

Deburring Components for Particulate Cleanliness

Particulate Cleanliness and Deburring

Cleanliness specifications for particles just a few 100 micrometers in size are commonplace in many industries today. Especially in the case of machined components with complex geometries, these specifications can only be reliably fulfilled if an effective deburring process is carried out beforehand. A new solution combines both processes with rapid automation, enabling deburring and cleaning to be merged in a single highly flexible system.

Components are constantly becoming smaller and more complex. This invariably makes them more sensitive to particulate contamination, which results in higher cleanliness demands. Depending on the part and application, specifications such as "no particles larger than 200, 300 or 400 micrometers" must be met. Therefore, especially manufacturers of machined or cut metal workpieces with complex geometries have to go to great efforts to clean the components in order to comply with requirements. Despite these efforts, however, particles larger than those permitted are still often found on analysis filters during subsequent cleanliness inspections. The component, or even an entire batch of parts, will therefore not be cleared for final assembly.

Particulate contaminants are often detached burrs

The cause is often coarse and fine burrs that have been detached during the cleaning process but not completely eliminated. A further cause is handling the parts during the residual contamination check, since burrs can be broken off here as well. Burrs are undesirable fragments of material that form on machined edges, as well as on component surfaces due to material displacement, and are still firmly attached to the workpiece. Since machined workpieces often have areas that are difficult to access, such as undercuts, slots, grooves and internal and intersecting bores, they pose a particular challenge when it comes to deburring.

Nevertheless, these machining residues also have to be removed because burrs could loosen in later service and impair the function of the part or even lead to a system failure. This is especially the case with cleanliness-critical components such as hydraulic parts, e.g. transmissions, brakes and steering systems, as well as valves and housings for motors and pumps.

Deburring - a manufacturing task or a cleaning task?

Despite its significant relevance when it comes to component quality, deburring is often still seen as an unproductive manufacturing step. This frequently results in controversial discussions between users and manufacturers of cleaning systems. Especially where high cleanliness standards are required, it is therefore common today for a system manufacturer only to guarantee the required residual particulate contamination values if parts are clean and completely deburred.

High-pressure water jets - targeted burr removal

In everyday industrial processes, various techniques are employed to remove burrs. These can generally be divided into targeted and non-targeted categories. For components made of steel and aluminium with complex internal geometries, the use of high-pressure water jetting has become...

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...established to remove burrs in a targeted manner. Various deburring tools, such as different nozzles or lances, are used for this purpose. These are inserted into the bores and inner geometries to aim a jet of water directly at the burrs. The pressure of the water jet is significantly higher than the later working pressure used to guide fluids such as hydraulic oil through the component. For example, if an oil pump operates at 150 bars, the water jet used for deburring will have a minimum pressure of 300 bars. As a result, any burrs that are not removed by the process do not pose a threat during later operation of the pump.

In order for targeted deburring to be effective, production-related burrs must be defined and the mechanical processes causing them must be known in advance. This information can be used to create a part-specific deburring program, which ensures that the water jet hits the burr in such a way that it is carried away rather than pushed into the bore.

Interface problems - detaching and removing burrs

For reasons of energy and resource efficiency, the lowest possible pressures and water volumes are utilized for deburring, with the result that some chips/particles remain on the components. This is because the detached burrs are not rinsed off by such small quantities of water. That is why the form



Reliable deburring is a necessity in order to comply with high cleanliness standards.

components are then cleaned. This is usually carried out in a separate system and mostly in the of batch processes. Such a constellation poses several challenges for users. Among other things, two separate machines are required to solve the task of "components as clean as required". In addition, process responsibility lies with the equipment user if he has commissioned different suppliers for the two machines. Any cleanliness issues arising are often difficult to solve because the responsibility for the overall result lies in different hands. Furthermore, cleaning parts in batch processes requires additional handling as well as specially designed workpiece carriers, and the parts are only given a general wash. The critical areas cannot be cleaned in a targeted manner.

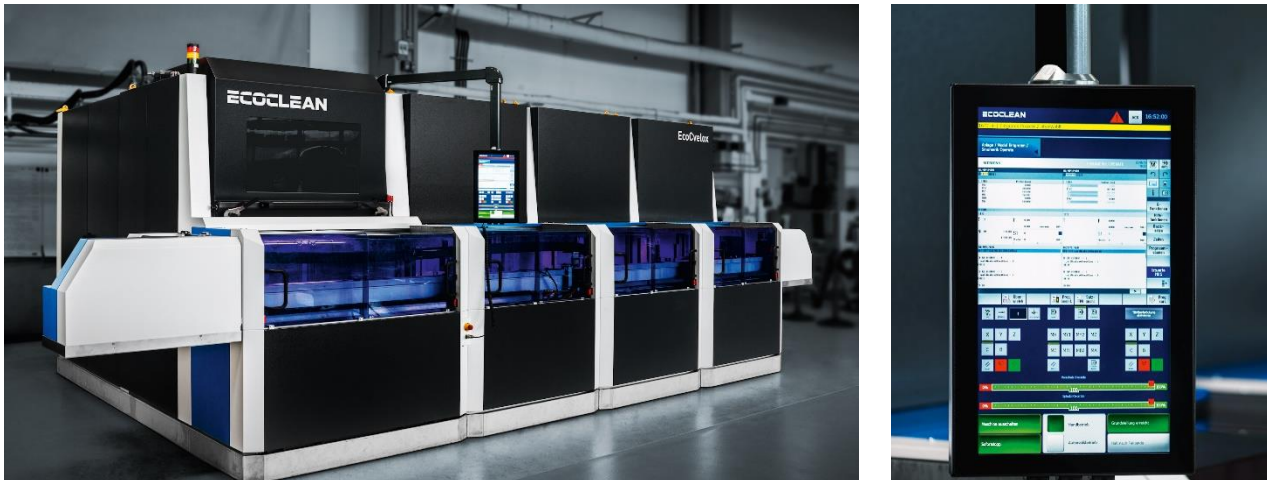
In a single process - targeted deburring and individual cleaning

Workpieces with high cleanliness requirements are therefore ideally not only deburred as single parts, but also cleaned in the same process. However, up till now very few solutions have been available. The solution lies in a brand new and highly flexible system concept. It features an integrated linear system for component handling, and automation can be tailored to customer requirements. Ecoclean's modular EcoCvelox combines a 5-axis high-pressure water jet deburring technology with a series of processes for part cleaning and drying. The standard modules are designed for parts with dimensions of 200 x 200 x 200 mm which are fed in on pallets. The various operations can be performed in cycle times of 15 seconds per pallet, with processing time accounting for around 14.5 seconds.

Deburring and cleaning - individually configurable

The modules for deburring, cleaning and drying components can be individually configured and extended as required. High-pressure deburring can be performed with the standard single spindle and a maximum pressure of 1,000 bars (up to 3,000 bars if necessary) or with an optional HD turret that can be fitted with up to five different tools.

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The new EcoCvelox combines deburring and cleaning with high-speed automation, enabling these processes to be carried out efficiently in a single machine from one source. On the 19-inch flat-screen screen (HMI) of the new and intuitive operating panel, each module of the machine is displayed clearly and separately in a complete overview, similar to a smartphone display.

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Both options can be adapted specifically to the part in question. For component cleaning, the processes of injection flood washing, spray cleaning, ultrasonics and targeted rinsing (all combinable) are available. Parts are dried in a high-velocity air-blowing and/or vacuum drying process. The air-blowing unit can also be integrated into a cleaning module, if the cycle time is appropriate.


CAD/CAM interface - fast and easy programming

Adapted for use with machine tools, a CAD/CAM interface can also be integrated into the deburring module. Existing data from component production can thus be used when programming high-pressure deburring, enabling it to be carried out quickly and easily offline and then imported into the plant control

unit. In addition, deburring processes for new components can be programmed and implemented in the shortest possible time and with minimum effort. For part identification, a camera system can be integrated, resulting in effective and cost-efficient deburring operations even with 'lot size one' parts.

Thanks to the highly adaptable system configuration and process design, this new solution meets all deburring, cleaning and drying requirements cost-effectively from a single source. Furthermore, its simple operation and ease of maintenance makes EcoCvelox an efficient answer to increasingly stringent cleanliness requirements

>>> Additional Product Information



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