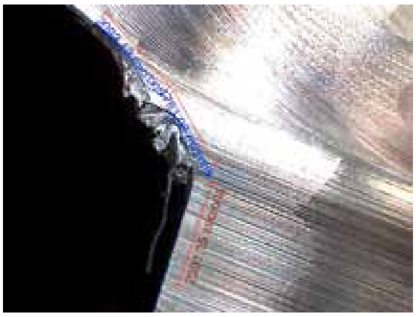
More than cleaning

INDUSTRIAL CLEANING TECHNOLOGY

Reduce costs with optimized production processes

It is true that for the surface quality of components a suitable cleaning technique is an essential element, but this alone cannot guarantee the desired degree of cleanliness. Both the basic quality structure of the component and the upstream production processes have a significant influence on the required final result. This is why a comprehensive survey of all production processes is one of the most important tasks – also from the aspect of investment and operating costs.

Successful cleaning processes depend on many factors. Industrial cleaning technology is not an end itself, however, but a challenge to the entire value added chain, enabling technically necessary component cleanliness to be guaranteed by a defined delivery time. Factors that can be controlled include the selection of material, processing sequences as well as handling and environment, which will be further examined in this article. The scale of change options, however, must be aligned to the function and task of the component, which in relation to geometry and technically necessary basic characteristics is unchangeable.



Burr remains after milling.

BASIC GENERAL CONDITIONS FOR CLEANING

Particulate residual dirt demands always require the following input conditions for all types of components:

- absence of burrs
- absence of clamping chips
- residual magnetism ← 4-5 A/cm

This is because when working with components that have not been deburred or only poorly deburred there is a risk that particles of varying size will be shed after the cleaning process during all subsequent assembly and handling steps or in the final mounted state of the actual product. The same applies for clamping chips in boreholes or intersections. These can easily "wander" into the interior during processing or when handling the component – but cannot leave it because of their self-blockade. In the case of potentially magnetic parts, high residual magnetism leads to free particles "sticking" to the component surface – a further risk factor which in the worst case will result in drastic impairment to the quality required.

CONTROLLABLE FACTORS

Moreover, some other aspects in all machining manufacturing processes have an impact on the type and durability of the cleaning module as well as on investment and operating costs. Hence the basic structure of a starting material has a noticeable impact on the component's cleanliness depending on the cleaning requirements. Castings in particular show considerable differences in their suitability for fine cleaning procedures depending on the respective alloys. In very critical cases this will lead - when using ultrasonic procedures for instance – to flaking effects with particles in size categories that are difficult to define. Therefore the quality of the casting process and casting mould are of considerable importance especially in aluminium die casting. On the one hand, there are immense differences in the surface and component quality when using the moulding sand procedure because of the useful life of the sand used. On the other hand, possible interim cooling of classical die cast moulds from which die flaking may occur leads to problems in subsequent processing and cleaning. Likewise residual contamination that produces loosely or firmly sticking particles. Not least, the constructive design of the mould for the positioning section points (see picture 1) and moulding in the areas of subsequent machining work (such as milling,

BASICS

Metallic chip in spiral form.

picture 2) are crucial for whether burrs occur and how much effort is required to remove them. After casting various blasting processes are often employed to remove casting residue and flaky burrs. In addition, many of these processes have the advantage that they compress the raw cast surface that results in altogether higher resilience making it easier to meet the stringent residual dirt demands.
The machining sequence and the selection of tools also have an effect on burr formation and the incidence of potential clamping swarf in conical or spiral form (see picture 3 and picture 4). Likewise the service life and the action time of the respective tools because at the end of their useful life they generally cause increased burr formation or impair the type and geometry of the machining chips. Therefore not only compliance with the measurement specifications from drawings should be included in the planning and consideration of the task but also the options for avoiding an independent deburring process.

TYPE AND QUANTITY OF CONTAMINATION

The effort and investment needed for a cleaning task depend very much on the type, size and quantity of input contamination. The more varied this is in the form of particle size or number and the quantity of the introduced machining oils or cooling lubricants, the more time-consuming and costly the design of the washing-mechanical installations and media treatment systems will be. Due to targeted flushing processes with the cooling lubricant during machining this contamination can be reduced to an acceptable minimum.

Yet even if all controllable variables have been considered and optimized in the preliminary process under the aspect of component cleanliness, the factor material handling remains: unnecessary idle time before cleaning, for instance, leads to surface drying of emulsion residues and consequently to intensified sticking of particles and to surface attacks on the machining plane by salts in the cooling lubricants. Moreover, the use of racks, especially if they are not designed in a way that protects and limits damage to the component, will lead to damage to machined or unmachined areas and to possible burr formation with corresponding consequences.

IN PRACTICE

To what extent the aspects described above influence in practice the choice of cleaning technology and hence investment costs is shown in this example:

Client:
Customer from the automotive industry

Task:
To clean a component for an aluminium pump housing with input contamination of → 1000µm

Special features:
Machining on double-spindle machine with emulsion. Free from burrs due to optimized die casting mould/tools
Residual dirt requirements: ← 600µm

LPW Reinigungssysteme GmbH in Riederich reacted at first with an offer for a single-chamber system of the PowerJet type, which is equipped with two tanks, distillation, pressure flooding (18 bar) and a manual loading unit. The machine is characterized by good treatment capacity, process- related cleaning reserves, low operating costs and a very good cleaning result. To fulfill the task batch loading in baskets would have been necessary, involving increased handling time. Investment volume for this variant was calculated at between 120,000 and 135,000 euros (without baskets).
After reviewing all preliminary processes an emulsion flushing process was integrated as an optimization measure in the machine tool with 14 to 18 bar. As a result the profile of the specially adapted cleaning system is as follows: LPW PowerLine standard throughput system with two tanks, hot-air drying, distillation and manual loading at the infeed side.
With this variant and its related optimizations it was possible to achieve the required cleaning result of ← 600µm in the preliminary process without any difficulty – and investment costs were reduced to between 100,000 and 115,000 euros.

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