Economical and sustainable cleaning of fasteners

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Economical and sustainable cleaning of fasteners

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Whether in the automotive and transportation sectors, traditional mechanical and plant engineering, energy technology, the production of construction and agricultural machinery, the manufacture of medical devices for diagnostics and therapy or c industrial sectors, the requirements for component cleanliness increased enormously in recent years – including fasteners. smallest particles and/or minimal film residues on the surfaces impair the results of subsequent processes, such as coating, heat treatment or corrosion protection, and disrupting the long-term, flawless functioning of individual parts or complete systems.

In order to avoid this, limit values for the particulate and filmic contamination still permitted on the component surface, also known as 'residual dirt', are increasingly being defined for fasteners. In terms of particle cleanliness, these can be specifications such as 'no particles larger than 200 µm'; the maximum number of permissible particles in a size class; or a weight-based (gravimetric) determination of the amount of residual dirt. Specifications for filmic cleanliness are often given in the form of surface energy or surface tension (e.g mN/m = millinewtons per metre). In the case of fasteners for high-tech areas, including high vacuum technology, semiconductor production equipment, and medical technology, individual specifications or factory standards, such as outgassing rates, are usually added.

Cost efficient and compact chamber systems enable efficient, stable and sustainable cleaning processes with solvents, modified alcohols and aqueous media. Thanks to integrated media treatment, a long service life of the cleaning medium is also ensured

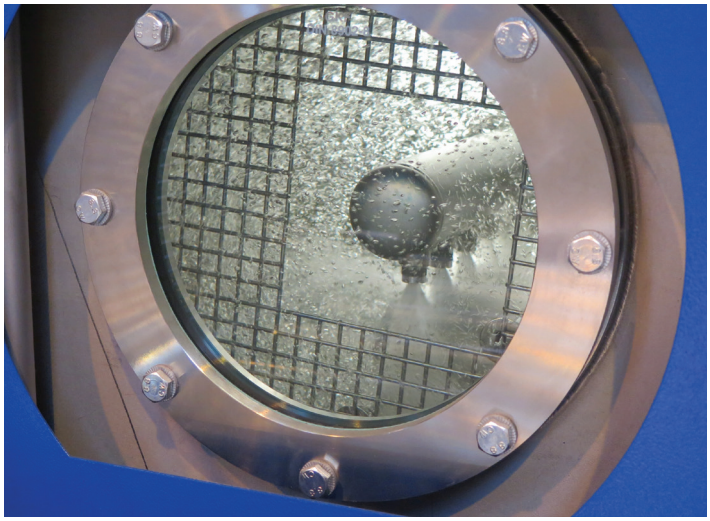
Typical challenges for cleaning

In addition to the cleanliness specifications to be met, there are various other challenges when cleaning connecting parts. These include different materials such as steel, stainless steel, aluminium, titanium, non-ferrous metals, plastics and composite materials, as well as the sometimes very complex geometries of the parts. In addition, the screws, nuts, and other parts, come into contact with various machining media during the manufacturing process, which generates particles and abrasion. They leave residues on the surface that can accumulate to form a mixture that is difficult to remove or, like some special lubricants (e.g Molycote), is inherently difficult to clean off. Cleaning, which is usually carried out as bulk material, often results in high weights and dense packings. Small fasteners in particular are difficult to clean and dry. High throughputs, short delivery times and sometimes low margins are further aspects.

In order to achieve the required cleanliness in a stable, efficient and sustainable manner, and to master the other challenges economically, comprehensive know-how about the various cleaning technologies, as well as knowledge about the applications and the physical relationships are required. As an experienced full service provider of future oriented solutions for industrial component cleaning and surface treatment, Ecoclean GmbH has both. This guarantees cleaning solutions that are designed and equipped to meet requirements and with which defined cleanliness specifications up to the highest demands in ultra-fine cleaning can be reliably achieved.

Selection of the optimum cleaning process

Fasteners are usually cleaned as a batch in wet chemical processes. The following factors must be taken into account: Material, size, geometry »



For efficient and short cleaning processes, the systems are equipped with various application specific process technologies. This includes high-pressure spraying with a pressure of up to 16 bar for solvent systems, which is used for densely packed batches of bulk goods and complex parts

and weight of the component, type and amount of contamination, downstream process and resulting cleanliness specifications, as well as throughput requirements. On this basis, it can be determined whether the adhering contaminants can be removed most effectively with a water-based cleaner, an environmentally compatible solvent or modified alcohol with lipophilic and hydrophilic properties. This information also makes it possible to define the most suitable process engineering and drying technology. Several cleaning steps are often required due to the different processing media used in the various manufacturing steps, such as pressing, rolling or heat treatment.

Correct system and process technology minimises cleaning costs

Cost efficient and compact chamber systems that work under full vacuum when using solvents, and have appropriate systems for media preparation, are state of the art for cleaning connecting parts. The batch capacity ranges up to lattice boxes. If a large variety of materials, very high throughput requirements, or the cleanliness specifications to be achieved during final cleaning, make the use of a chamber system unfeasible, modular ultrasonic multi-bath immersion systems such as the UCMSmartLine are available. Thanks to modules with integrated electrical and control technology for the cleaning, rinsing, drying, loading and unloading process steps, as well as a flexible transport system, it can be easily adapted to the respective task.

To keep the costs per cleaned component as low as possible, the systems are equipped with various application specific process technologies, for example for spray, high-pressure, immersion, ultrasonic and plasma cleaning, steam degreasing, injection flood washing, Pulsed Pressure Cleaning (PPC) or Ultrasonic Plus and, if required, for passivation/preservation of the parts. In combination, these processes make it possible to influence both the cleaning result and the cleaning time for specific components. For densely packed bulk material batches and complex components, spray processes and injection flood washing with adjustable pressures of up to 16 bar also ensure significantly improved results and shorter process times for solvent cleaning processes. Pressure change processes such as PPC or Ultrasonic Plus, in conjunction with aqueous or solvent immersion cleaning, enable contaminants to be removed reliably and quickly from small cavities. By combining processes in one cleaning system, that would otherwise require several systems, such as solvent or aqueous batch cleaning with a subsequent low pressure plasma process, the component surface can be prepared effectively and efficiently for subsequent coating, among other things.

If a large variety of materials, high throughput requirements or cleanliness specifications necessitate an ultrasonic multi-bath immersion system, modular solutions with integrated electrical and control technology and a flexible transport system are available.

Monitoring of validated process parameters

Whether in a chamber or ultrasonic multi-bath immersion system, the cleaning of fasteners for high-tech applications is often based on validated process parameters, compliance with which must be monitored and documented, such as the ultrasonic frequency and power. The Acoustic Performance Measurement (APM) systems from Ecoclean GmbH provide a solution for this task, with which measurements up to an ultrasonic frequency of 2,000kHz can be carried out inline and reproducibly. Monitoring is carried out using a condenser or laser-acoustic microphone, which is aligned with the surfaces of the ultrasonically equipped cleaning and rinsing tanks of a multi-bath immersion system. The measurements are thus carried out without movement or contact, ensuring the reproducibility of the results. In addition, APM technology makes it possible to detect ultrasonic frequency and sound pressure through 'walls'. It can therefore also be used in closed cleaning and rinsing tanks, as well as chamber cleaning systems. Analysis, evaluation and storage of the recorded data are carried out by the measuring system software.

Test centre for process development and design

The best way to determine which system and process technology is optimal for the respective task, in terms of cleanliness and cost-effectiveness, is to carry out cleaning tests with originally contaminated components. Ecoclean has extensively equipped test centres worldwide for this purpose, which enable tests to be carried out under near-production conditions. +