mobility concepts.

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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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