# Cleaning

### Brief Description

These Work Instructions summarize the most important information needed for the cleaning of parts.

### Area of Application, Responsibility

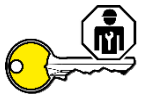
Responsibility for the correct implementation of all assembly and test points lies with the Evatec assembly employee who is authorized to do so, or with suppliers trained and authorized by Evatec.

### Items Affected

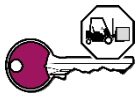
- Art.no.: Multiple

### Scope of authorization

Assembly



Supplier



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### Time Target

Part dependent

### Revision History

| Revision | Date | Author | Content / Changes |
|---|---|---|---|
| 1 | 25.10.2024 | LANI | Initial Revision |
| 2 | | | |
| 3 | | | |

The current version is in PLM. Release date see PLM time stamp.
The original document is written in German. This language version is a translation of the German original (DOC-172676).

# Table of Contents

# 1 Purpose, goal

Cleaning serves to remove residues and contaminants that may arise during the manufacturing processes of parts. A non-exhaustive list of common contaminants includes:

- Emulsions (e.g., coolants, cutting oils, etc.)
- Corrosion protection coatings (inorganic or organic chemicals)
- Lubricants (e.g., graphite, molybdenum disulfide, PTFE (fluoropolymers))
- Environmental contaminants (solids, chips, dust, rust, scale)
- Pastes, pigments
- Polishing agents (e.g., metal oxides)
- Adhesive residues
- Oxides, discolorations

Cleaned parts must be completely free of residues both mechanically and chemically. The goal is to achieve a hydrocarbon- and stain-free surface that meets all cleanliness requirements in accordance with legal and environmental standards.

# 2 Area of application, responsibility

These Work Instructions are intended for assembly employees of Evatec AG or corresponding contractors. These specialized workers know and respect the relevant requirements.

The responsibility for the proper execution of the work and compliance with these instructions lies with the person carrying out the work respectively his employer.

**In this regard, an employer is anyone who assigns work to someone else!**

Supervisors instruct their employees with regard to these guidelines. This also applies to temporary and external employees.

# 3 Further applicable documents

| Designation | DMS- / article number |
|---|---|
| Evatec Work Instructions: Packaging and Labeling | DOC-129876 |

# 4 Special tools and consumables

| Designation | DMS- / article number |
|---|---|
| None | - |

# 5 Limitations

Throughout the entire manufacturing process, the use of silicone-containing substances, heavy metals, complexing agents, and auxiliary and lubricating agents with fragrances and PVC plastics is generally prohibited. These substances are biologically difficult to degrade and cannot be completely washed out in cleaning systems that use aqueous solutions.

## 5.1 Explanation of Complexing Agents

Complexing agents are inorganic or organic compounds that bind metal ions in a way that alters their behavior (e.g., their reactivity and solubility). They are used to bind and remove metals, dissolve them, soften water, bind gases, or initiate polymerizations. Complexing agents can convert poorly soluble compounds into easily soluble ones. They are employed in products like fertilizers, detergents and cleaners, corrosion inhibitors, as well as in the pharmaceutical and food industries.

# 6 Description of the Cleaning Process

## 6.1 Charging

Charging refers to the placement of workpieces in a cleaning or processing system in a way that ensures optimal exposure to the cleaning medium. Particular attention should be paid to the following points:

- The cleaning or rinsing medium should be able to drain freely.
- Sealing, viewing, and surface areas must not be damaged.
- The contact area of the workpiece to be cleaned should be as small as possible.
- Heavily soiled parts or areas that are difficult to access should be pre-cleaned as necessary.

## 6.2 Functional Sequence as a Non-Binding Example

The following is an exemplary, non-binding procedure for a cleaning process, listed in chronological order. The cleaning process should always be designed to meet cleanliness requirements.

| ***Process*** | ***Objective*** |
|---|---|
| ***Pre-cleaning*** | Removal of coarse contaminants, pre-cleaning of blind holes and cavities |
| ***Rinsing*** | Removal of cleaning agent residues from pre-cleaning |
| ***Main Cleaning*** | Complete degreasing and removal of abrasions and particles |
| ***Rinsing*** | Repeated rinsing until flawless wetting with deionized water[1] |
| ***Drying*** | Spot-free drying with hot circulating air |
| ***Inspection*** | Cleanliness as per specification, checking for any damage |
| ***Packaging*** | Immediate packaging of the dry and, if necessary, cooled component as per DOC-129876 |

***[1]: Demineralized water, with a maximum conductance of 5 µS/cm, must be used.***

## 6.3 Approval of Cleaning Processes and Products

A new cleaning process or cleaning product may only be used after approval by Evatec. The responsible department at Evatec for this is the Quality Department. Reasons for introducing a new cleaning product include improved material or environmental compatibility or enhanced cleaning effectiveness.

ⓘ **Already approved and mutually tested processes and products must not be changed without prior consultation.**

## 6.4 Continuous Regulation of Cleaning Processes

For optimal control of the cleaning bath, aspects beyond temperature regulation must be considered. These include maintaining a dynamic bath circulation to ensure consistent cleaning performance, effective filtration to remove particles and deposits, regular replenishment of chemicals consumed during cleaning cycles, and continuous removal of contaminants to preserve bath effectiveness. The selection of cleaning agents is crucial as it determines the need for additional procedures and the use of specific auxiliary equipment to support the cleaning process.

### 6.4.1 Continuous Monitoring of Cleaning Effectiveness

Ongoing monitoring of cleaning effectiveness is necessary to promptly detect deviations from the desired cleanliness standard. This maintains efficient process flow and prevents the need for repeated cleaning cycles. Testing procedures include:

- Water break test on the surface: The wetting film on the surface must not break within a material-dependent time constant to ensure the surface is free of grease and oil.
- Wipe test: The surface is wiped with a dry or alcohol-soaked white cloth to detect any particles or contaminants.

In addition, the material guidelines provided by the equipment manufacturer must be followed.

### 6.4.2 Continuous Monitoring, Analysis, and Regulation of Wash Bath Contents

Monitoring the wash bath includes using refractometer measurements to check the target cleaning agent concentration and ensure it remains within the correct range. Regular, at least three times daily, checks of the active substance concentration are required to maintain cleaning performance. In the event of a deviation, the concentration must be adjusted.

Documenting these measurements ensures quality and is expected accordingly.

ⓘ **Periodic external lab analysis to verify cleaning agent concentration and effectiveness offers an objective confirmation of internal measurements and contributes to quality assurance, making it strongly recommended.**

Adjusting the cleaning agents based on the measured values can extend the lifetime of the wash bath. Efficient removal of contaminants optimizes cleaning performance and reduces the consumption of new chemicals. Fine filters, such as membrane or bag filters, are integrated into the return lines of cleaning systems to retain particles up to a certain size, depending on the type of cleaning system.

ⓘ **In the case of varying rinse water quantities, a stable DI conductance must be ensured.**

### 6.4.3 Cleaning Bath Preparation

During cleaning bath preparation, a demulsifying cleaner is used in combination with an oil separator, which has a separation efficiency of more than 75%. This combination enables efficient separation of oils and other contaminants from the cleaning medium, thus preserving the quality and effectiveness of the cleaning bath.

## 6.5 Disposal Situation

By selecting the appropriate cleaning chemicals and processes, the disposal situation can be alleviated, and operating costs can be reduced. Special attention should be paid to compliance with legal requirements and environmental regulations that mandate environmentally responsible disposal of wastewater and chemical residues to minimize environmental impact and ensure adherence to relevant environmental protection laws.

## 6.6 Follow-Up Processes

### 6.6.1 Rinsing Processes

The rinse water treatment typically consists of a recirculation system with a rinsing capacity of 1000 l/h and an adjustable conductance level. From the first rinse onwards, a conductance of less than 5 µS/cm must be maintained through appropriate rinsing duration and sequences up to the final rinse.

### 6.6.2 Blow-Off Process

During the blow-off process, especially used in spray washers, systems are blown out with air after the final rinse. In this step, water vapor present in the cleaning or spray chamber is removed by an exhaust fan.

### 6.6.3 Drying Process

In this context, drying processes for workpieces can generally be divided into two methods:

1. **Hot Air Circulation Drying:** The parts are dried with clean, dust-free hot air at 80-110°C (40-60°C for plastic parts), ensuring the air quality does not cause recontamination. The hot air system is equipped with an EU 9 particle filter (retention rate > 99%). This method ensures that rinse water is completely and spotlessly removed from surfaces.
2. **Vacuum Drying:** In this method, parts are placed in a vacuum chamber, which allows moisture to evaporate at lower temperatures. This technique is particularly suitable for delicate workpieces where thermal stress needs to be minimized and ensures uniform and residue-free drying, even in cavities and hard-to-reach areas.

The supplier has the discretion to select the most suitable drying method. It is especially important to consider the material properties of the workpieces, their geometric complexity, and specific end-cleanliness requirements to ensure optimal and material-friendly drying.

## 6.7 Cleaning Instructions

**Cleaning Code 0 (CC0): Oil- and Grease-Free Cleaning**

Cleaning required for:

- Appearance
- General cleanliness of assembly areas and surroundings
- Further processing

| Inspection Feature | Tests |
|---|---|
| • **Oil-, grease-, and stain-free surfaces**<br>• **Consistent surface texture**<br>• No visible chips and particles with the naked eye | **Visual Inspection:**<br>• Check under good lighting (~1000 lux)<br>• Clean workplace conditions (no oil mist, preferably dust- and particle-free)<br>• **Parts to be handled with gloves** |

**Cleaning Code 1 (CC1): Cleaning for Grey Room**

Cleaning by washing machine, hand, high-pressure cleaner, or blowing with oil-free compressed air

Cleaning required for:

- Appearance
- General cleanliness of assembly areas and surroundings

Examples of Use: Frames, motors, rack cabinets, cable ducts, vacuum pumps

| Inspection Feature | Tests |
|---|---|
| • **Oil-, grease-, and stain-free surfaces**<br>• **Consistent surface texture**<br>• No visible chips and particles with the naked eye | **Visual Inspection:**<br>• Check under good lighting (~1000 lux)<br>• Clean workplace conditions (no oil mist, preferably dust- and particle-free)<br>• **Parts to be handled with gloves** |
| • Particle-free surfaces (dust, metallic abrasion) | **Wipe Test 1 (recommended):**<br>• White, lint-free cloth (dry)<br>• Only slight discoloration of the cloth allowed |

ⓘ **All individual parts and components of assemblies must be pre-cleaned or procured clean as per CC1, CC2, or CC3.**

**Cleaning Code 2 (CC2): Cleaning for Clean Room**

Cleaning in washing machines according to these cleaning instructions

Cleaning required for:

- Appearance
- General cleanliness of assembly areas and surroundings

Examples of Use: Handles, piping systems, pre-vacuum lines

| Inspection Feature | Tests |
|---|---|
| • **Oil-, grease-, and stain-free surfaces**<br>• **Consistent surface texture**<br>• No visible chips and particles with the naked eye | **Visual Inspection:**<br>• Check under good lighting (~1000 lux)<br>• Clean workplace conditions (no oil mist, preferably dust- and particle-free)<br>• **Parts to be handled with gloves** |
| • Particle-free surfaces (dust, metallic abrasion) | **Wipe Test 1:**<br>• White, lint-free cloth (dry)<br>• Only slight discoloration of the cloth allowed |

ⓘ **All individual parts and components of assemblies must be pre-cleaned or procured clean as per CC2 or CC3.**

**Cleaning Code 3 (CC3): Cleaning for Vacuum and Process Contact**

Cleaning in washing machines according to these cleaning instructions

Cleaning required for:

- Appearance
- General cleanliness of assembly areas and surroundings
- Prevention of cross-contamination of process and vacuum contacts

Examples of Use: Vacuum valves, vacuum handlers, parts and assemblies in vacuum environments

| Inspection Feature | Tests |
|---|---|
| • **Oil-, grease-, and stain-free surfaces**<br>• **Consistent surface texture**<br>• No visible chips and particles with the naked eye | **Visual Inspection:**<br>• Check under good lighting (~1000 lux)<br>• Clean workplace conditions (no oil mist, preferably dust- and particle-free)<br>• **Parts to be handled with gloves**<br><br>**Water Break Test:**<br>• Immerse in deionized (DI) water for full wetting<br>• Film break no sooner than 10-30 seconds |
| • Particle-free surfaces (dust, metallic abrasion) | **Wipe Test 2:**<br>• White, lint-free cloth (soaked in isopropyl alcohol (99.8%))<br>• No discoloration of the cloth allowed (exception: slight discoloration for aluminum) |

ⓘ **All individual parts and components of assemblies must be pre-cleaned or procured clean as per CC3.**

## 6.8 Permissible Material Combinations

For cleaning different materials in a single process, special considerations are necessary regarding potential etching effects and oxidation. The following material combinations are generally considered permissible:

- Materials within grade numbers 1.4XXX according to DIN 17007
- Materials within grade numbers 2.4XXX according to DIN 17007

Within the third main group of light metals (3.XXXX according to DIN 17007), many combinations are possible in principle. However, careful consideration is required to ensure material compatibility and avoid unwanted chemical reactions or cross-contamination.

ⓘ **The fundamental rule remains that cleaning must meet the specific requirements of the materials without causing damage or compromising material integrity.**

# 7 Maintenance and Inspection

All relevant maintenance tasks must be regularly performed on the cleaning systems, with maintenance records kept. Additionally, the cleaning quality must be continuously monitored according to the following methodology:

| Level | Methodology | Interval |
|---|---|---|
| 1 | Visual inspection | Ongoing |
| 2 | Wipe test with a dry, white, lint-free cloth | Weekly |
| 3 | Wipe test with an alcohol-soaked (99.8% isopropylene) white, lint-free cloth[1] | Weekly |
| 4 | Reference spectrum from residual gas measurements[1] | Annually |

*[1]: Confirmation of completion (proof) must be documented in writing.*

Residual gas measurements refer to the analysis of remaining gas concentrations in the cleaning environment. These measurements assess any residual gases that may remain in the system after the cleaning process. This monitoring helps ensure no harmful or unwanted gases are left behind that could impact the quality of the cleaned parts.

# 8 Packaging

Cleaned parts should only be handled with clean gloves. After cooling to room temperature in clean rooms, components should be packaged and labeled according to DOC-129876.