LPW

More than cleaning

//Atomic residues

//Bacteria

//Toxic residues

//Particles

//Film contaminations

"THE SOLUTION TO COMPLEX CLEANING REQUIREMENTS NOT ONLY INVOLVES THE ASSESSMENT OF THE CURRENT TASK. RECOGNITION OF THE CHALLENGES OF TOMORROW PLAYS AN EQUALLY IMPORTANT ROLE"

TRADITION UND INNOVATION

Modern industrial cleaning technology has its origins in the German speaking world. Due to the increasing requirements for surface quality under gravimetric and particular principles as an addition to the known solvent-based cleaning technology, another efficient sector developed in the 1980s:
the industrial cleaning technique on water-basis. As part of this development, quality systems have been produced under the name of LPW ever since the 1960s.

The world is changing. Technical cleanliness is a crucial product feature which affects the entire process chain. Especially where the development and production of premium and innovative products are concerned.

LPW Reinigungssysteme GmbH lives up to these quality standards with a high level of flexibility, innovation skills of a mid-tier business as well as a strong network of partner companies all true to the motto "quality made in Germany".

Classic fields of application for our systems are the mechanical engineering, automotive, electronics and aerospace industries. Our High Purity division also makes us a very popular partner in branches with demanding cleaning requirements such as medical technology and the optical and semiconductor industry.

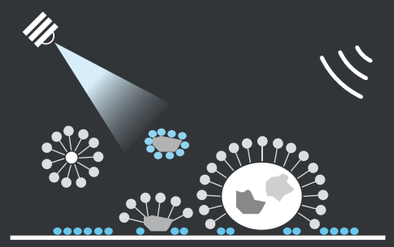
We combine proven cleaning and drying techniques with new highly modern technologies. The combination of physical factors such as pressure, vacuum, spraying technology and fluid dynamics open up further possibilities and thus optimise the overall process. Intelligent process technology in conjunction with customer expertise represent an important element of our continuous R&D work.

Selection of the suitable cleaning technique

The optimisation of the overall process plays an important role in order to achieve a well-defined surface quality and thereby outlines the essential task for the operator, in close cooperation with the system supplier, as a carrier for know-how and innovation.

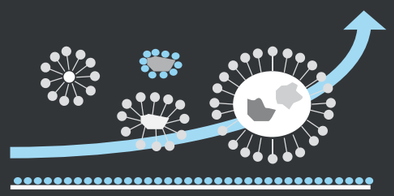
The design of the actual cleaning technique is split into four sections:

1. REMOVAL OF LOOSE AND INHERENT CONTAMINANTS



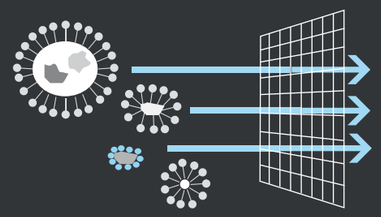
Core task of the cleaning technique is the removal of unwanted particular or filmogen contaminants on an organic or inorganic basis. Therefore process reliable wash-mechanical techniques such as injection flooding, blast and brush treatments as well as ultrasound are deployed, as well as wet chemical or thermal processes.
The selection depends on the respective requirement and quality of the component.

2. PREVENTING RE-CONTAMINATION



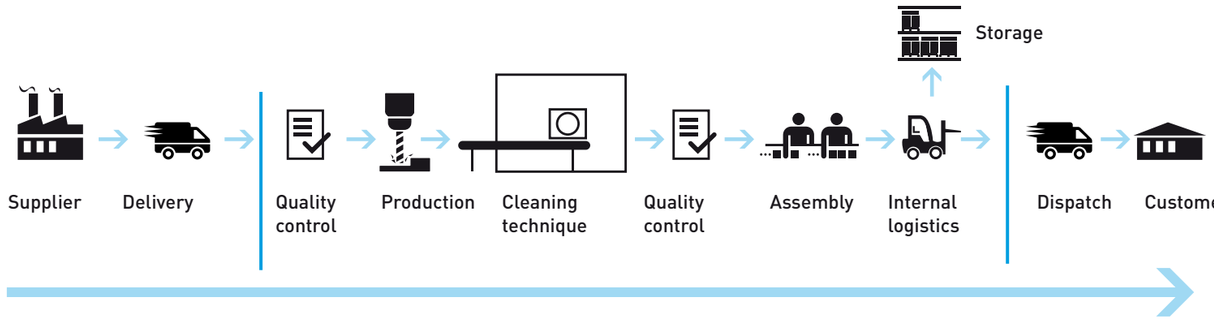
After having separated the contaminants from the component's surface one can judge an efficient treatment if it is capable of transporting the dirt through suitable carrier mediums (in general aqueous or solvent-based fluids) immediately from the components section in order to avoid effects of re-contamination and to direct it to the appropriate processing medium.

3. PROCESSING MEDIA



The right choice of processing systems is crucial for the cleaning quality, the duration of process efficiency as well as the life time of the deployed cleaning media. One distinguishes between the classical circuit filtration systems and the processing systems with partial flow power. Style, costs and complexity strongly depend on the respective cleaning tasks.

4. REQUIREMENTS DUE TO THE FOLLOW-UP PROCESS



From a modern and innovative industrial cleaning technology one may expect a customized adaption, for example through a modular building kit, that adapts to current and future requirements of the respective follow-up processes.
A variety of wash-mechanical skills, a great choice of suitable cleaning media that keep operating costs low as well as an option for the perfect integration in existing logistic processes requires a perfectly fitted and demand-oriented design.

"MODERN INDUSTRIAL CLEANING TECHNOLOGY IS NOT ONLY A QUESTION OF TECHNOLOGY"

WASH MECHANICAL ACTION // CHEMISTRY // TIME // TEMPERATURE

"IN AQUEOUS CLEANING, TIME, TEMPERATURE, MECHANICAL ACTION AND CHEMISTRY ARE THE BASIS FOR ALL FEASIBLE SOLUTIONS"

Influencing factors

in aqueous cleaning

To fulfil the respective tasks aqueous component cleaning basically has four interacting domains to choose from. They form the basis for all feasible solutions:

MECHANICAL WASH ACTION

The introduction of mechanical treatments (for example ultrasound, brush and nozzle systems, compression and volume power) greatly influence the cleaning result and also the necessary processing time.

TIME

Foremost, this factor includes the necessary overall processing time of the cleaning, rinsing and drying in order to fulfil the desired cleaning result. If the total time exceeds the required processing cycle time, it will have a serious impact on the choice of the suitable manufacturing equipment.

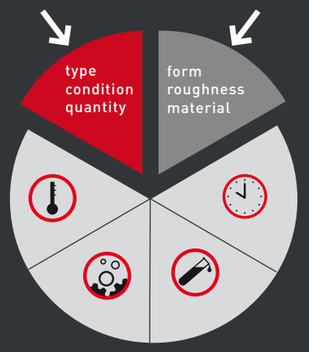
CHEMISTRY

Special purifiers, depending on the performance and material requirements, will be added to the aqueous media in order to support the resolution of organic and inorganic contamination, moreover to have a crucial influence on the manner and quality of the bath treatment capacity. Additionally, these additives can take over i.e. pickling, phosphating, conservation or other tasks.

TEMPERATURE

The temperature influences both the quality of the cleaning effect and drying as well as the time of the overall process. Due to the component's features and the physico-chemical background there are limits regarding the design of the adequate treatment.

... for more information visit www.lpw-reinigungssysteme.de, Basics



FURTHER INFLUENCING FACTORS

A. Efficiency / Cycle time
B. Wash / Drying process
C. Temperature need of the goods

Comparison of plant systems

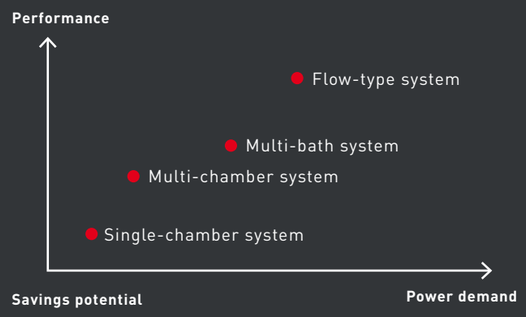
ENERGY CONSUMPTION

	Single chamber system	Double chamber system	Serial immersion bath system
Power input full load activity (kW)	**27.5**	**45.0**	**91.0**
Max. efficiency (lots/h)	**5** Cycle time 12 min.	**9** Cycle time 6,5 min	**11** Cycle time 5,5 min
Power demand (kWh/lot)	**5.5**	**5.0**	**6.8**

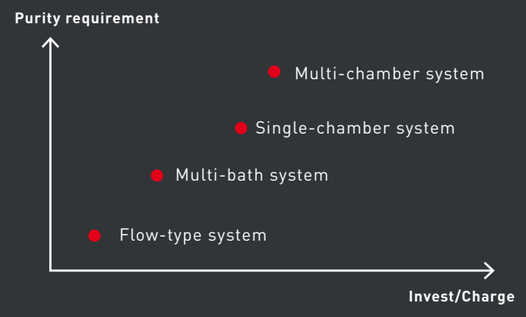
Regardless of the effects of a fresh cleaning bath, the aqueous single chamber system proves to be the more efficient system with the biggest chances to increase effiency even more. In designing it as a double chamber system this performance will be intensified through the distribution of the base load.

... for more information visit www.lpw-reinigungssysteme.de, Allgemeines/Energieeffizienz

RELATION THROUGHPUT/POWER DEMAND



RELATION REQUIREMENTS/INVEST



Overview LPW Range

The aqueous full-range for industrial tasks

"OUR CLEANING SYSTEMS ARE ADAPTED TO OUR CUSTOMERS' NEEDS AND NOT THE OTHER WAY ROUND"

DESIGNING

The design criteria for an aqueous cleaning plant are fixed in cooperation with the consumer on the basis of the customer requirement specifications, defined requirements and realistic tests in comparable plants or the on-site technical centre. One usually selects from the established solution possibilities depending on the required performances, residual dirt requirements and organisational parameters.

SOLUTION POSSIBILITIES

In general, there are spray and flood processes available which differ according to goods movement:

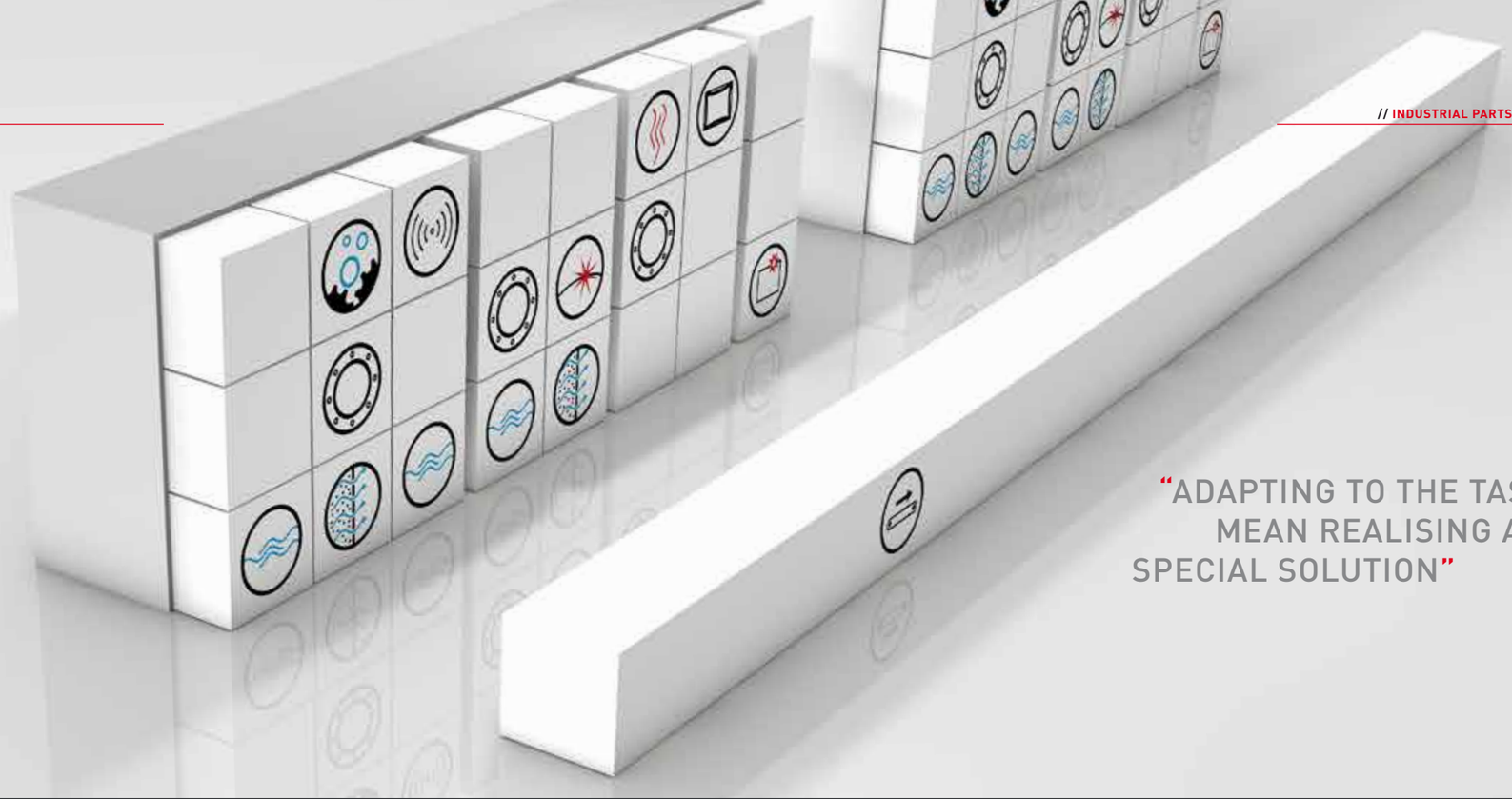
- **Single/multi-chamber flood washing systems**
- **Single/multi-chamber spray washing systems**
- **Belt washing systems**
- **Multi bath systems**
- **Alternative/special systems**

MODERN AND FUTURE-ORIENTED AUTOMATION SOLUTIONS

Industrial cleaning technology requires a robust and process reliable automation with the following features: Suitability for basket and pallet goods. Sufficient size tolerance for the delivery/receipt of the goods to and from the treatment chamber. Possibility to separate cleaned and dirty goods. Suitable media-resistant and contamination-resistant components in the wet zones. Temperature stability within the dry zones. Corrosion-protected surfaces as well as reduced complexity of technical performance. Along with classical roller track systems, LPW also delivers solutions for complex tasks with several drop and delivery stations in multi-stage cleaning processes.

SPECIAL SOLUTIONS

Not every task can be solved with a standardized modular component. Often there are spatial, component or process-related influences that demand special solutions. LPW Reinigungs-systeme GmbH has many years of experience in this field and is very well prepared for designing customized solutions as a result of our own in-house process development as well as a technical centre with its own residual dirt analysis.



System PowerJet

The modular all-rounder

"ADAPTING TO THE TASK DOES NOT MEAN REALISING AN EXPENSIVE SPECIAL SOLUTION"

FEATURES AND STANDARDS

- **High standardisation grade and use of standard parts**
- **High quality performance in production and assembly**
- **Can be extended and expanded at a later date**
- **Low operating costs at high availability**

The LPW-PowerJet modular series is currently our most powerful system for meeting premium purity requirements in all high-tech branches. At the end of the 1990s the automotive industry and industry in general were investing in single-chamber immersion systems because these were seen as the standard for almost all applications regarding final cleaning tasks. Multi-chamber systems have since been added to these because they offer a much wider process scope.
This applies particularly for the final cleaning of medical system devices or components for the semiconductor industry which usually takes place on wet benches/ serial immersion bath systems. Chamber systems are by now far superior under consideration of all the relevant aspects. The bottom line is that these plants are extraordinarily flexible and extremely efficient systems that are designed to fulfil all criteria regarding residual purity and at the same time for high availability and low operating costs.

These systems are designed so that they can be integrated ideally into the production processes. Our modular PowerJet system also meets customer requirements for integration as a "quality gate" between the grey room and clean room environment. The unique features of this modular structure include the hermetically sealed treatment chambers, maximum flexibility with regard to throughput and the easily expandable configuration. The design of this system type allows integration of all known cleaning techniques and media processing techniques. With much higher filtration rates and minimised cross contaminations in comparison with all other known systems. We offer a high degree of flexibility with regard to the media-wetted materials (e.g. stainless steel or plastic). LPW also offers suitable automation and control systems. These range from simple automatic loading to complex connections to multi-stage upstream and downstream processes, also under the aspect of batch size 1 and batch tracking if required.

//Available cleaning processes

- Spray cleaning
- Ultrasound systems
- PowerJet cleaning technique
- Cyclic nucleation (CNp)
- Fast emptying

//Available drying processes

- Hot-air drying
- Vacuum drying
- IR drying system
- CNp drying

/Additional options (examples)

- Filtration
- Deionised/high purity water system
- Automation

» Flexible and extremely efficient system
» Designed for high residual dirt requirements
» High disposability at low operating costs

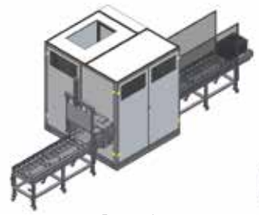
Single/Multi flood washing system

PowerJet - the all-rounder

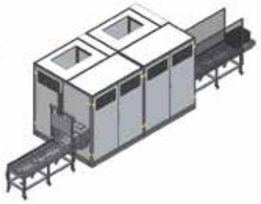
Variants

PowerJet
Compact

PowerJet
Twin/Triple



PowerJet
Inline compact



PowerJet
Inline Twin/Triple

PowerJet
Topload

GENERAL FEATURES

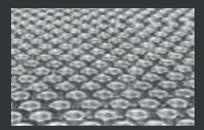
» High-quality fine cleaning:
- Components made of metal, plastic, glass or ceramic
- Bulk goods or positioned single components
- Fully or partially automated
- Cleaning of residual dirt or surface tension
- Process-reliable removal of chips and processing residues after mechanical processing
- Use of all known wash-mechanical and wet chemical flooding and spraying techniques
- Cleaning according to branch-specific purity requirements

530

670

960

POSSIBLE FIELDS OF APPLICATION



Premium aqueous fine cleaning

» Components made of metal, plastic or ceramic
» Bulk goods or positioned single components
» Full or partly automated, i.e. diesel-injection components
» Cleaning on residual dirt of surface tension

Removal of coarse contaminants

» Preparation for overhauling of a second-hand engine
» Removal of contamination from usage before crack tests
» Cleaning after lugging
» Cleaning after grinding and polishing processes

Cleaning before/ after thermal deburring

» Removal of tinder residues before final assembly or processing
» Removal of oil / emulsion residues as TEM-preparation i.e. hydraulic components

Fine cleaning of stainless steel/ aluminium components

» Process-reliable removal of chippings and processing residues after mechanical treatment
» Preparation for meter/ leak test operations i.e. extension components, engine/transmission production
» Cleaning of residual dirt or surface tension

Cleaning of engine- and transmission-components

» Aluminium, steel and grey cast iron components
» Process-reliable removal of chippings and treatment residues after the mechanical treatment
» Preparation of the components for meter/ leak test operations
» Cleaning of residual dirt or surface tension

Cleaning before/ after heat treatment (hardening)

» Removal of organic residues (normally emulsion)
» Cleaning of processed components before further assembly

» In addition to tailor-made, customised designs, modular standard systems are also available:
- 530 (batch size 530 x 320 x 200 mm)
- 670 (batch size 670 x 480 x 300 mm)
- 960 (batch size 1020 x 650 x 560 mm)
- as well as all special sizes

» With standing or lying media templates

» Possible integration of all known cleaning techniques (e.g. spray/flood cleaning, ultrasound, cyclic nucleation, fast emptying, etc.)

» Possible integration of all known drying techniques (e.g. hot-air, vacuum, CNp, IR, steam drying, etc.)

» Possible integration of all known media processing techniques (e.g. full power filtration, bypass filtration)

» High flow-rates
» Designed for high residual dirt demands

Multi bath immersion cleaning system

PowerStep - one with high capacity

GENERAL FEATURES

The cleaning systen PowerStep is designed for multistage aqueous immersion washing of workpieces in baskets or racks at high flow-rates. The baskets of goods are inserted in a transport rack automatically.

Then the transport rack is moved by a lifting device or cycle sliding-system to the respective treatment station. After the finished treatment the carrier rack is lifted from the station and transported onwards.

POSSIBLE FIELDS OF APPLICATION

Premium aqueous fine cleaning

» Components made of metal, plastic or ceramic

» Bulk goods or positioned single components

» Full or partly automated i.e. diesel-injection components

» Cleaning of residual dirt or surface tension

Fine cleaning of stainless steel/ aluminium components

» Process-reliable removal of chippings and processing residues after mechanical treatment

» Preparation for measuring-/ leak-test-operations i.e. extension components, engine-/ transmission-production

» Cleaning of residual-dirt or surface tension

» Low cost cleaning system for simple component geometries
» High availability at low operating costs

Single-/ Multi chamber spray washing system

AquaJet - the flexible one

GENERAL FEATURES

The series AquaJet has all features and advantages of a premium immersion washing system with regard to design, quality and efficiency. With suitable component geometries one can achieve comparable cleaning and drying results despite shorter cycle times. The advantages of this system come expecially into play regarding intermediate cleaning or cleaning prior to quality relevant measuring operations. Whether as a budget-friendly isolated application or a fully integrated and automated module within a production process, it creates a good basis for high customer benefit.

POSSIBLE FIELDS OF APPLICATION

Surface final cleaning of individual components

» Components made of metal, plastic or ceramic

» Positioned individual components as a rule, cup-shaped geometry

» Full or partly automated

» Preparation of the components for measuring-/ leak-test-operations

Pre-cleaning

» Removal of chippings and processing residues between and prior to final cleaning stage (aqueous or solvents)

Intermediate cleaning

» Removal of chippings processing residues between mechanical treatments

» Preparation of the components for measuring-/ leak-test-operations

- Design for big flow-rate quantities at continuous loading
- High availability
- Low operating costs due to an energy-optimised system

Cycle washing system

PowerLine - the long-distance runner

GENERAL FEATURES

The Powerline cleaning system is designed for continuous cycle washing of workpieces with a high throughput rate. The type of the components, the contamination and the required degree of purity all lead to a version in line with the job requirements. A cycle cleaning system generally involves a job station, cleaning and rinsing zones, the drying zone and transfer station. The receiver tanks containers are located under the spray tunnel. The parts are put onto the transport system at the loading station. In order to minimise a delay between the cleaning and rinsing stations a neutral zone between them is essential.

A vapour suction in the inlet area and maybe in the neutral zones prevents fumes coming out of the plant. Furthermore, one can integrate blow devices in the neutral zones in order to free the workpieces largely from splashing water. After the cleaning process the drying follows – depending on the application with circulating air or a high pressure blow drying via blow devices.
Depending on the design and chosen option, additional such as vaporisers, dirty water tanks and oil separators are placed as side units next to the plant.

BEISPIEL EINSATZGEBIET

Final/intermediate cleaning of individual components

- Non or slightly scooping components
- Positioned or free flow
- High flow-rate quantities

"MADE IN GERMANY IS NOT AN IDEOLOGY BUT THE PREREQUISITE FOR HIGH QUALITY AND EFFICIENT PRODUCTION PROCESSES"

Custom-made special solutions

Tailor-made solutions

PowerJet 1300 T5 Twin CNp

CUSTOMER REQUIREMENTS

Cleaning of individually formed cooling pipes as well as various extension parts for the semiconductor supplier industry with direct clean room connection.

OUR SOLUTION

Closed machine system with 5 receiver tanks and 2 treatment chambers (batch size 1,300 x 600 x 550 mm). Cleaning takes place in a combination of flood, ultrasound and CNp processes, drying by means of vacuum infra-red drying in the second treatment chamber.
The bath processing is ensured by circuit filtrations, an integrated distillation plant as well as a purified water circuit processing.

PowerJet 530 T4 Twin CNp medical

CUSTOMER REQUIREMENTS

Intermediate and final cleaning of medical instruments

OUR SOLUTION

Closed machine system with fully automatic process sequence, reading in of washing programs by barcode. The system comprises 2 working chambers which can be operated simultaneously. Each chamber has two connected tanks that are separated from each other. Tanks 1 and 2 are assigned to the first treatment chamber, tanks 3 and 4 to the second one. Tank 1 contains the cleaning medium which consists of 80 % purified water and 20 % cleaner. Tanks 2 to 4 are filled with purified water. Process steps during cleaning are, e.g., flooding of the working chambers, spraying of the goods and cyclic nucleation by alternating overpressure and underpressure (CNp).

PowerJet 670 T5 Hexa

CUSTOMER REQUIREMENTS

RFID-controlled intermediate and final cleaning of fuel injection components at a batch size of maximum 670 x 480 x 300 mm and a throughput rate of approx. 10-12 batches/h with a chaotic goods feed up to batch size 1.

OUR SOLUTION

Highly flexible and efficient system in the form of a 6-chamber Power-Jet T5 Hexa cleaning system. Among other things, this ensures that the rinsing and drying processes for steel and stainless steel components are completely separated. An autonomous long-term preservation is integrated for the steel components.
The media processing takes place in addition to the full power filtration in every bath by a large coalescence oil separator with magnetic cartridges as well as a distillation plant with heat coupling in the baths.
A 2-bay automatic shuttle system for coupling to a loading/unloading circuit with integrated goods rack return and RFID system is responsible for loading.

PowerJet 960 T3 Triple

CUSTOMER REQUIREMENTS

Fully automatic cleaning of gears and shafts for motor vehicle transmissions with a cycle time per basket stack (approx. 250 kg) between 3 and 4 minutes and a purity requirement of max. 2 mg/1000cm²

OUR SOLUTION

Cleaning system with three front-loaded treatment chambers for a batch size (W x D x H) of 800 x 600 x 560 mm with three receiver tanks (cleaning, rinsing 1, rinsing 2), ultrasound in chamber 1, full power filtration, 3 coalescence oil separators. Distillation device for bath processing, with integrated hot-air drying as well as external vacuum drying. The goods are moved in swivel mode. The automatic feeder is loaded by an area portal.

LPW – the company

Tradition, experience and innovation

The LPW cleaning systems GmbH is ranked amongst the leading suppliers for premium systems and process technologies in the industrial component cleaning business with aqueous media. The highly specialised systems are deployed not only in the areas of mechanical engineering, cars, aerospace but also for suppliers of the respective industries and in industry in general – for over 50 years.
The company's range of services includes standard as well as individual solutions to optimise production processes with regard to energy efficiency, availability and quality.

MADE IN GERMANY

All LPW-systems are developed and manufactured at the headquarters in Riederich. Also the single components of our suppliers are all "made in Germany". Together with our production halls an in-house technical centre with connected residual-dirt-analysis for testing purposes as well as training and meeting rooms are at our customers' disposal.

REPRESENTED WORLDWIDE

For many years LPW has already been delivering abroad and is in the meanwhile represented with over 250 systems on the international key markets. Also beyond Germany's borders our customers are provided with optimal support with regard to development, purchase, distribution and service. Amongst other things this is guaranteed through the membership in the internationally operating Surface Alliance as well as through a wide network in several countries.

THE PARTNER FOR YOUR SUCCESS

Taking past experiences into account, using today's know-how and technology, thinking ahead about tomorrow's tasks – and therefore finding solutions for the future. According to these principles we develop customized systems with the best possible technical and economic benefit for our customers. For success, the cooperation of the various special departments as well as a strong innovative energy are crucial factors.
LPW – More than cleaning.

"TO REMAIN MEANS BEING PREPARED FOR TOMORROW'S CHALLENGES"

Questions and Answers

about the industrial cleaning technology

1 QUESTION 1
WHAT IS AQUEOUS CLEANING SUITABLE FOR? WHERE ARE ITS LIMITS?

ANSWER

Aqueous cleaning is the classic solution for the cleansing of inorganic contamination such as salts and pigments/particles as well as, with suitable chemistry, for the cleansing of organic contamination. In addition, specific surface effects can be achieved, for example, for welding or coating pre-treatment. Aqueous media are used, above all, in the final rinsing processes for high cleanliness requirements in precision cleaning, especially of filmogen contaminations.

2 QUESTION 2
WHAT PART DOES THE CLEANING TECHNIQUE PLAY WITH REGARD TO THE COMPONENTS' CLEANLINESS?

ANSWER

In general, the cleaning technique represents the end of a partial or total production process before the assembly or any further logistical process. Prerequisite for the achievable quality are, however, the nature and excellence of the materials, the quality and order of the mechanical machining process, the skills of the appointed staff as well as the absence of burr at least to an equal degree. Failures in the pre-process often make it hard or even impossible to achieve the necessary technical purity requirements. In addition, the respective ambient conditions regarding the technical cleanliness and the qualification of the staff are often of equal importance in precision cleaning.

3 QUESTION 3
HOW IMPORTANT ARE THE MEDIA PROCESSING AND MEDIA SUPPLY SYSTEMS?

ANSWER

The media processing systems have the task of reliably removing the contamination dissolved from the component surface from the media flow according to the required cleanliness criteria and thus safely avoiding cross or re-contamination. The same focus must be placed on the media supply. The quality of the used media (e.g. water, air, chemicals) must also be orientated to the required level of technical cleanliness. Along with the improved cleaning results these systems prolong the life time of the baths with regard to cleaning performance and process reliability.

4 QUESTION 4
WHO SUPPORTS THE OPERATION OF A CLEANING SYSTEM?

ANSWER

The system supplier guarantees support for maintenance and repair after delivery by means of his own capacities or service partners. Though in day-to-day business the chemical supplier with his service package plays an important role regarding bath care and the maintenance of the bath quality. In coordination with the system manufacturer he is an important supporter for the operator running the system. However, specially trained application technicians of the system manufacturer who are able to provide on-site support in process and procedural optimisation are called for especially in premium high purity applications.

5 QUESTION 5
WHAT DOES ENERGY EFFICIENCY MEAN FOR US?

ANSWER

The optimum process design of the entire process for achieving the required technical cleanliness comes before all energy efficiency considerations. In the water-based cleaning technique in particular, thermal energy is used for tempering the process baths on the one hand and to ensure the drying results within the given time frame on the other hand. Mechanical washing processes also create a certain amount of waste heat. In addition to the well-known alternatives for system heating (e.g. electric bath heating, district heating connection or gas heating), LPW Reinigungssysteme GmbH also offers direct coupling to waste heat generating processes (e.g. vacuum pumps, distillation plants) as well as energy-efficient drying processes which completely dispense with the use of fan heaters for example. We also offer suitable solutions for the optimisation of the process times with the aim of being able to reduce the energy consumption/batch.

6 QUESTION 6
HOW DO SPRAY AND FLOOD CLEANING TECHNIQUES DIFFER?

ANSWER

Spray cleaning techniques are suitable for components with low complexity and medium requirements regarding component cleanliness and are characterised by their potentially high kinetic energy.
However, they harbour the risk of cross or re-contamination. Flood cleaning, on the other hand, is especially suitable for densely packed goods or components with more complex geometries. Whilst the kinetic energy of the nozzle systems tends to be lower due to the resistance in the liquid medium, processes such as injection flooding or the various possibilities of ultrasound cleaning, for example, can be exploited in the immersed condition. In addition, vacuum cleaning, e.g. with CNp, can be integrated.

7 QUESTION 7
WHICH TECHNIQUE IS BETTER? ULTRASOUND OR CNP?

ANSWER

Both techniques have their clear justification in fine or precision cleaning processes. The ultrasound or megasound techniques are clearly indicated for less complex geometries. However, due to their physical properties, these are only suitable with considerable restrictions for densely packed goods or capillary structures. CNp, as a geometry-independent cleaning technique, plugs this gap. The techniques are frequently used consecutively or combined.

8 QUESTION 8
WHAT IS MEANT BY FILMOGEN CONTAMINATIONS?

ANSWER

This type of contamination is one of the biggest challenges for the processes and technology especially in precision cleaning. A filmogen contamination is to be understood as a thin, coherent (non-particular) layer of undesirable contaminations directly on the boundary layer of a component. It can have organic, inorganic, ionic, neutral, metallic or non-metallic ingredients. It can also occur in the material (3rd dimension) due to the pre-processes.

... mehr Fragen und Antworten unter
www.lpw-reinigungssysteme.de, FAQ

LPW

More than cleaning

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MEMBER OF SURFACE ALLIANCE

Mehr unter:
https://www.youtube.com/watch?v=RQKNwEK4aT4