



# A Guide to component cleaning

How to plan and prepare for the right component cleaning process and equipment

## What is parts cleaning ?

Almost every manufacturing process has a need for cleaning. This normally involves a stage in the manufacturing process when the part needs to be cleaned before the next activity or for a final clean to ensure that the part is in an acceptable condition for the customer.

In most manufacturing operations 'intermediate' cleaning can often be repeated after various stages.

Parts cleaning can be a relative simple



operation depending on the type of soiling or contamination and the level of cleanliness required

Parts' cleaning has the following functions;

1. To clean and prepare the surface of a part prior to a subsequent process such as coating or treating.
2. Cosmetic cleaning to remove unsightly or unwanted surface soiling.
3. As a process to remove contaminants which may ultimately affect the quality, operation or function of a product.
4. A process to remove soiling or to disinfect parts after use or before first use.

Essentially therefore, parts cleaning can range from simple cosmetic cleaning to critical cleaning.

## What is meant by 'clean'?

The answer to this may differ widely. Cleaning standards and specifications vary.

1. Cleaning standards can mean a subjective, visual test.
2. It can mean measured scientific tests to establish pass-fail levels of cleanliness. These can range from a simple filtration method to sophisticated surface

examination by electron microscope or mass spectrometric techniques.

3. Standards may have levels of acceptance on a pass / fail criteria based on the measurement of what is acceptable by the customer. These will usually be based on the application and use of the part and the role cleanliness plays in its performance.
4. In certain medical applications further tests to measure bio-cleanliness may be used.

## What are Cleaning Specifications ?



Cleaning specifications help to establish the process by which cleaning standards are met. These specifications will detail the method and process of cleaning, providing information on the chemistry, cleaning

and drying steps, process times and use of agitation or cleaning actions.

## What are the factors that affect selection ?

There are a number of drivers or reasons to introduce or to change a component cleaning process.

1. New products or changes in the products being manufactured
2. Customer demand or higher customer expectations
3. Replacing old or ineffective cleaning equipment
4. Changes in raw materials necessitating cleaning prior to production
5. Business strategy to improve production efficiency
6. Business requirement to improve quality or to manage cost
7. Environmental impact
8. Health & safety reasons
9. Regulation or legal requirements
10. Company policies

Each of these reasons for change will have implications for the selection of cleaning chemistry and investment in appropriate cleaning equipment.

## First steps - what's available?

The first thing to recognise is that there is likely to be more than one option and that there is no one size fits all. Every application is different and there are many combinations of cleaning chemistry and types of component cleaning equipment.

## Broad Considerations - what do you need to achieve?

Being clear about why you need to clean, what aspects need to be addressed and who, such as your customer, needs to be satisfied with the final result.

It is useful to meet with all stakeholders in the process to list the objectives and agree the desired outcome. This might include;

1. Different or higher cleaning standard
2. Higher through-put (Productivity)
3. More consistent cleaning
4. Lower cost
5. Compliance and safety
6. Use of an acceptable chemistry
7. Customer acceptability
8. Reduced risk of product failure / improved quality

## Broad Considerations - the task itself

The task of cleaning usually involves the removal of a soil or contamination from the surfaces of a substrate.

This is where a number of variables can occur as both the material of the substrate and the nature of the contamination will inform what cleaning options are available. Considerations will include;

The material of the substrate

The design of the component, such as shape or holes and crevices that may present challenges to cleaning.

The nature of the contamination, such as polar/non-polar, new/aged, particulate or soluble contamination, volume and extent of soiling.

There are also considerations about the residue of cleaning. Is there a need to remove any moisture or to ensure corrosion resistance or to provide another surface finish.

## How to select cleaning chemistry

Deciding which chemistry to use will depend upon;

Its ability to remove the contamination (assisted by other factors)

The chemistry's compatibility with the substrate or other materials in the process

Environmental and health considerations

Regulation

Corporate policy

Customer requirements

Generally there are two broad options, solvent or aqueous. Both offer many choices and both have benefits, but also drawbacks.

## Methods of selecting cleaning chemistry



It is usually advisable to be as open as possible about chemistry and not to exclude without reason.

Reasons to choose one chemistry over another will depend on a number of factors

Its cost and availability

Its capacity to clean effectively

Any special handling requirements

There is no reason to exclude any solvent unless its use is prevented by law. Most solvents can be managed in enclosed processes to prevent loss or exposure.

Aqueous choices can offer distinct benefits as well as add further complications, such as drying and effluent disposal.

## Selection of a cleaning chemistry

General information on cleaning performance can be obtained from chemical suppliers. However the only way to ensure suitability is to test the chemistry with actual contaminated parts. Testing can be arranged with Layton Technologies (usually free of charge) [www.laytontechnologies.com](http://www.laytontechnologies.com)

To test clean, a range of test parameters are established and results recorded. These results can be evaluated.

Several chemistries can be tested.

Some solvent chemistries will be effective in removing more than one type of soiling and from more than one type of substrate. Some solvents are effective in a fairly wide range of applications.

Aqueous chemistries may be limited in their effectiveness across more than one type of material or contamination and may need dedicated chemistry to each application.

Cleaning performance can be significantly improved by;

Temperature

Duration of cleaning exposure

Agitation - spray, rotation etc

Ultrasonics

## What are the Advantages and disadvantages

To some cleaning using aqueous chemistry has a clear advantage in terms of health and safety. However it is not always clear cut. There are implications of aqueous cleaning that can increase environmental impact for example an increase in energy and water consumption (a resource that also has to be managed). Then there is the problem of managing the inevitable

waste which has to be disposed of. This means further environmental impact and cost.

Similarly solvent cleaning has an environmental impact. The use of solvents, produced from finite natural resources, have the potential to damage the environment if not properly managed and controlled. There are also possible health and safety risks with certain solvents, again requiring careful containment measures.

On balance both offer advantages and both have potential disadvantages. It is important to remain objective and consider what works best for your business in terms of cleaning effectiveness. When working with Layton we can advise you on the most effective way to manage the process to ensure that environmental and safety matters are properly managed.

For aqueous cleaning these are some of the issues to look out for;

1. How effectively will the chemistry and process clean?
2. What are the likely costs of energy, water and effluent disposal?
3. Do I need to dry the parts and if so how efficiently can this be achieved?

For solvent cleaning, these are some tips to consider;

What containment and management is necessary?

1. Are there any regulations or laws to consider?
2. Can it be easily sourced and how is supplied?
3. Is the solvent affordable?

### Stakeholder interests

It is advisable to meet with everyone who has an interest in the cleaning project. There are likely to be a number of people who will need to be involved in the selection, implementation and on-going operation who will need to be consulted.

Typically the project team might involve;

1. Budget holder
2. Process or production representative
3. Site or facilities representative
4. Environmental and H&S representative
5. Cleaning specialist or someone to approve cleaning standards
6. Quality representative
7. Operator representative and/or maintenance
8. Plant installation engineering representative
9. A representative or internal 'champion' for your external customer

Depending on the size of the project and the type of cleaning process, this team may vary in size and composition. It is essential however to consider the wider interests of stakeholders to avoid what can be basic but costly errors.

It would also be advisable to ask potential vendors and chemistry companies to present to this stakeholder group and after vendors have been selected to get them to attend meetings of the group.

### Budget considerations

As cleaning has become more demanding in terms of automation, solvent management, environmental compliance and process complexity, inevitably the cost of cleaning plant has also risen to reflect this higher specification.

There are ways to ensure that the equipment you eventually buy is both value-for-money and fit for purpose, these include;

1. Understand the reason for cleaning and the standard you want to achieve
2. Clearly specify your needs
3. Ensure that the equipment is designed to meet your specific needs and can be modified if necessary

4. Ensure that the costs of consumables, including solvents are accounted within the costs
5. Calculate other operating costs including energy, water, waste costs and manning levels
6. Consider the degree of automation required. Can increased automation increase productivity and lower costs?
7. Maintenance costs
8. What additional services might be needed and have these been factored into the cost
9. Are there installation costs, such as removal of old plant and new work to install a replacement
10. What ancillary equipment is required such as chillers or compressors
11. What addition equipment is necessary to handle the installation

### Specifying your machine

Having identified the reasons why you need clean parts and what you want to achieve, the choice and specification of the cleaning plant, chemistry and process is the next logical step. Providing potential machine vendors with a clear statement of your requirements will help to ensure that you purchase a fit-for-purpose system and eliminate any excessive cost. This is a simple step-by-step guide;

#### 1. Solvent or aqueous

You will have considered which option will give you the best result and meet other environmental objectives.

#### 2. Future proof

There is no certainty to planning what might happen in the future, but choosing equipment that allows some flexibility in terms of cleaning media, will help you to hedge against chemicals that may fall into tighter regulation, become less available or more expensive in the future. It is also worth considering what might happen to the pattern of your business that might impact upon the productivity of your cleaning system. Do you need a cleaning provision that allows extra capacity later?

#### 3. Cleaning media

Conversations with both chemistry suppliers and equipment manufacturers should provide the advice you need and this together with access to trials will help you to prove your cleaning process. It is important to recognise that unless you have a specific agreement with the equipment manufacturer the responsibility for the process rests with you.

#### 4. Environmental and safety constraints

Your machine and chemistry choice will need to reflect all requirements to meet

health and safety and environmental compliance.

#### 5. Space limitations

Any height, weight and footprint constraints will need to be factored into the machine selection. As will access to the location and any special limitations on services. Where space is limited there are systems available which can offer compact design with high work capacity. It should also be noted that multistage systems will obviously require more space.

#### 6. Location limitations

Where locations offer additional challenges including accessibility, additional engineering or modification, these factors need to be considered within the scope and cost of the project.

#### 7. Process time / throughput

The calculation of what throughput you need and therefore the batch size and cycle time is a key element of the project. This will form a central part of the machine specification and its cost. It is possible to manage the variables of time and volume by improving the cleaning process through various means such as adding ultrasonics for example. See also Process Details and Cleaning Standard below.

## 8. Operating duty - continuous or shifts, regular or occasional

This will also influence the size and capacity of the machine. If you require a machine to offer continuous service, then there may be a need to have twin systems that allow some off-line maintenance whilst still offering some throughput. Where machines are only used in irregular or infrequent service then this should be reflected in the machine specification.

## 9. Maintenance

No machine can operate without maintenance. But the frequency and level of maintenance is important to understand. Operational maintenance should be relatively simple and be capable of being carried out by the operator with minimal training. It will inevitably be necessary to have more in-depth servicing which can be provided by the vendors' engineers. Most machine suppliers will offer a service and support facility in addition to offering a warranty. It's important to understand what this means and in the case of on-site support, where that support comes from (i.e. UK based).

## 10. Process details - steps required in cleaning

The process is designed to provide a consistent cleaning result over a set period. This normally includes several steps or stages. Each step is designed to contribute to the cleaning process by removing various contaminants or by rinsing or treating and finally drying. In aqueous cleaning these stages can be performed in a set of tanks arranged in a linear configuration. Other aqueous options and most solvent systems offer a single chamber where the process chamber completes various stages through a regime of emptying and filling with various chemistries. The process will be dictated by the standards required and the trials which have proven that a given set of actions will achieve the standard.

## 11. Cleaning standard if required.

In many critical applications a clearly defined cleaning result will be required. It is essential that some proof is obtained that the chemistry and machine specification will deliver this standard and as importantly will offer recording methods to support and documentation necessary.

## Vendor selection

Once the machine specification has been developed, usually with essential advice and support from vendors then a choice can be made about the vendor itself. Things to note are;

### 1. Capability and experience

Check that the vendor has the necessary expertise in process knowledge and engineering capability to design and manufacture the equipment. Essentially the ability to understand how to put the process into operation in a safe and environmental compliant system. A visit to view vendor facilities is essential.

### 2. Capacity

Has the vendor enough capacity to manufacture your machine. Check the resources available and the expected delivery schedule.

### 3. Business security

It is important to reassure yourself that the vendor has a stable business with a suitable proven track record and is financially viable

#### 4. Training and support

Your vendor should be able to provide you with essential training for the operators and offer appropriate manuals to allow you to operate and maintain the equipment.

#### 5. Partnership

It is easy to talk about partnership working, but if you can do the vendor appraisal and selection early in the project, there are significant benefits in using their expertise to support you and ensure that simple pitfalls are avoided.



### The Implementation phase

Once you have selected your vendor and placed an order for the machine it is necessary to work closely with the vendors' design and production team.

1. Ensure that the details of the machine meet your needs
2. Keep to deadlines, especially where key milestones need your approval and decision
3. Make certain that any changes are agreed and documented with any associated cost approved
4. Allow time for possible delays, don't 'cut it fine' if you are planning to replace an existing and essential cleaning process.
5. Plan the necessary preparation for services and other ancillary engineering to allow a smooth installation
6. Hold regular review meetings with stakeholders and equipment vendors.

### Review and improve

7. Check that stakeholder needs have been satisfied

Ensure that early problems regarding the function of the process have been reported and addressed

Check that operators are familiar with the controls and maintenance, refresh training if necessary

Consider on-going maintenance, including a planned maintenance programme and regular service.

For more information

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