

# PARTS CLEANING PROJECT GUIDE

RESOLVE YOUR INDIVIDUAL CLEANING TASK



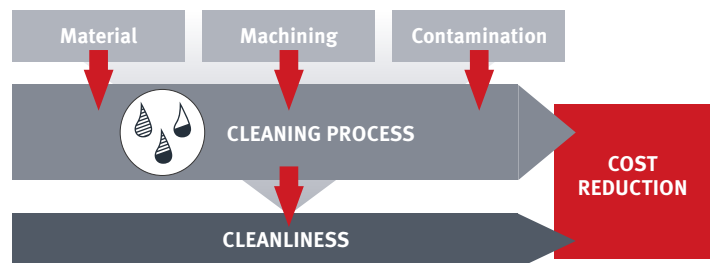
**SUCCESSFUL  
PROJECT PLANNING**

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## GENERAL CONTEXT - PRODUCTION AND CLEANING

Machined parts and components are produced in predefined manufacturing processes that include the use of various special auxiliary supplies and consumables. Parts and components are normally made from a specified material. As a result of the machining process, they are contaminated with specific substances.

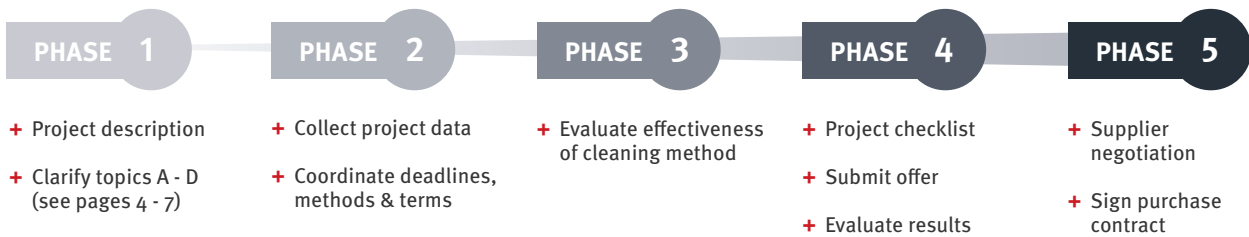


- In many cases, even minor changes to the production process, such as the use of a different cooling lubricant, can affect the downstream cleaning process and cleaning result.

The required technical cleanliness must be achieved at commercially viable costs and with complete process safety.

# SUCCESSFUL PROJECT PLANNING FOR PARTS CLEANING

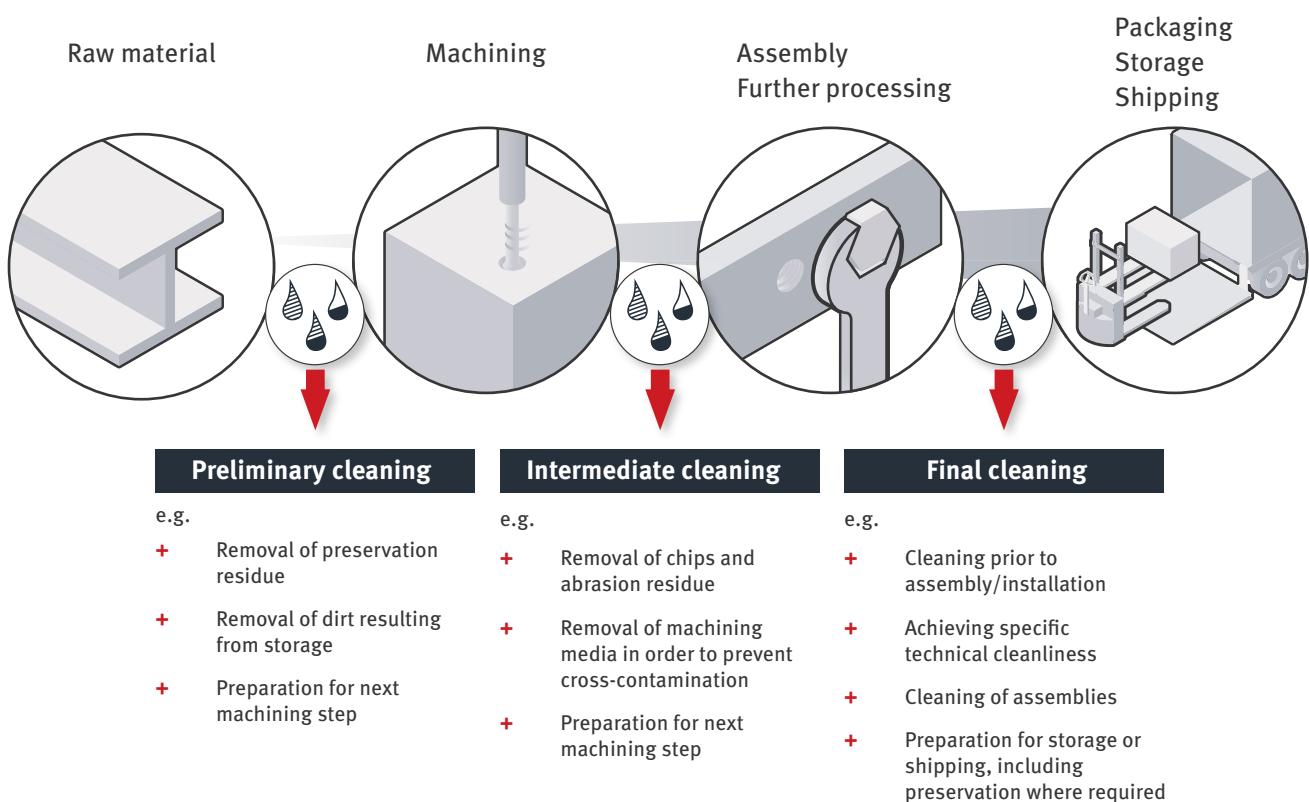
The planning of a cleaning solution is a complex task and requires coordination and cooperation between knowledge experts in various departments.



To obtain the desired cleaning result in a way that is commercially viable and offers the necessary process safety, a cleaning project must be undertaken in a structured and systematic manner.

## DIFFERENT CLEANING TASKS ALONG THE PRODUCTION PROCESS

Parts might need to be cleaned at various points in the production process.



► Along the entire production and logistics process, it is important to prevent re-contamination.



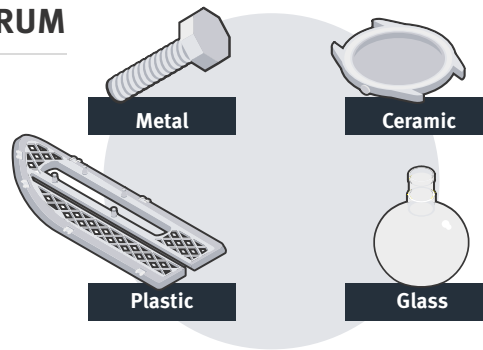
## A CLEANING TASK

The systematic identification and definition of the cleaning task makes sure that this important production step is fully integrated into the overall production process.

### PROPERTIES OF PART / SPECTRUM

Which parts need to be cleaned?

- + Material properties
- + Size & weight
- + Geometry (e.g. blind holes)
- + Future products



### CONTAMINATION

What are the factors that affect the surface quality?

- ☐ Particulate contamination (chips, abrasion residue)
- ☐ Film-type contamination (oil, grease, cooling lubricant)
- ☐ Quantification of contamination, e.g.
  - + Weighing before and after cleaning
  - + Measuring consumption of machining oil/emulsion per year
- ☐ Is it possible to reduce or eliminate contamination prior to cleaning?

### UPSTREAM AND DOWNSTREAM PROCESSES

Detailed description of the individual processes upstream and downstream of the cleaning step

Which upstream processes are mainly responsible for contamination? e.g.

- + Preservation on purchased materials
- + Contamination occurring during individual machining steps

What are the requirements for downstream processes? e.g.

- + Assembly, painting, coating, gluing
- + Preservation, packaging, transport
- + Preventing re-contamination, e.g. transfer to different containers, observing parts temperature for packaging, parts handling with suitable gloves only

### REQUIREMENTS FOR SITE OF INSTALLATION

To achieve and maintain a high technical cleanliness of the workpieces after cleaning, the process must be performed in a clean environment.

- + Assess location of installation, e.g. with regard to proximity to annealing oven, other production machinery
- + Integration into a cleanroom
- + Parts infeed/outfeed/covered by tunnel
- + Climate conditions

NOTES

## B CLEANLINESS TARGET

### DEFINING TECHNICAL CLEANLINESS

	Unit
Particle size	$\mu\text{m}$
Particle count	Count per part / surface area
Gravimetric analysis	$\text{mg} / 1,000 \text{ cm}^2$
Surface tension	$\text{mN} / \text{m}$

The degree of technical cleanliness determines the cleaning time and costs.

- ☐ What are the requirements regarding the part surface?
- ☐ Are there specific standards to be met? e.g. medical technical products, parts for aerospace industry
- ☐ Components might need to be checked for remanence

### QUALITY ASSURANCE

How are samples taken and examined?



- ☐ Testing method must be consistent
  - + Surface tension  
e.g. dyne level testing with test inks or pens
  - + Detection of oil and grease  
e.g. with fluorescence measurement
  - + Cleanliness testing  
e.g. according to VDA 19.1  
(decay curve: extraction, filtration, analysis)



- ☐ Is there a need for batch tracing?

### PERSONNEL

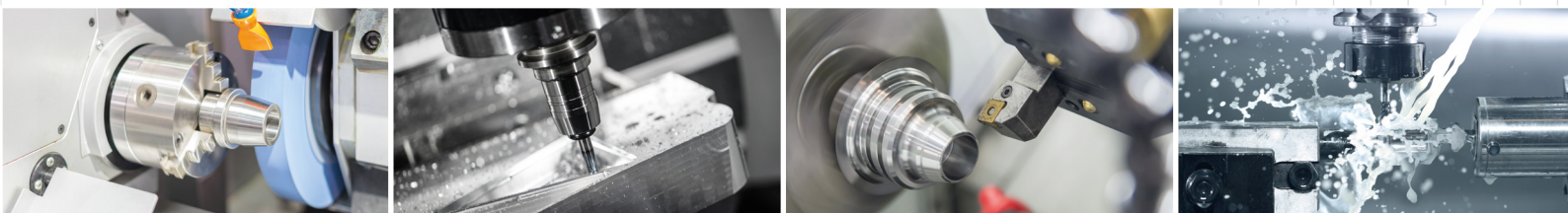
Do personnel have experience in technical cleanliness?

- + Awareness
- + Qualification & Training

### INVESTMENT

- ☐ Is there a budget in place?
- ☐ Are investments in the pipeline?

#### NOTES



## C PARTS HANDLING

### ☐ RANGE OF PARTS

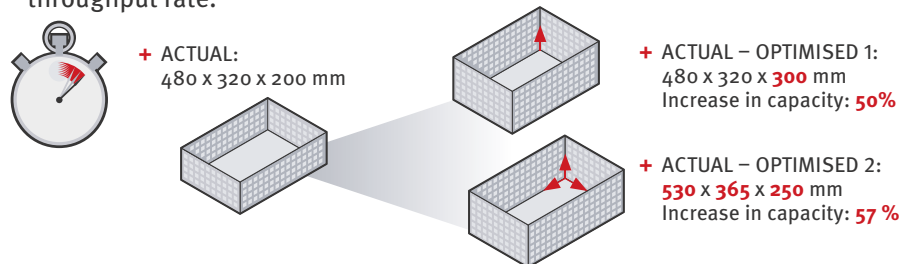
A complete inventory of the parts to be cleaned needs to be drawn up.

☐ Are parts machined in batches or in a continuous process?

- + Individual parts
- + Bulk material
- + Batches
- + Rack parts

### ☐ THROUGHPUT RATE

During cleaning tests performed at the PERO Competence Center, the size of the parts carriers and the cleaning programme are determined on the basis of the actual cleanliness requirements. These parameters define the optimum cycle time and throughput rate.



e.g. R1 cleaning unit with A-type processing chamber

☐ Examination of existing parts carrier systems

- + Quality of parts carrier and cleaning outcome (wire mesh basket vs perforated metal box)
- + Parts carrier design (rack parts vs bulk material)
- + Handling (manual or automated)
- + Compatibility with cleaning unit

☐ Determining quantity structure for parts to be cleaned, taking into account shift model

☐ Choosing quantity unit, e.g. parts per hour, production output per year

### ☐ PARTS CARRIERS

- + Wire mesh basket
- + Adapter tray
- + Plastic tray
- + Rack tray
- + Perforated metal box



### ☐ PARTS LOADING

☐ How are the parts transferred to the cleaning unit?

- + in parts carrier (avoid transfers between carriers)
- + on industrial trolley
- + with forklift truck
- + by robot

☐ Transfer into cleaning unit (determined by capacity)

- + Manual transfer (observe max. batch weight!)
- + Layout plan of unit and handling area
- + Automatic transfer (definition of interfaces)
- + Charging equipment

☐ Transfer out of cleaning unit

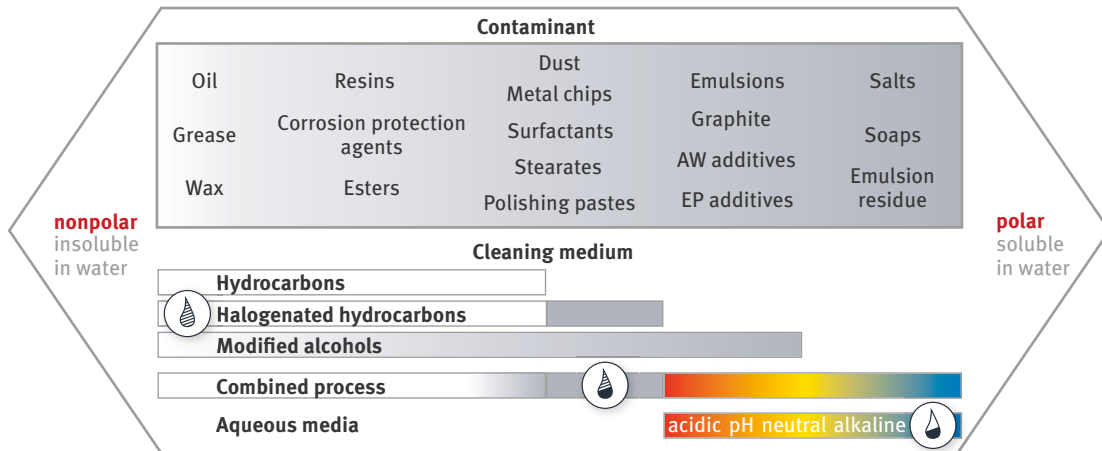
NOTES



## D CLEANING MEDIA

### CHOOSING MEDIUM

Identify the best wet medium for the cleaning task.



### KEY FACTORS

Wet media differ greatly when it comes to handling, storability, care and maintenance.

- + Surface tension
- + Degreasing effect
- + Cleaning performance
- + Drying
- + Residue
- + Filterability

### REGULATIONS

Which statutory regulations at regional, national or international level must be adhered to?

- + German Federal Water Act (WHG)
- + 31st German Federal Immersion Control Ordinance (31. BImSchV)
- + 2nd German Federal Immersion Control Ordinance (2. BImSchV)
- + VOC Directive

### MEDIUM HANDLING AND TREATMENT

#### Aqueous media & solvents

- + Bag filter
- + Cartridge filter
- + Distillation

#### Aqueous media

- + Screen basket filter
- + Drop-out box
- + Micro-/ultra-filtration

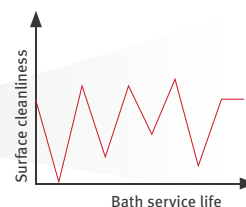
Different cleaning media require different preparation and treatment

#### Solvents

- + Initial filling
- + Stabilisation
- + Distilling
- + Topping up

#### Aqueous media

- + Stock
- + Bath maintenance/titration
- + Bath change
- + Disposal



NOTES

# PROJECT DATA

PROJECT DETAILS									
Company									
Postal code/city									
Delivery address, loc. of installation									
Contact									
Function									
Contact details		@							
		Tel:							
Data Protection Agreement signed		<input type="radio"/> Only for applicants that are subject to EU General Data Protection Regulation (GDPR)							
Project name									
Awarding of contract by		<input type="radio"/> Auction		<input type="radio"/> Tender presentation/meeting					
Relevant documents / customer requirements		<input type="radio"/> Purchasing terms		<input type="radio"/> Equipment / substance instructions			<input type="radio"/> Requirement / general specifications		
Timeline (deadlines set by customer)		1 Delivery / 2 Commissioning / 3 Start of production (SOP)							
		1		2		3			
Current process/method									
How are parts cleaned now?									
What requirements exist now?									
A - CLEANING TASK									
Parts range									
Parts by method of production		<input type="radio"/> Lathing		<input type="radio"/> Grinding, polishing		<input type="radio"/> Thermoplastic			
		<input type="radio"/> Milling, cutting		<input type="radio"/> Punching & bending		<input type="radio"/> Forming			
		<input type="radio"/> Casting		<input type="radio"/> Punching		<input type="radio"/>			
Part properties									
Dimensions	Largest part		L [mm]		W / Ø [mm]		H [mm]		
	Smallest part		L [mm]		W / Ø [mm]		H [mm]		
Weight	Largest part		g/part		kg/part				
	Smallest part		g/part		kg/part				
Special properties		<input type="radio"/> Parts with thin walls		<input type="radio"/> Capillary bores		<input type="radio"/> Blind holes			
		<input type="radio"/> Recesses		<input type="radio"/>					
Material		<input type="radio"/> Aluminium		<input type="radio"/> Ceramics		<input type="radio"/> Brass			
		<input type="radio"/> Stainless steel		<input type="radio"/> Plastic		<input type="radio"/> Steel			
		<input type="radio"/> Glass		<input type="radio"/> Copper		<input type="radio"/>			
Contamination									
Film-type contamination		<input type="radio"/> Grease, wax		<input type="radio"/> Cooling lubricant, emulsion		<input type="radio"/> Oil			
Add. information (e.g. type, quantity)									
Particulate contamination		<input type="radio"/> Abrasion residue		<input type="radio"/> Chips					
Add. information (e.g. type, quantity)									
Remanent magnetization		<input type="radio"/>							
Production steps									
Upstream processes									
Downstream processes									
Location of installation		<input type="radio"/> Production hall		<input type="radio"/> Clean production env.		<input type="radio"/> Clean room			
Temperature, air humidity, location (approx.)			°C		%		m above sea level		
Water protection area		<input type="radio"/>							
Is recirculation cooling water system available on site? (solv. cleaning units)			Inlet temp. [°C]		Return temp. [°C]	<input type="radio"/> no			
Dirt protection (e.g. tunnel inlet/outlet) required?		<input type="radio"/>							



B - CLEANLINESS TARGET							
Technical cleanliness							
Requirements	<input type="radio"/> Visually clean	<input type="radio"/> Free of spots		<input type="radio"/> Free of chips			
	<input type="radio"/> Free of oil and grease	<input type="radio"/> Dry		<input type="radio"/> Other			
Additional specifications							
Surface tension					mN/m		
Metal particles	<input type="radio"/> <200 µm	<input type="radio"/> <400 µm		<input type="radio"/> <600 µm			
	<input type="radio"/> <1,000 µm						
Particle count		Particles/surface area			Particles/part		
Gravimetric analysis		mg/1,000 cm²					
Quality assurance	<input type="radio"/> Batches must be traceable						
C - HANDLING							
Parts handling							
Range of parts	<input type="radio"/> Individual parts	<input type="radio"/> Rack parts		<input type="radio"/> Bulk material			
Machine type	<input type="radio"/> Tunnel cleaning unit	<input type="radio"/> Batch cleaning unit					
Quantities and throughput rates							
Throughput rate (enter one rate)		parts/hour		parts/day		parts/year	
Shifts	<input type="radio"/> 1 shift		<input type="radio"/> 2 shifts		<input type="radio"/> 3 or 4 shifts		
	<input type="radio"/> 5-day week		<input type="radio"/> 6-day week		<input type="radio"/> 7-day week		
Parts carriers							
Parts carriers in place	<input type="radio"/> Yes	<input type="radio"/> No		<input type="radio"/> required			
Parts carrier types	<input type="radio"/> Wire mesh basket	<input type="radio"/> Plastic tray		<input type="radio"/> Adapter tray			
	<input type="radio"/> Perforated metal box	<input type="radio"/> Rack tray					
Outer dimensions of parts carrier (including handles, etc.)		L [mm]		W [mm]		H [mm]	
Max. load weight		kg/parts carrier					
Number of parts carriers		Parts carriers/batch (e.g. 4 carriers 480x320x200)					
Max. batch weight		kg/batch					
Charging concept	<input type="radio"/> Line integration						
Charging method	<input type="radio"/> Manual	<input type="radio"/> Automated					
Charging direction	<input type="radio"/> from left to right	<input type="radio"/> from right to left					
D - CLEANING MEDIUM							
Solvent	<input type="radio"/>						
Type of solvent, manufacturer*							
Aqueous medium	<input type="radio"/>						
Aqueous detergent*	Type, manufacturer						
pH range	<input type="radio"/> acidic	<input type="radio"/> neutral		<input type="radio"/> alkaline			
pH							

## COMMENTS

# CLEANLINESS TESTING

Early testing and verification of the required technical cleanliness after cleaning gives businesses extra safety. Such tests performed prior the integration of the cleaning unit in the production line guarantee the effectiveness and reliability of the future cleaning solution.

- At the PERO Competence Center, operators can test and devise their own cleaning methods, availing of expert support by PERO technicians.



## CHOOSING THE BEST MEDIUM FOR THE TASK

The following units for cleaning tests are available at the PERO Competence Center:

- + Up to 10 separate units for cleaning with various solvents
- + Up to 8 separate units for cleaning with aqueous media

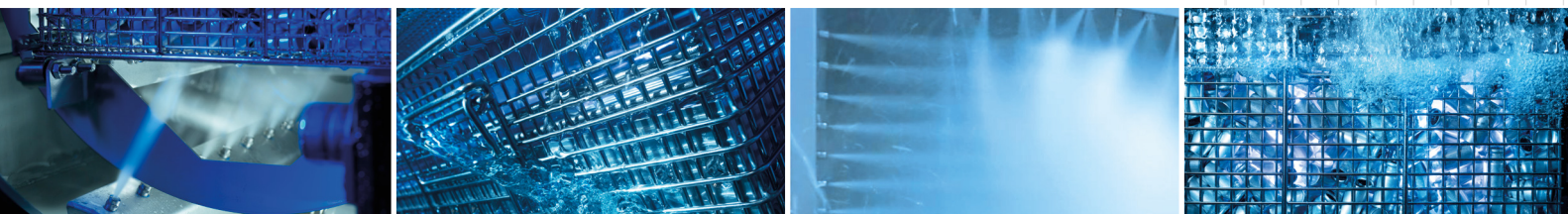
### Solvents

- + Batch cleaning units for parts carrier sizes of max. 1,340 x 480 x 300 mm
- + Comparing different media
- + Testing alternative cleaning processes
- + Seeing the appropriate handling of parts

### Water based media

- + Batch facilities for quality carriers up to 660 x 480 x 300 mm
- + Tunnel cleaning plants
- + Cleaning systems for large components up to a width of 2,100 mm and a weight of 1,500 kg

- Bring your contaminated parts to PERO at Königsbrunn and use them to find the best cleaning method and equipment for your specific tasks.



NOTES

## TECHNICAL CLEANLINESS ANALYSIS

At the technical cleanliness lab, PERO examines the outcomes of the cleaning tests.

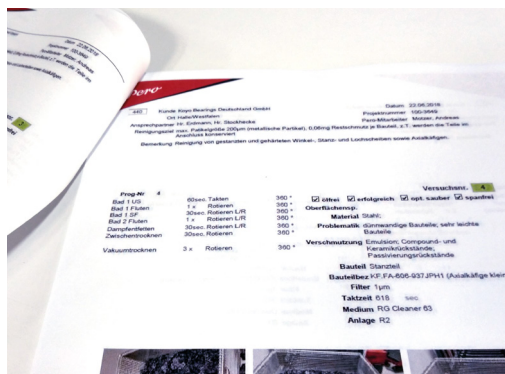


Mikroskopische Analyse							
Maßstab:		X 6,3 µm/Pxl Y 6,3 µm/Pxl		Auswerte-Ø [mm]:		44	
Größter metallischer Partikel				Länge [µm]:		158	
Größter nichtmetallischer Partikel <sup>1</sup>				Länge [µm]:		124	
Faserige Anteile <sup>2</sup>				Länge der größten Faser L [µm]:		774	
				Gesamtlänge Fasern [mm]:		13,72	
Partikelgröße [µm]	Code	Partikelanzahl <sup>1</sup> auf Filtermembran		Partikelanzahl <sup>1</sup> pro Bauteil		Partikelanzahl <sup>1</sup> pro 1000 cm²	
		Insgesamt <sup>1</sup>	Metallisch	Insgesamt <sup>1</sup>	Metallisch	Insgesamt <sup>1</sup>	Metallisch
Zusammengefasste Statistik:							
> 600	J-K	0	0	0,0	0,0	0,0	0,0
100 - 600	F-I	3	1	0,6	0,2	43,5	14,5
15 - 100	C-E	308	10	61,6	2,0	4463,8	144,9
Ausführliche Statistik:							
> 1000	K	0	0	0,0	0,0		
600 - 1000	J	0	0	0,0	0,0		
400 - 600	I	0	0	0,0	0,0		
200 - 400	H	0	0	0,0	0,0		
150 - 200	G	1	1	0,2	0,2	14,5	14,5
100 - 150	F	2	0	0,4	0,0	29,0	0,0
50 - 100	E	53	1	10,6	0,2	768,1	14,5
25 - 50	D	118	7	23,6	1,4	1710,1	104,4
15 - 25	C	137	2	27,4	0,4	1985,5	29,0
5 - 15	B	445	1	89,0	0,2	6449,3	14,5
CCC <sup>3</sup> (Component Cleanliness Code):							
A(B13/C-E13/F-I6/J-K00)							
A(B13/C11/D11/E10/F5/G4/H00/I00/J00/K00)							
<sup>1</sup> : Partikel ohne Fasern gezählt							
<sup>2</sup> : Definition Faser: Nichtmetallisch, Kompaktheit < 30 % oder Länge/Breite > 10.							

## DOCUMENTATION

The cleanliness certificate summarises the results of the chosen cleaning method, and documents the cleaning medium as well as the individual process steps.

- This document therefore provides the perfect basis for further project meetings within the organisation.



## CONFIGURING UNIT AND PROCESS

Based on the project data, the outcomes of the cleaning tests and the cleanliness analyses, the project partners identify the best cleaning process and plant type for achieving the set cleanliness target.

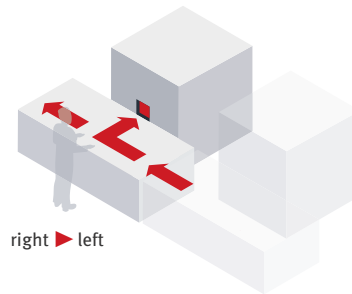
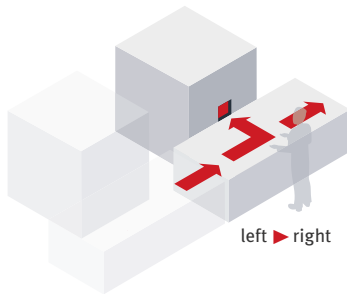


# PROJECT CHECKLIST

Have all technical and commercial issues required for the drafting of a requirement specification or a request for an offer been clarified?

## TECHNOLOGY

- ☐ If necessary, calculate the timeframe and costs in relation to customer requirements (requirement specifications, machining/equipment instructions, other specifications)
- ☐ Solvent/cleaning chemicals: supplier/manufacturer, type
- ☐ Filling/draining fittings and equipment
- ☐ Fine filter grade
- ☐ Parts handling (charging/unloading)
- ☐ Medium supply
- ☐ Plant finish (paintwork, colour)
- ☐ Positioning of unit and charging equipment:



## COMMERCIAL ASPECTS

- ☐ INCOTERMS
- ☐ Delivery date
- ☐ PERO standard scope of delivery
- ☐ Customer instructions
- ☐ Purchasing terms
- ☐ Payment terms
- ☐ Warranty



# PROJECT OFFER

The unit type and the chosen options are specified in detail and priced.

## NOTES





# PROJECT EVALUATION

All parties involved in the project are informed on the benefits of the proposed solution.



## OPERATING COST CALCULATION

As each application is unique, the real costs and performance figures must be taken into account in the commercial project evaluation.

	pro Jahr	pro Stunde	pro Charge	pro Tag
<b>Kosten im 1. Jahr</b>	43.750 €	6,39 €	1,02 €	0,022 €
Abschreibung	18.865,29 €	2,72 €	0,44 €	0,011 €
Kalk. Zins	79.966,29 €	11,58 €	1,87 €	0,045 €
Erstbetriebskosten	33.750 €	4,94 €	0,79 €	0,020 €
Energie	118.556,39 €	17,38 €	2,79 €	0,069 €
Lösungsmittelverluste	8.447,14 €	1,23 €	0,20 €	0,005 €
Bedienpersonal	5.000 €	0,73 €	0,12 €	0,003 €
Altteilentsorgung	11.471 €	1,67 €	0,27 €	0,007 €
Aktivkohle Tausch	20.624 €	3,01 €	0,48 €	0,012 €
Wartung	296.680,21 €	43,75 €	7,00 €	0,175 €
Eigenwartung	347.430,21 €	51,14 €	8,25 €	0,206 €
LM Austausch	267.930,21 €	39,44 €	6,35 €	0,159 €
<b>laufende Kosten m. Personal</b>				
<b>laufende Kosten</b>				
<b>Gesamtkosten</b>				
<b>laufende Kosten</b>				

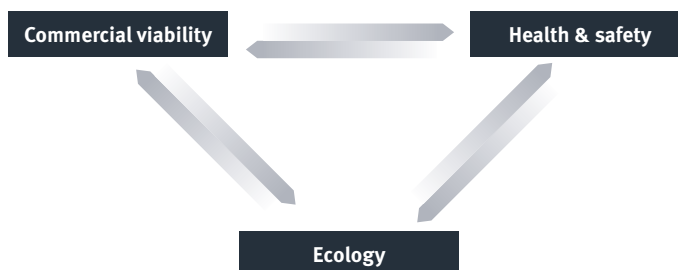
## ADDED VALUE

Summarise the technical and commercial benefits of the proposed cleaning solution.

- + Cleaning unit availability
- + Monetary evaluation of performance
- + Efficiency of cleaning method

## BENEFITS

Compare the proposed cleaning solution with the current system and alternative solutions.



## SUPPLIER NEGOTIATION

The comprehensive technical and commercial evaluation forms the basis for the purchasing decision.

- In most companies, the parts cleaning system is a key element in the production line.



## PURCHASING AGREEMENT & CONTRACT

Unambiguous contractual clauses prevent misunderstandings, additional costs and delays. A written agreement provides clarity for both the vendor and the buyer.

### CUSTOMISATION

After the order has been placed, the unit is designed, produced and built with original components and configured for the proposed use.

- ☐ Parts carriers
- ☐ Solvent / cleaning chemicals: supplier/manufacturer, type
- ☐ Parts for on-site acceptance testing

## PARTNERSHIP

Fast delivery of spare parts and a competent team of service technicians guarantee a high availability of your new PERO cleaning unit.



- PERO is dedicated to establishing good business relationships based on cooperation and partnership.

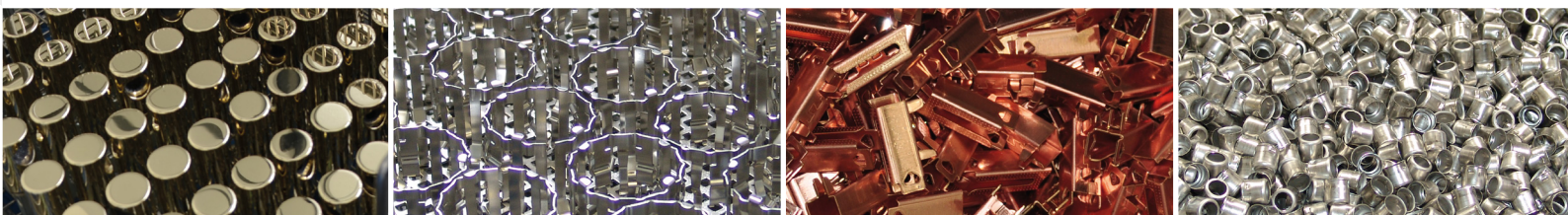




# NOTES

Photos: footer pages 5 & 7, page 12 centre & page 14 top: Shutterstock. All other graphics: Pero AG

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Errors and omissions reserved.



# COMPETENCE CENTRE

## FOR THE TECHNICAL CLEANLINESS OF COMPONENTS

More than **15 demonstration machines** available in our 1,100 square meter Competence Centre, allowing you together with our Pero engineers to develop the optimum cleaning process for your company.

### Cleaning process with

#### Water based media

- + Batch facilities for quality carriers up to 660 x 480 x 300 mm
- + Tunnel cleaning plants
- + Cleaning systems for large components up to a width of 2,100 mm and a weight of 1,500 kg

#### Solvents

- + Comparing different media
- + Testing alternative cleaning processes
- + Seeing the appropriate handling of parts

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## MAKING USE OF STRONG PERFORMANCE

- + Free cleaning tests on original dirty parts including documentation
- + Evaluations and analyses of cleanliness according to VDA 19 in **our laboratory**
- + Technological insight and valuable data for your company

Even before you have decided about the investment, assessing the profitability of the future process can be carried out. The defined technical cleanliness of the components reliably reached and maintained.

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