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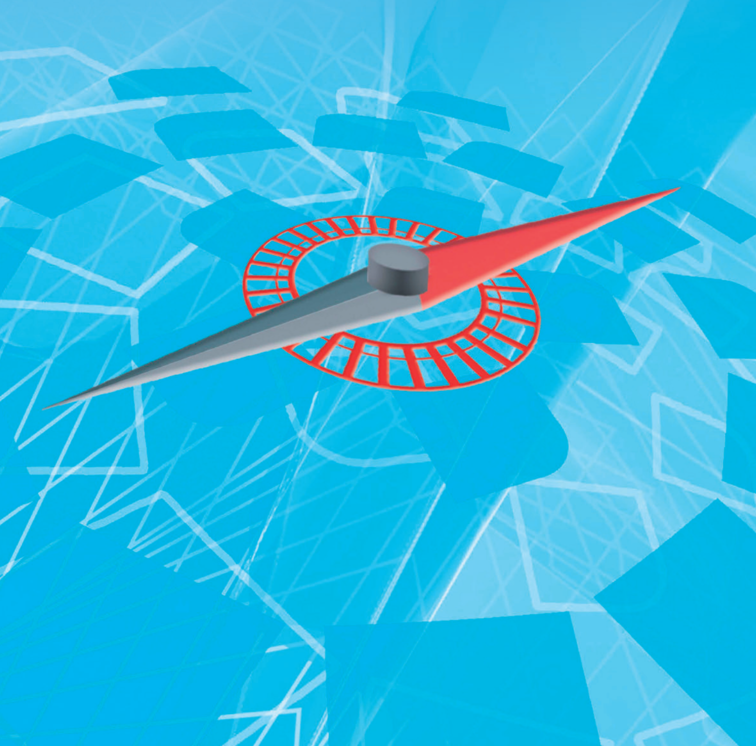
Checklist for Planning a Cleaning Process



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Checklist for Planning a Cleaning Process (system, process, chemicals and periphery)

Incorporation of the Cleaning Process into the Process Sequence

The point of departure for planning a new cleaning process involves an analysis of upstream and downstream manufacturing steps.

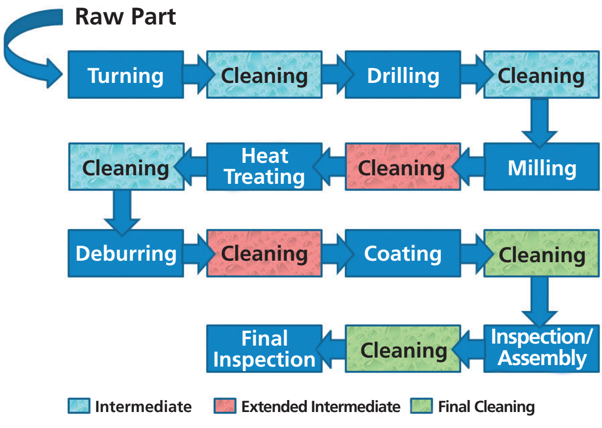

Figure 1: Sample Process Sequence (source: SurTec Deutschland GmbH)

The above chart demonstrates that there may be several cleaning processes with different requirements to which a component is subjected during manufacturing. In order to assure an optimum cleaning process, it's important to be familiar with the auxiliary and operating materials used for the individual processing steps, as well as the downstream processes and their cleaning requirements, to which the utilised chemicals, the process and the system technology must be matched.

This guideline is intended to support the user in gathering all of the required information for the procurement of a new cleaning system.

1. Description of the Components

1.1 Materials

The materials of all of the components to be cleaned must be known, above all in order to ensure that they are compatible with the cleaning agents:

- Steel (e.g. low-alloy steel, cast steel, galvanised steel, nickel plated steel)
- Stainless steel
- Non-ferrous metals (e.g. brass, bronze, copper)
- Light metals (e.g. aluminium, anodised aluminium, die-cast aluminium, aluminium alloys, magnesium, titanium)
- Composite materials (e.g. steel and aluminium, aluminium and non-ferrous metal, metal and plastic)
- Other materials (e.g. ceramic, glass, plastic, die-cast zinc)

1.2 Contamination

The specifications for all types of contamination which might occur must be documented. A rough breakdown into organic and inorganic contamination is advisable in this respect. Insofar as possible, data sheets should be made available for all processing materials.

Examples of organic contamination:
Cooling lubricants, deep-drawing lubricants, corrosion protection oils, assembly oils, grease, wax, polishing paste, soldering residues, fingerprints.

Examples of inorganic contamination:
Chips, flash rust, tuberculation, scale, pigments, carbon, dust, salts.

If possible, the quantity per piece/lot should also be ascertained and specified. This is above all important in order to determine the most suitable cleaning agent (solvent or aqueous cleaner), conditioning method and cleaning system size.

If possible, an estimate should be made indicating what can be expected in the future and which other parts might be cleaned with the system.

1.3 Part Shape and Weight

Part geometry, as well as how the parts will be handled and transported, play a very important role in the selection of the cleaning process (e.g. spraying, immersion, ultrasound) and the utilised system technology (e.g. side-by-side, continuous pass or compact system).

Examples of the characterisation of component geometries:

Size and weight, drill holes / blind-holes, thread (length, diameter), undercuts, grooves etc. Corresponding sample parts, drawing files (2D/3D) or images should be included.

1.4 Throughput and Handling

Workpiece carriers, handling units and lot size are selected depending on the component's size, cleanliness requirement and susceptibility to damage.

- Bulk materials (e.g. wire baskets, perforated sheet-metal boxes)
- Retained parts (e.g. wire baskets, component-specific retainers, pallet)
- Individual parts (e.g. suspension conveyors, continuous conveyors, robots)

In order to determine correct system technology and capacity, required throughput must be specified, for example:

- Work piece carrier size and quantity per hour
- Number of parts per hour, according to part type if applicable
- Type of operation (e.g. single-shift, multi-shift)

The workpiece carriers must be laid out for best possible cleaning (e.g. no cavities or undercuts). Special attention should be given to the selection of a suitable material for the workpiece carriers, for example in order to reliably rule out the possibility of corrosion or chemical influences (e.g. stainless steel, electroless nickel plated steel or titanium). Positioning of the goods in the basket/rack is also very important. It must be assured that the components don't shield each other mutually, and special attention must be given to the points at which the components are secured and contact occurs.

1.5 Component Cleanliness Requirements

Required component cleanliness is dictated to a great extent by the next manufacturing step.

Pertinent specifications are frequently included in the drawing, for example:

- Particulate contamination (e.g. quantity per part, particle size distribution, maximum particle size)
- Film-like contamination (e.g. quantity per surface, residual carbon)

The measuring methods and tests for determining the degree of cleanliness must be specified (e.g. VDA 19 / ISO 16232, surface tension (mN/m2), fluorescence measurement, specific test and measuring methods.

Surface condition must be unambiguously described, i.e. specifications such as clean, grease-free or particle-free are inadequate.

If the requirements are not adequately known the component cleanliness is dictated by the downstream manufacturing steps , for example: Heat treating, electroplating, plasma treatment, CVD/PVD, painting, bonding, machining or forming, storage, transport, assembly

1.6 Corrosion Protection Requirements

Additional corrosion protection specifications are required in the case of parts which are susceptible to corrosion, for example:

- Temporary corrosion protection
- Long-term protection (e.g. storage, shipment by sea)
- Planned packaging
- Film thickness of the corrosion protection agent insofar as defined (e.g. in the case of ready-to-install conservation)

2. Integration of the System into Production

2.1 Possible Installation Surface

- Size of the installation surface (length, width, height)
- Load-carrying capacity of the floor
- Structural restrictions

2.2 Supply Lines

Connections for:

- Electrical power (voltage, frequency, power)
- Water (potable water, well water, rainwater, deionised water)
- Coolant water
- Compressed air
- Heating medium (steam, thermal oil, gas, electrical power)

2.3 Disposal

- Discharge of exhaust air to outside atmosphere possible (yes/no)
- In-house wastewater treatment (yes/no, type)
- Direct/indirect discharger
- Waste collection point (oil concentrates, sludge etc.)

2.4 Supply Lines

The system's degree of automation must be specified, for example:

- Decentralised system with manual or automatic feed
- Integration into existing concatenation (e.g. roller conveyor, chain conveyor) or automation (e.g. robot, handling system)

2.5 Storage of Chemicals

Most chemicals are assigned to a specific water hazard classification (WGK 1-3), which necessitates a warehouse with corresponding equipment.

3. Description of the Components

3.1 Components Manufacturing Process Sequence

A detailed analysis of the process sequence – from the raw part to the finished product – is essential for the recognition of interaction. This serves as the basis for establishing control parameter set-points and limit values in combination with the selected measuring and test procedures (see figure 2).

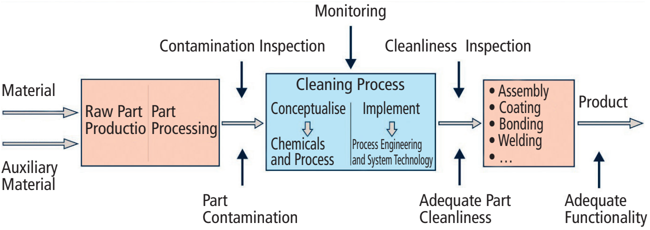

Figure 2: Analysis of the Process Sequence (source: SITA Messtechnik GmbH)

3.2 Quality Control

Quality control with targeted measures are implemented by means of process engineering and by the system operator, as well as measuring, test and control technology, serves as a basis for keeping the process under control in order to stably and efficiently assure component cleanliness.
This is made possible by means of continuous cleanliness inspection and monitoring of process parameters which influence quality on a regular basis (see figure 3).
In particular this involves process-media status variables such as cleaning agent concentration and contamination load, which change continuously as a result of the running process.

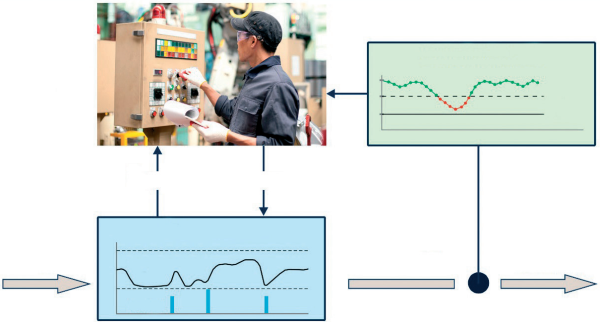

Figure 3: Monitoring Process Parameters which Influence Quality
(source: SITA Messtechnik GmbH)

Measuring these parameters makes it possible to detect changes and to compare actual values with set-points and limit values. The resultant prompt reactions of the system operator in order to control the process, for example by adding cleaning agent or maintaining the bath, ensure a good process control which contributes to the required quality.

4. Further Procedures

4.1 Contacting Equipment and Chemicals Suppliers

When all of the above listed information has been gathered, suppliers of cleaning systems, workpiece carriers and chemicals can be selected. An initial meeting should be held with these companies. On the basis of their experience and the information you have compiled, they can make a proposal for implementing your system, quote a price and plan cleaning tests. These tests are explicitly recommended. Equipment and chemicals suppliers are also able to provide information concerning the extent to which the proposed process will or may have to be approved by and/or registered with the responsible authorities (water management office, regional water authority etc.).

4.2 In-House Presentation

On the basis of the proposals from the cleaning equipment and chemicals suppliers, the new process can be presented to the responsible departments (General management, environmental department, QA, production) at one's own company and discussed with all involved parties.

4.3 Contacting Equipment and Chemicals Suppliers

The user should make originally contaminated components from his production department available to the equipment suppliers. The chemicals suppliers should be provided with sample parts, as well as samples of auxiliary and operating materials from running production, and the corresponding data sheets. During the course of preliminary testing, an ideally suited cleaning agent and preservative are selected for the respective application.

Further cleaning tests can then be prepared by the equipment supplier, which are conducted in cooperation with the user. It must be assured that testing is conducted under conditions which are as close as possible to actual practice (i.e. adequate quantities of originally contaminated parts, suitable means of transport such as workpiece carriers, clean packaging).

Decisions concerning the following points are made on the basis of the cleaning tests with subsequent quality inspection:

- Cleaning agents – solvents (hydrocarbons, modified alcohols, chlorinated hydrocarbons) or aqueous cleaning agents, special media
- Cleaning processes (e.g. spraying, immersion, ultrasound)
- Required number of process steps
- Bath maintenance and purification measures
- Drying processes
- Treatment times and resultant cycle times

The system's required performance characteristics and equipment (e.g. pump power, ultrasound frequency, purification performance, utilised materials for system components and seals) are calculated and specified on the basis of the cleaning tests.

On the basis of this information, the system supplier can prepare a binding process proposal and a price quotation

Costs may be incurred for preliminary testing and the supplier should be agreed upon in advance.

5. Notes

The objective of process control in industrial parts cleaning is to assure adequate component cleanliness as required for the respective downstream process with minimal consumption of resources.
Actual practice has revealed that process costs are often reduced in the interest of a lower price. Companies that save money by reducing process costs frequently suffer quality losses and increased consequential costs down the road.

If the quotations from the various system manufacturers and chemical suppliers differ greatly with regard to price and performance, their proposals should be carefully examined. An exchange of experience with users (request reference list) who use systems and chemicals from the respective suppliers is advantageous.

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Professional Association for Industrial Parts Cleaning (FiT)

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