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CleanControlling®

Online basic seminar
TECHNICAL CLEANLINESS
VDA 19.1 and VDA 19.2



Cleanliness inspection according to VDA 19 Part 1

Jörg Kotzian, CleanControlling GmbH

Contents

Sequence and execution of cleanliness inspection

Selection of the extraction method

Deposition

Selecting the inspection method

When selecting the test method,

the test purpose must be taken into account

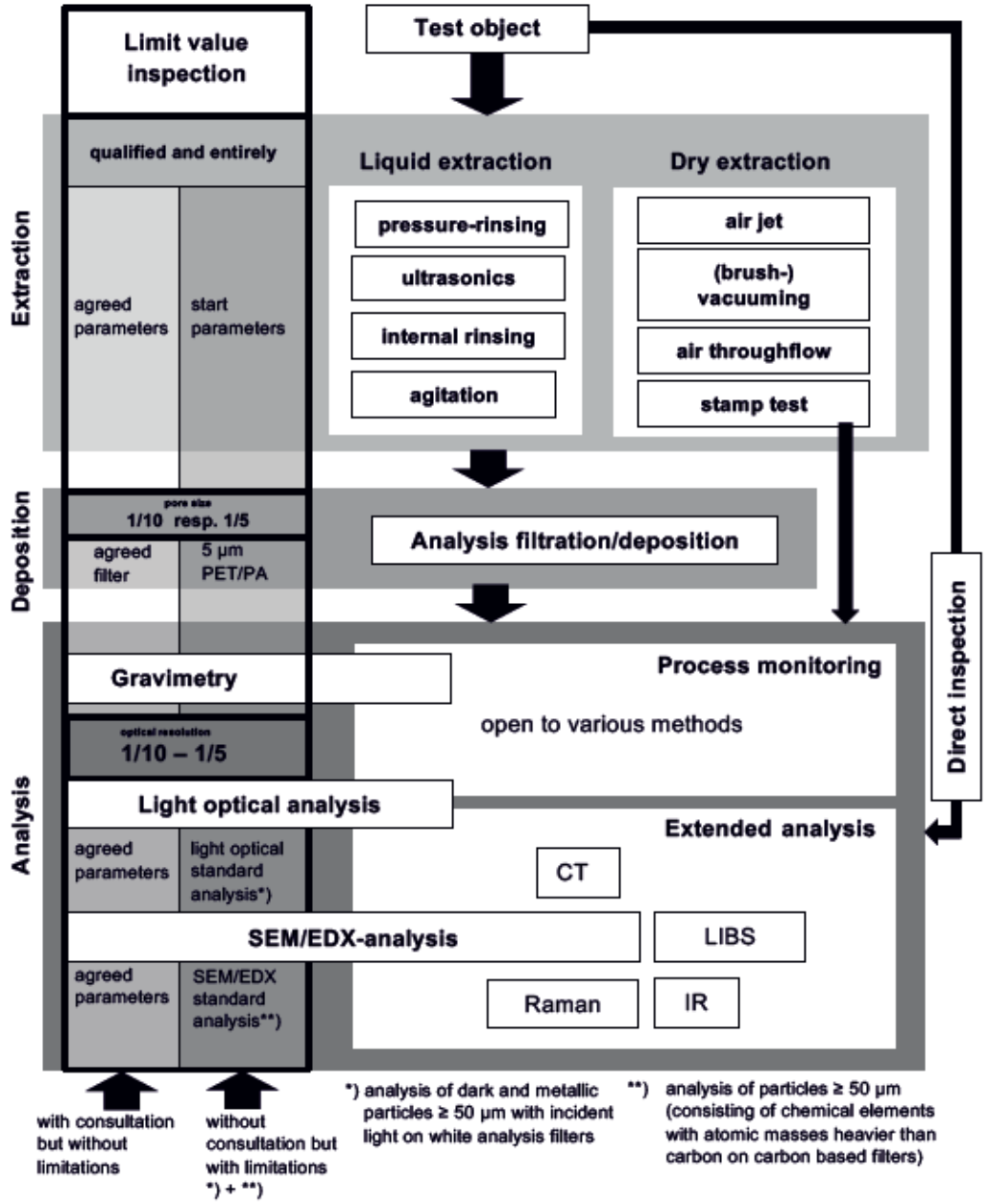


Figure 1-1: Inspection Procedure According to VDA 19.1

Selecting the inspection method

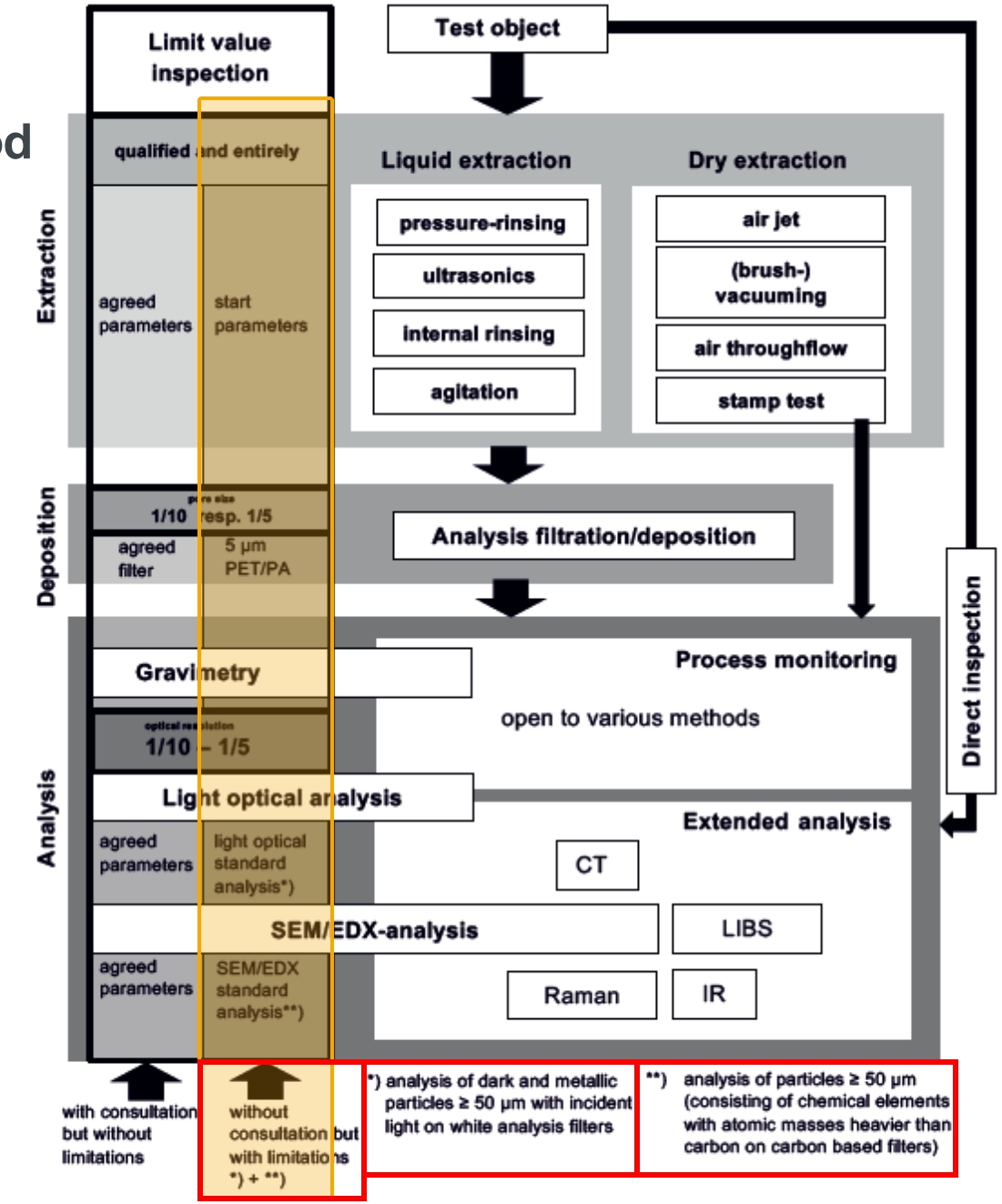


Figure 1-1: Inspection Procedure According to VDA 19.1

Selecting the inspection method

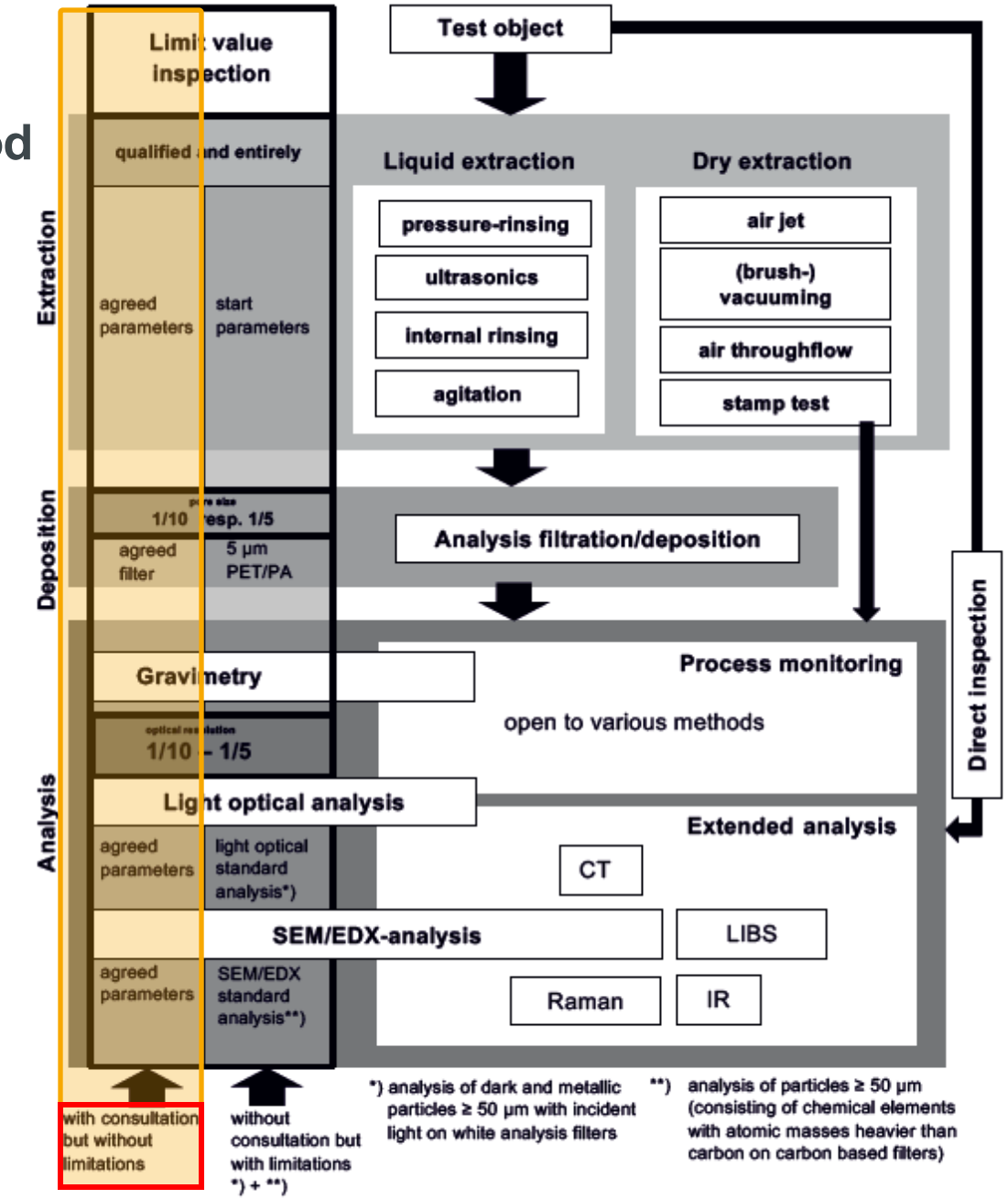


Figure 1-1: Inspection Procedure According to VDA 19.1

Selecting the inspection method

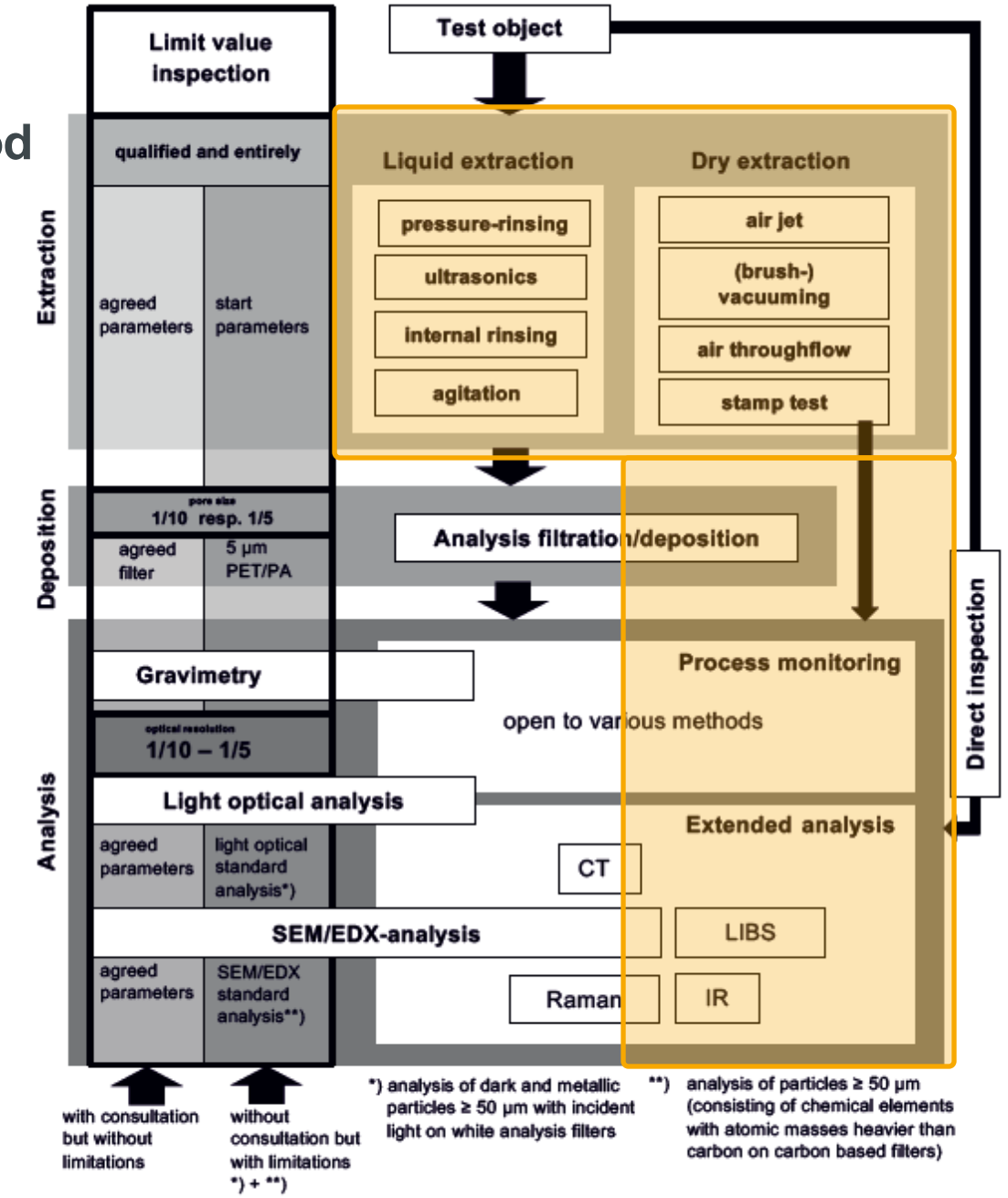


Figure 1-1: Inspection Procedure According to VDA 19.1

Note 1:
In individual cases, direct analysis of particles on a test object is also possible, provided its nature allows this. In this case the steps of extraction and particle separation are omitted (see chapter 8.2.2.3.4).

Note 2:
In the stamp test, the “separation” step for the particles is omitted, or rather it takes place in one step together with the extraction.

Contents

Sequence and execution of cleanliness inspection

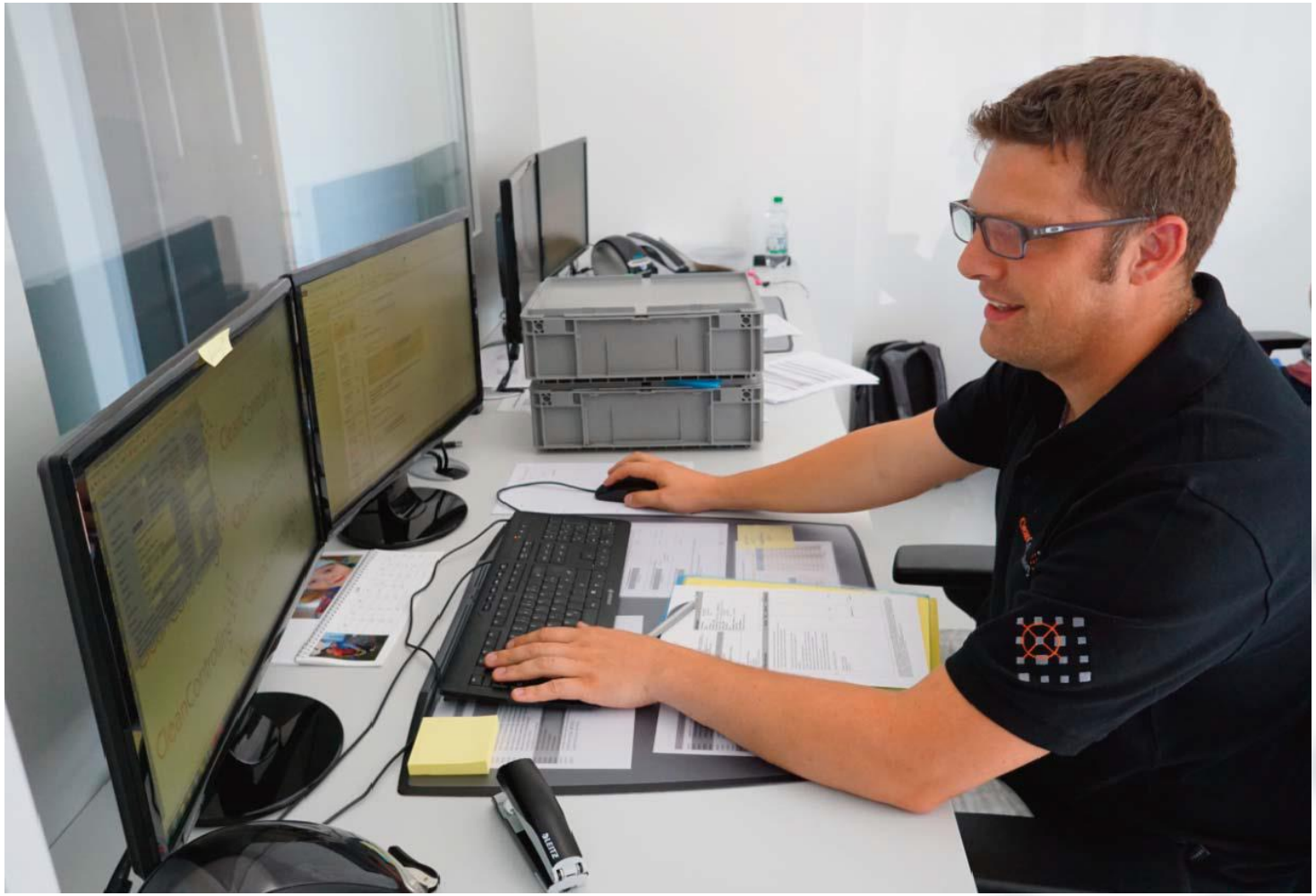
Selecting the extraction method

Deposition

Test planning / work preparation

Planning documents

- Review of standards
- Drawing review
- Cleanliness requirements
- Specifications for extraction
- Specifications for evaluation



Extraction methods – Pressure rinsing / low-pressure rinsing

Key influencing parameters

- Extraction liquid, temperature
- Volume flow in combination with nozzle cross-section
- Geometry of nozzles and lances
- Distance and angle to the component
- Sequence during the extraction
- Time per surface, or feed rate
- Repetitions per surface



Extraction methods - Ultrasonics

Key influencing parameters

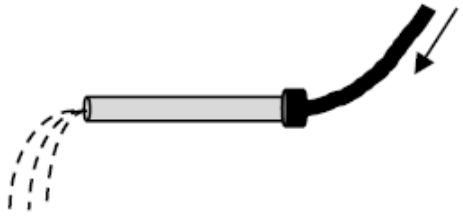
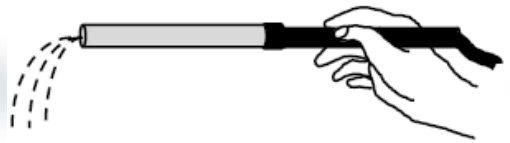
- Extraction liquid, temperature
- Frequency of the ultrasonic device
- Power density of the ultrasonic device
- Orientation of ultrasonic oscillators in the bath
- Orientation of the component to the sound source
- Extraction time
- Component movement



Extraction methods – Internal rinsing

Key influencing parameters

- Extraction liquid, temperature
- Volume flow, pressure
- Geometry
- Pulsation
- Frequency

Internal rinsing in a closed system	Internal rinsing by adapting a rinsing line	Internal rinsing by adapting a pressure-rinsing tool
		

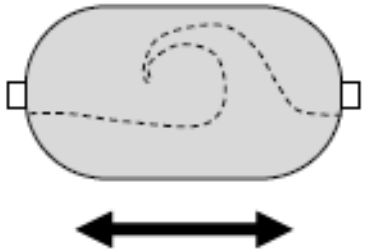
Source: VDA19.1

Extraction methods - Agitation

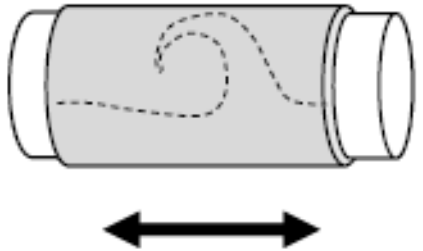
Key influencing parameters

- Extraction liquid, temperature
- Volume of extraction liquid
- Duration, amplitude, frequency
- Number of fillings
- Subsequent rinsing

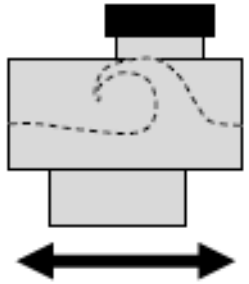
1) Agitation of a pressure tank



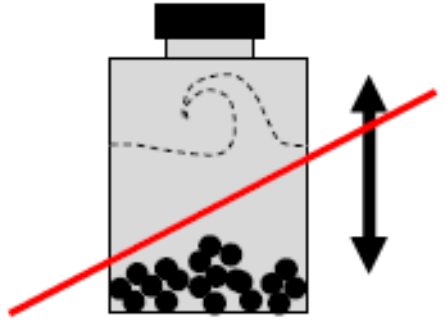
2) Agitation of a section of piping (short fat cross-section)



3) Agitation of a container



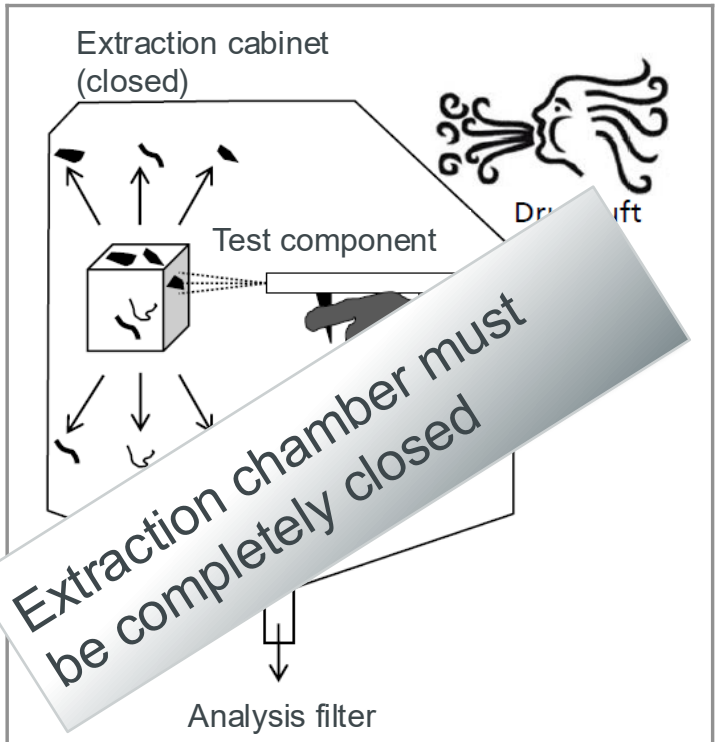
4) Agitation of small components in a container: not suitable



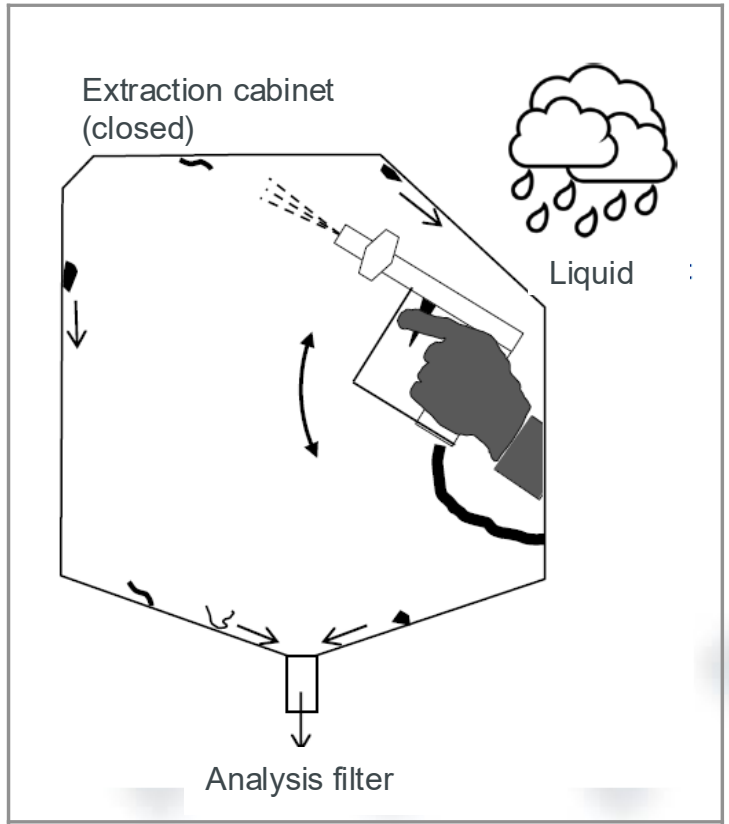
Extraction methods - Air jet extraction

Key influencing parameters

- Nozzle shape
- Jet off pressure
- Distance to the test component
- Jet off time



Extraction step 1
- Jet off with compressed air

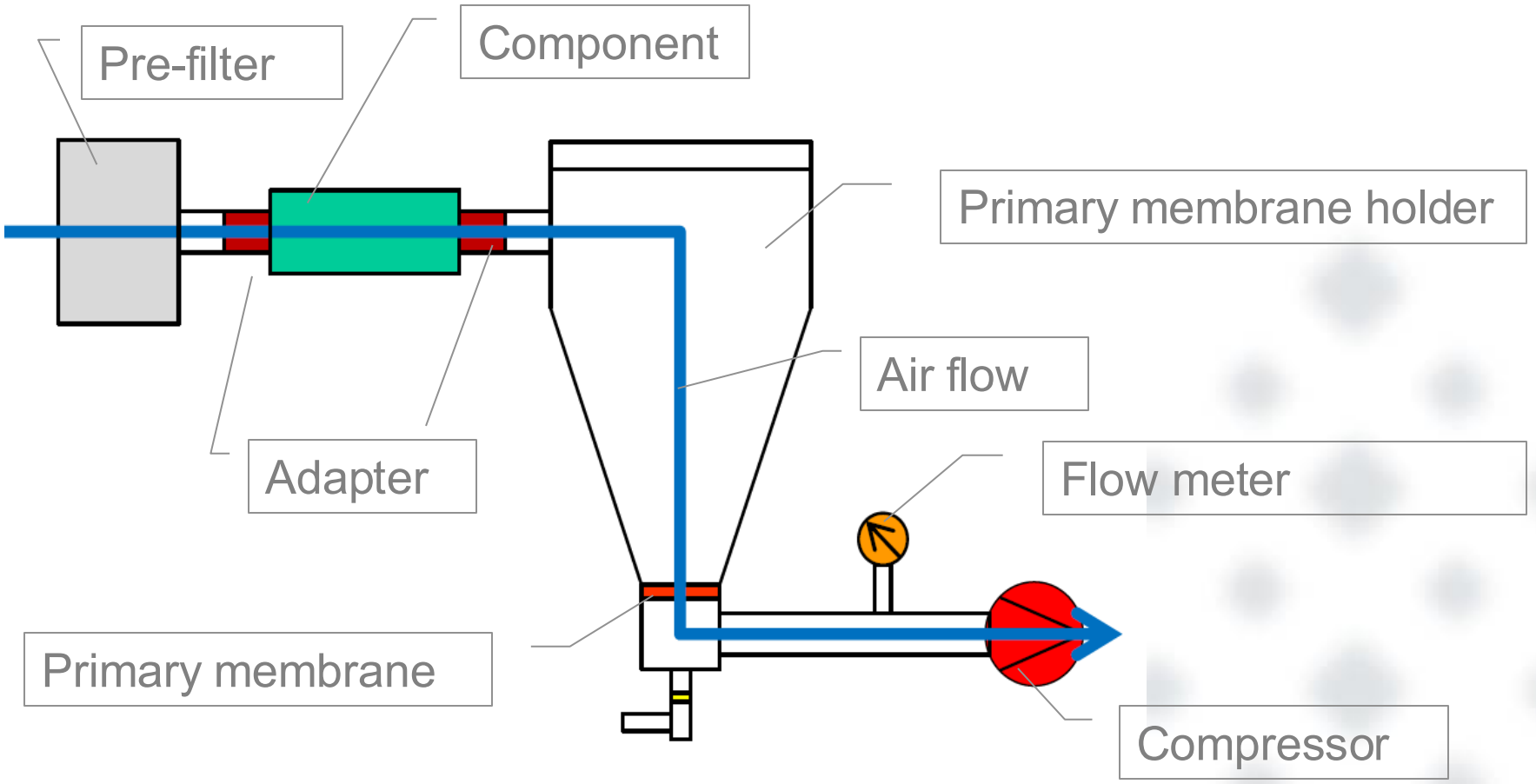


Extraction step 2
- Subsequent rinsing with liquid

Extraction methods - Air flow-through

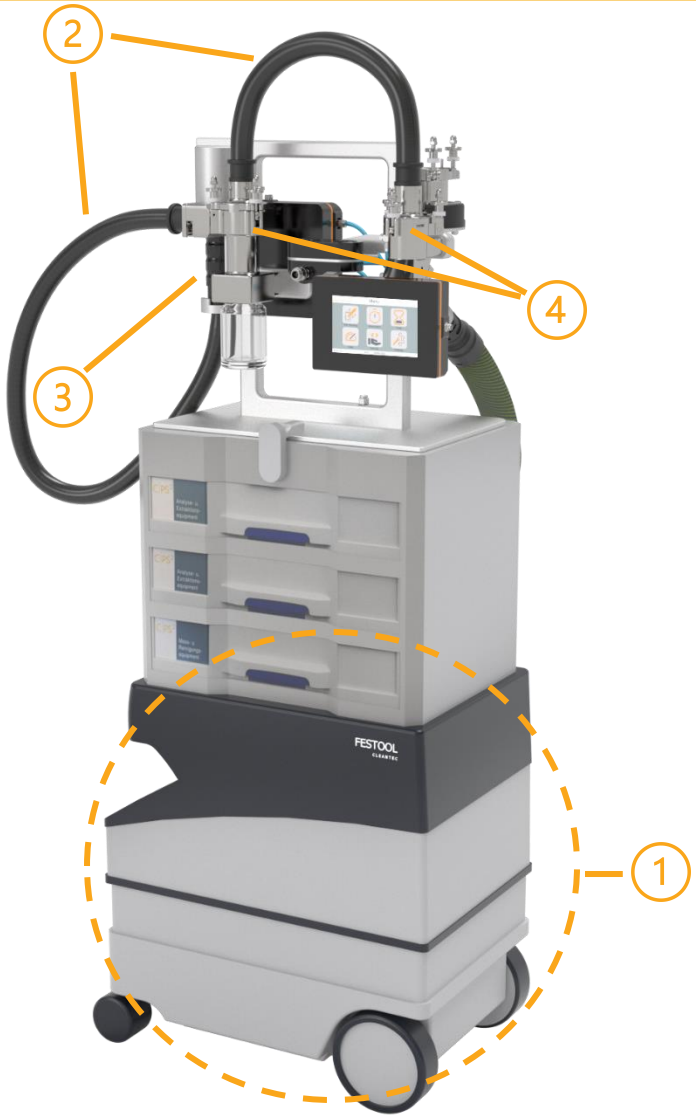
Key influencing parameters

- Volume flow
- Duration
- Mounting situation
- Test sequence



New extraction methods per VDA 19.1 – (Brush-)vacuuming

Materials & equipment



1 PUMP SYSTEM
to achieve the required volume flow

2 PIPE OR HOSE SYSTEM
to guide the extracted air

3 (BRUSH-)VACUUMING NOZZLE
Increased extraction effect by means of a brush attachment

4 PARTICLE SEPARATION UNIT
Filter holder or cyclone unit for separation onto a particle trap or into a collecting vessel

Source 1: Internal documents of CleanControlling GmbH

Source 2: VDA-19.1

New extraction methods per VDA 19.1 - (Brush-)vacuuming

Materials & equipment

Optional items that may be required:

5 **COMPONENT FIXTURE**
e.g. holder or manipulator



6 **ROOM OR VACUUMING BOOTH**
if necessary with filtered air, if the ambient air is unsuitable for achieving the required blank values



7 **EXTRACTION DEVICE**
for re-preparation onto an analysis filter when a collecting vessel is used



Source 1: Internal documents of CleanControlling GmbH

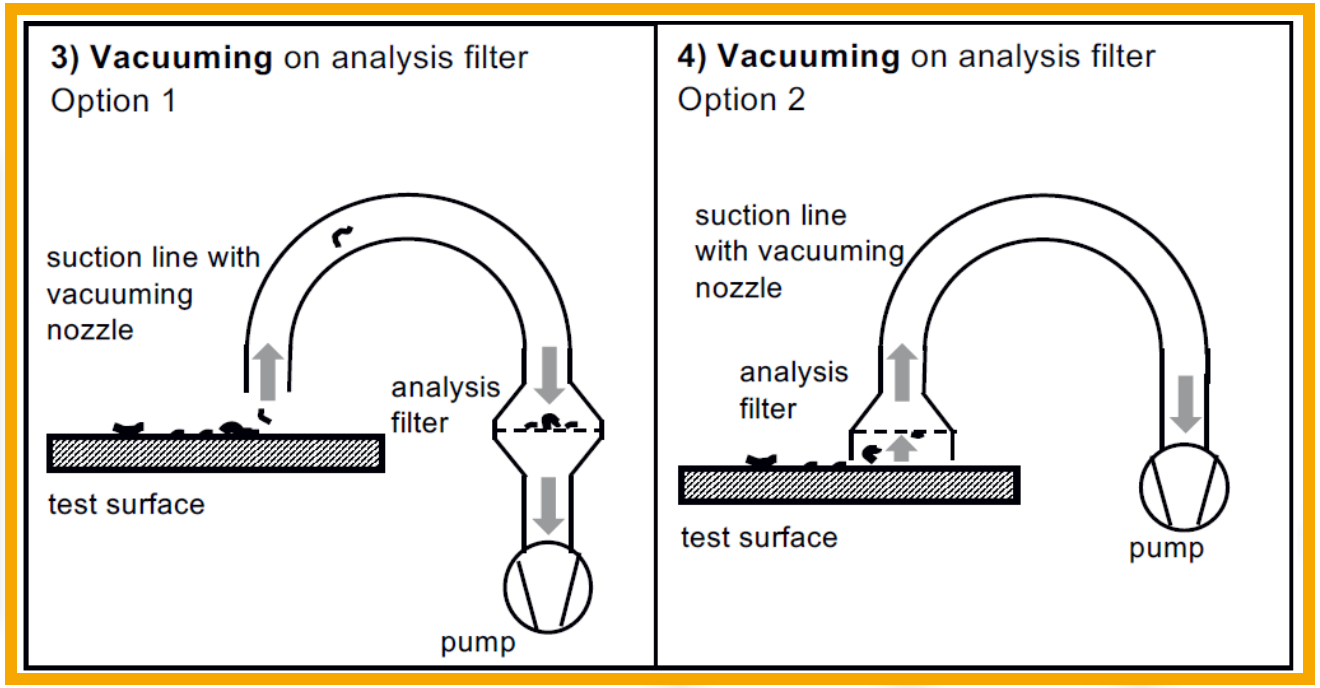
Source 2: VDA-19.1

New extraction methods per VDA 19.1 - (Brush-)vacuuming

Set-up – Vacuuming onto an analysis filter







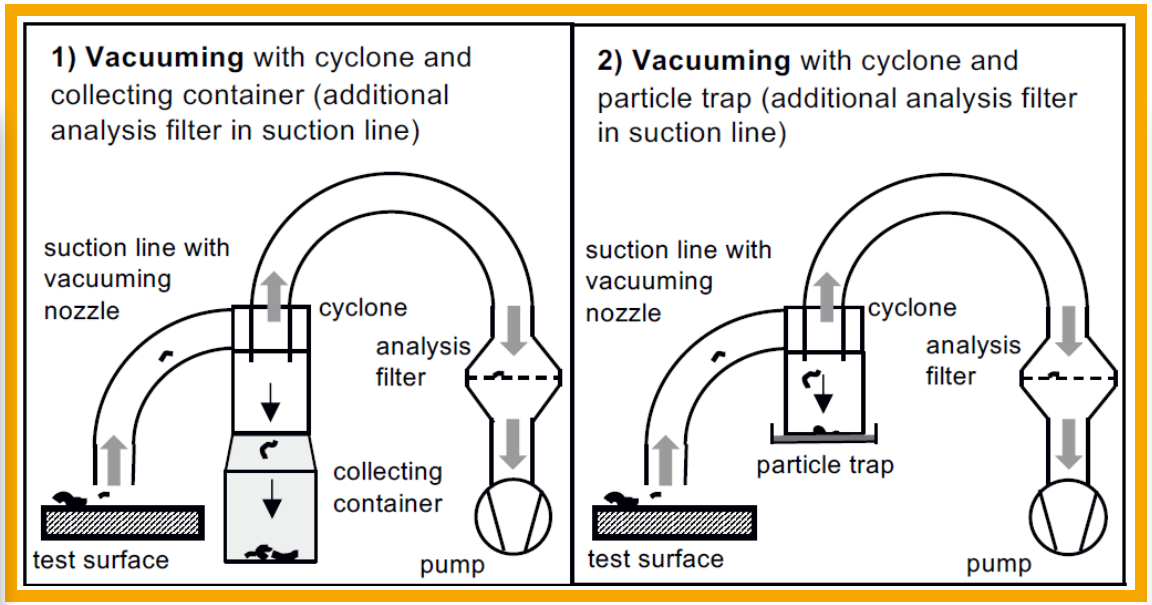
Source 1: Internal documents of CleanControlling GmbH

Source 2: VDA-19.1

New extraction methods per VDA 19.1 - (Brush-)vacuuming

Set-up – Vacuuming via a cyclone unit







Source 1: Internal documents of CleanControlling GmbH

Source 2: VDA-19.1

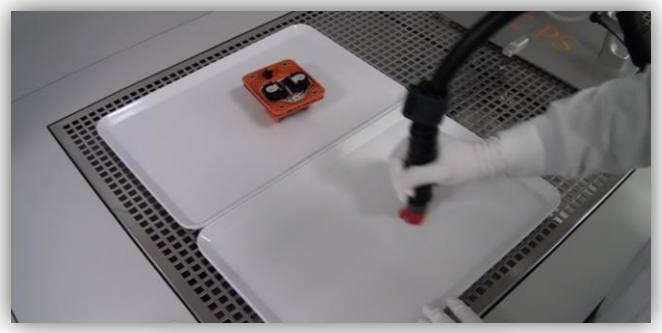
New extraction methods per VDA 19.1 - (Brush-)vacuuming

Blank value measurement

- **Option A:** Vacuuming against **atmosphere**
  - Blank value of the system and the ambient air at the extraction site



- **Option B:** Vacuuming of the **support surface**
  - Blank value of the system, the ambient air at the extraction site and the contact surface



- **Option C:** Vacuuming with **pre-filter**
  - Differentiated blank value of the system and the ambient air at the extraction site (2 filters)



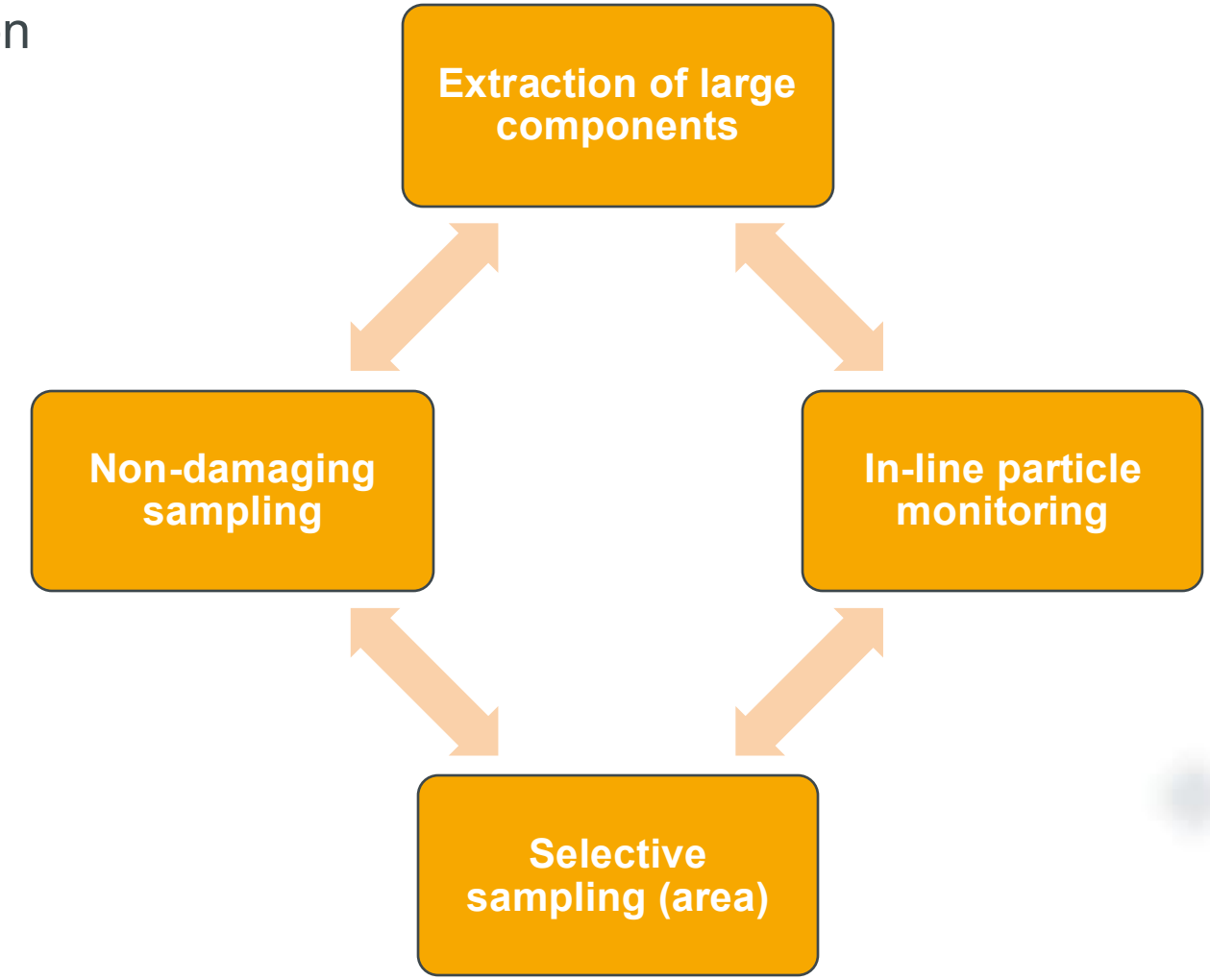
Recommended duration:

2 minutes

Source 1: Internal documents of CleanControlling GmbH

New extraction methods per VDA 19.1 - (Brush-)vacuuming

- Fields of application



OVERVIEW OF EXTRACTION METHODS

New extraction methods per VDA 19.1 - (Brush-)vacuuming

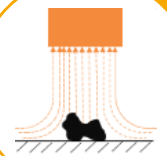
Start parameters





Intake area of the nozzle

- 2.0 cm² (round nozzle 16 mm)



Vacuuming flow rate

- ≥ 20 m³/h



Nozzle distance (without brushes)

- Max. 8 mm



Vacuuming time/component surface area

- $t_{ST} = (60 \times A_{cp})^{0.4}$

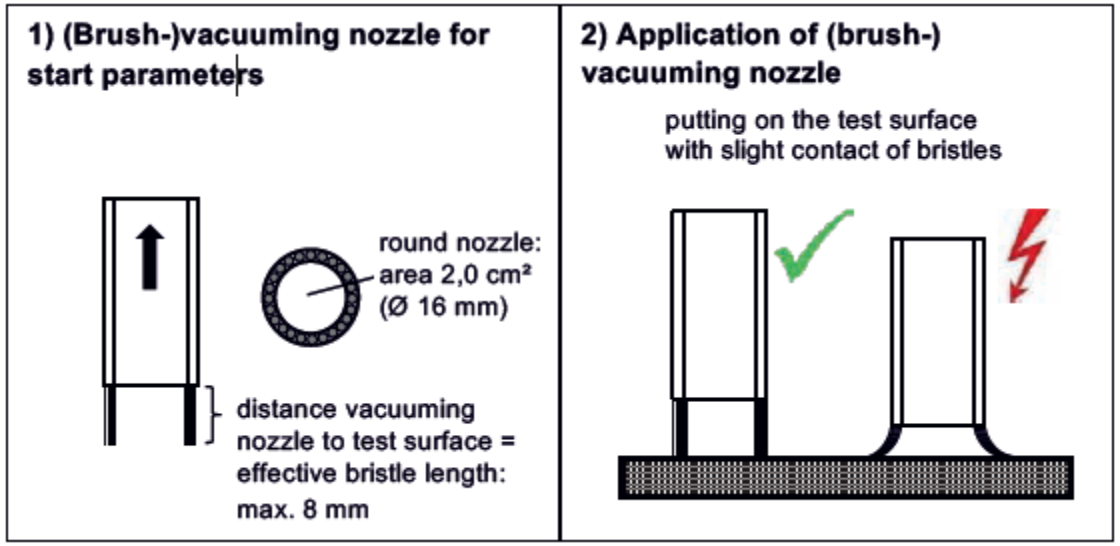
Source 1: Internal documents of CleanControlling GmbH

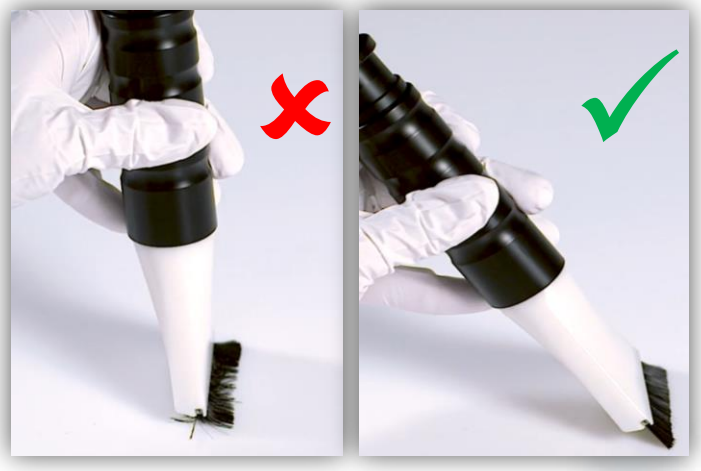
Source 2: VDA-19.1

New extraction methods per VDA 19.1 - (Brush-)vacuuming

Start parameters - Intake area of the nozzle









Bristles should therefore be avoided for sensitive parts

Source 1: Internal documents of CleanControlling GmbH

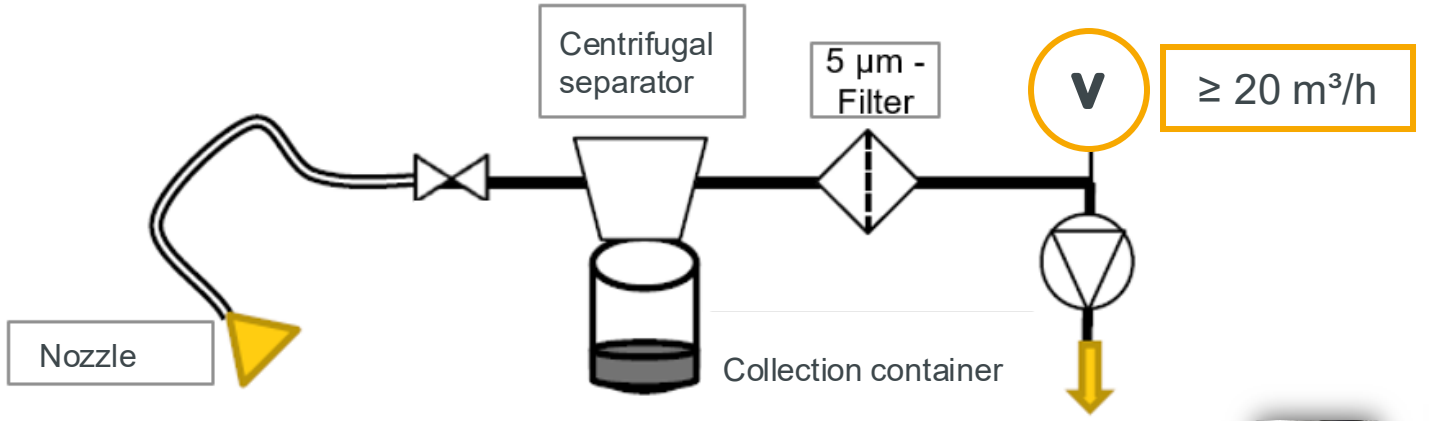
Source 2: VDA-19.1

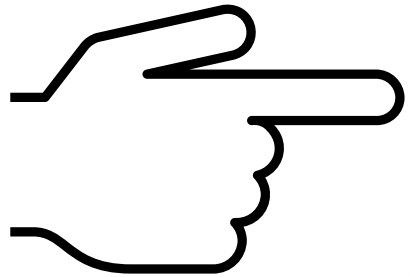
New extraction methods per VDA 19.1 - (Brush-)vacuuming

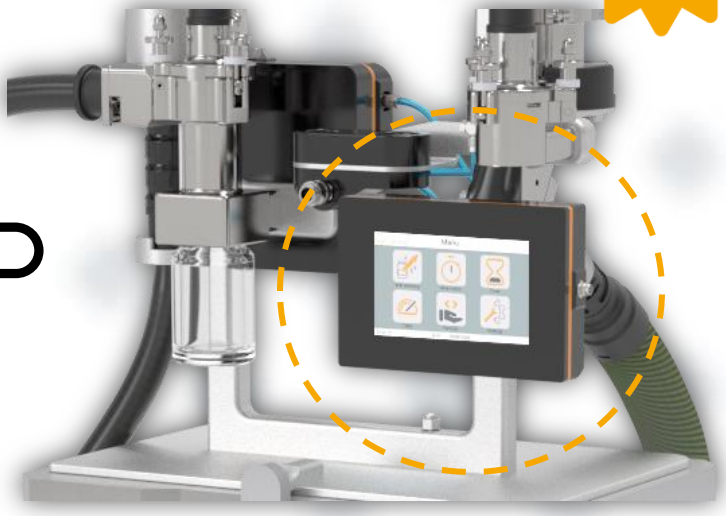
Start parameters – Vacuum flow rate











Source: Internal documents of CleanControlling GmbH

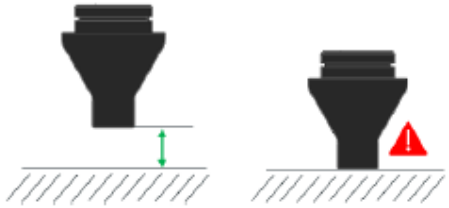
New extraction methods per VDA 19.1 - (Brush-)vacuuming

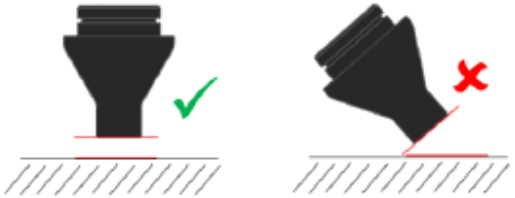
Start parameters - Nozzle distance



Max. 8 mm
Brush = pressure-free contact with the component

- To ensure optimal extraction of particles, attention must be paid to the distance and angle between the suction inlet area and the component surface being extracted





- If the distance is too large, the flow velocity of the incoming air stream directly at the component surface decreases and the cleaning effect drops
- If the distance is too small, or the nozzle touches the component surface, the nozzle may become blocked

Note 4: If electronic test objects are reused after (brush-)vacuuming, ESD protection measures are necessary.

Source 1: Internal documents of CleanControlling GmbH

Source 2: VDA-19.1

New extraction methods per VDA 19.1 - (Brush-)vacuuming

Start parameters - Vacuuming time



- (Brush-)vacuuming start time **per component area**:

$$t_{St/A} = \frac{(60 \times A_{cp})^{0,4}}{A_{cp}}$$

- The vacuuming time per square centimetre of component surface used to create the declining curve is **dependent on the component size**
- **Important:** To sample small components thoroughly, more time is required relative to their size
- (Brush-)vacuuming start time **per component**:

$$t_{St} = (60 \times A_{cp})^{0,4}$$

The final **vacuuming time** for routine testing is determined in the course of the declining test

Source 1: Internal documents of CleanControlling GmbH

Source 2: VDA-19.1

New extraction methods per VDA 19.1 - (Brush-)vacuuming

Start parameters - Vacuuming time

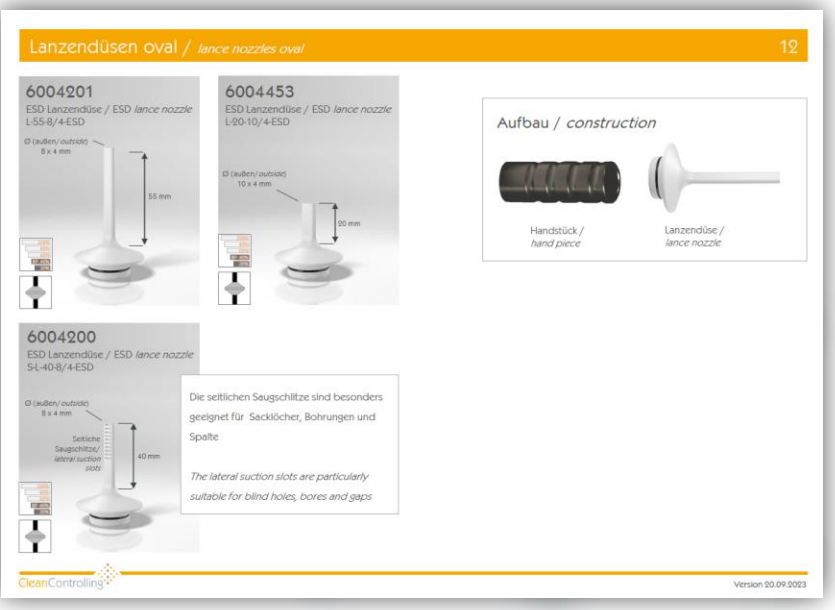
Table 6-15: (Brush-)Vacuuming Start times (for Start Parameter Set)

Test surface in cm²	Start vacuuming time/ test surface in s/cm²	Resulting start vacuuming time per test object in s
100	0.320	32
200	0.215	43
300	0.167	50
400	0.143	57
500	0.123	62
750	0.097	73
1000	0.082	82
2000	0.054	108
3000	0.042	127
4000	0.036	142
5000	0.031	155
7500	0.024	183
10,000	0.020	205
15,000	0.016	241
20,000	0.014	270

If the declining criterion is **not met** with these **start parameters**, or if justified parameters are to be used, the start parameters **may be deviated from**

Note 2: The formulas and tables are general recommendations for deriving the start vacuuming time per component surface for a declining test. It may make sense to increase this start value if, for example, the component is very complex. Furthermore, for large surface areas, it should be checked whether the resulting short vacuuming times per area allow a careful and sufficient extraction of all surface areas, or whether in this case a longer vacuuming time should be chosen.

Note 3: If using other nozzles that do not match the start parameters, it may be necessary to adjust additional vacuuming parameters such as distance or flow rate to achieve adequate vacuuming.



Source 1: Internal documents of CleanControlling GmbH

Source 2: VDA-19.1

New extraction methods per VDA 19.1 - (Brush-)vacuuming

Procedure

- **Important: Adapt the procedure to the conditions of the test object and suction system**

1. **PROVISION**
   of all equipment required for the test
2. **CLEANING OF RELEVANT SURFACES & SUPPORT SURFACES**
3. **BLANK VALUE DETERMINATION**
   optionally with pre-filter
4. **PREPARATION OF THE TEST OBJECTS**
5. **PERFORMING THE EXTRACTION**
   observing the suction distance, volume flow & suction time
6. **FINAL-VACUUMING**
   to avoid cross-contamination

Recommended duration:



At least 30 seconds

Important: If a brush attachment is used, it must also be extracted

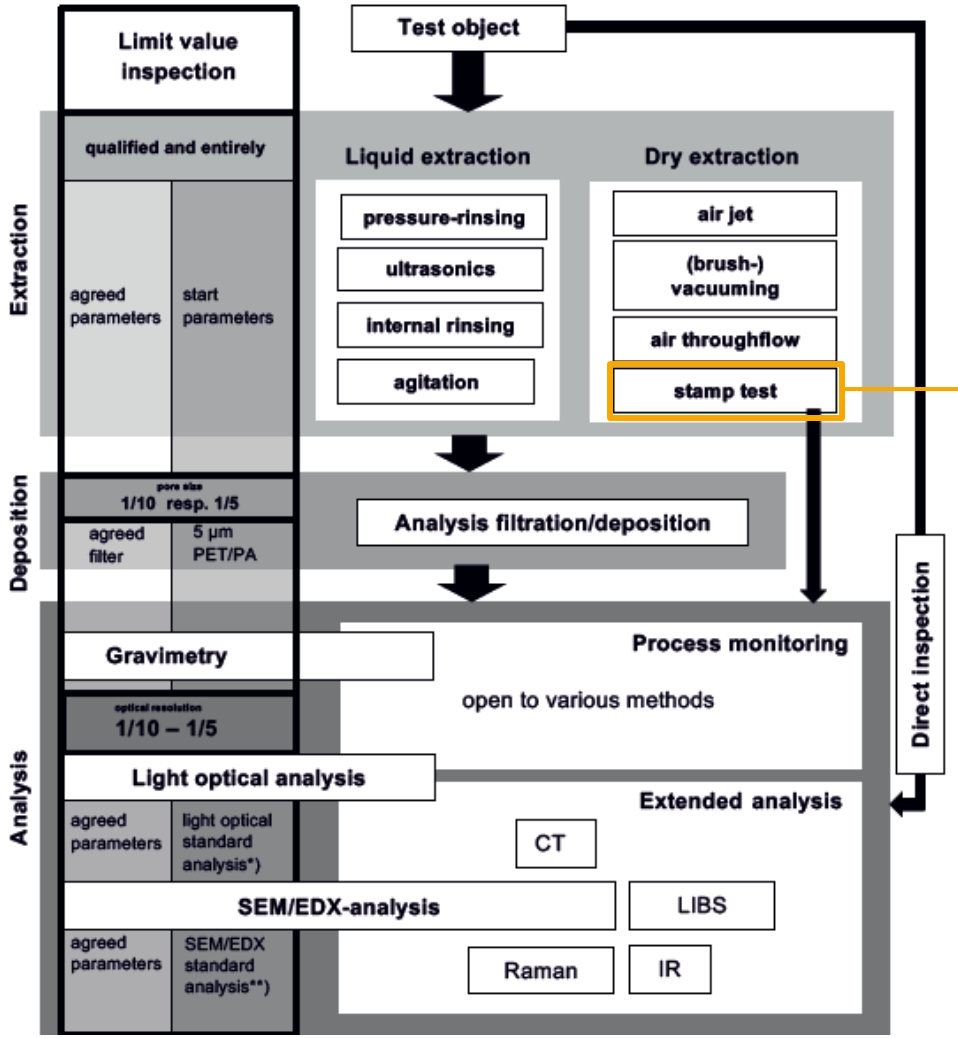


Source 1: Internal documents of CleanControlling GmbH

Source 2: VDA-19.1

New extraction methods per VDA 19.1 - Stamping

Classification





Source 1: Internal documents of CleanControlling GmbH

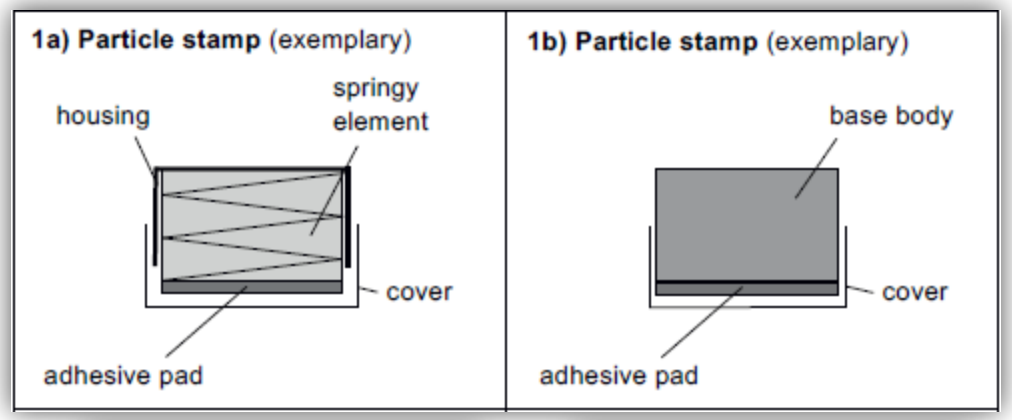
Source 2: VDA-19.1

New extraction methods per VDA 19.1 - Stamping

Materials & equipment

- Adhesive surface (adhesive pad or adhesive surface)
- Active sampling of the surface by pressing the stamp onto it
- Separation onto a surface for analysis in a single step
  - Light-optical analysis
  - Scanning electron microscope
- Suitable for limited component areas, e.g. seals
  - Geometries must be matched to each other
  - Material must also be suitable
  - Free of oil and grease
  - No particles may be released

Important: A component fixture may be needed to hold light objects in place







Source 1: Internal documents of CleanControlling GmbH

Source 2: VDA-19.1

New extraction methods per VDA 19.1 - Stamping

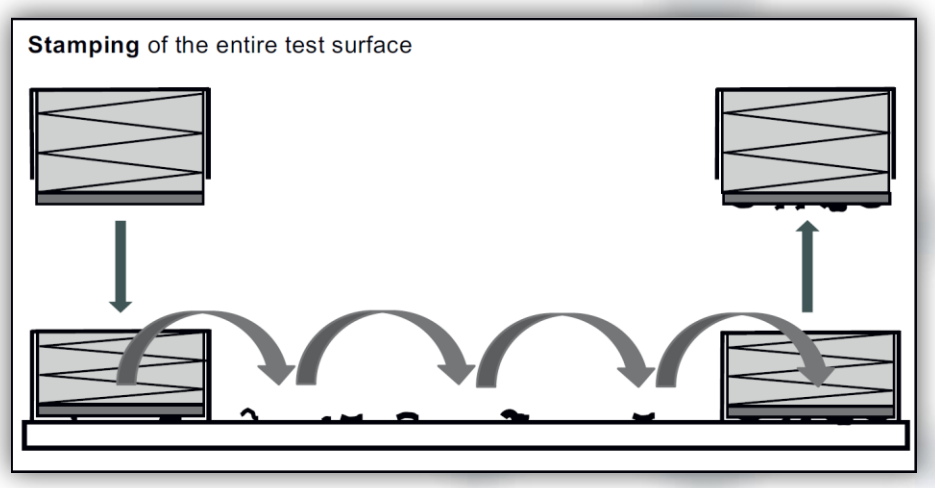
Start parameters

- **Important:** There are **no standardised start parameters** for the stamp test

Start parameters are to be agreed within the customer–supplier relationship

- The qualification test is also carried out by means of a declining test
- The result determines the **number of stamps**
- One stamp can be used **6-8 times**

The blank value is determined by a **zero measurement** of the stamp

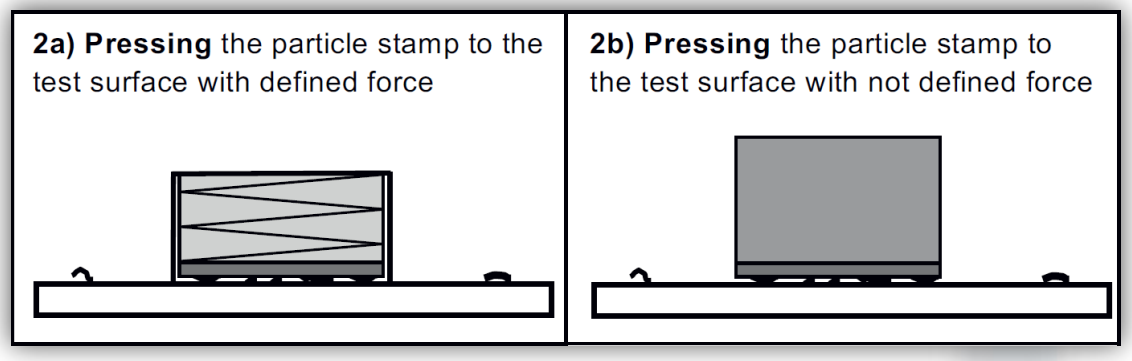


Source 1: VDA-19.1

New extraction methods per VDA 19.1 - Stamping

Procedure

1. **PROVISION**
   of all equipment required for the test
2. **OPENING THE LID**
   Remove the protective film if necessary
3. **STAMPING THE TEST SURFACE**
   Repeat until the entire test surface has been stamped.
   When adhesion decreases → use a new stamp
4. **STORE AND SEAL THE STAMP**



Important: Place slightly overlapping onto the adjacent test field

Source 1: VDA-19.1

Contents

Sequence and execution of cleanliness inspection

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Deposition

DEPOSITION

Process flow chart

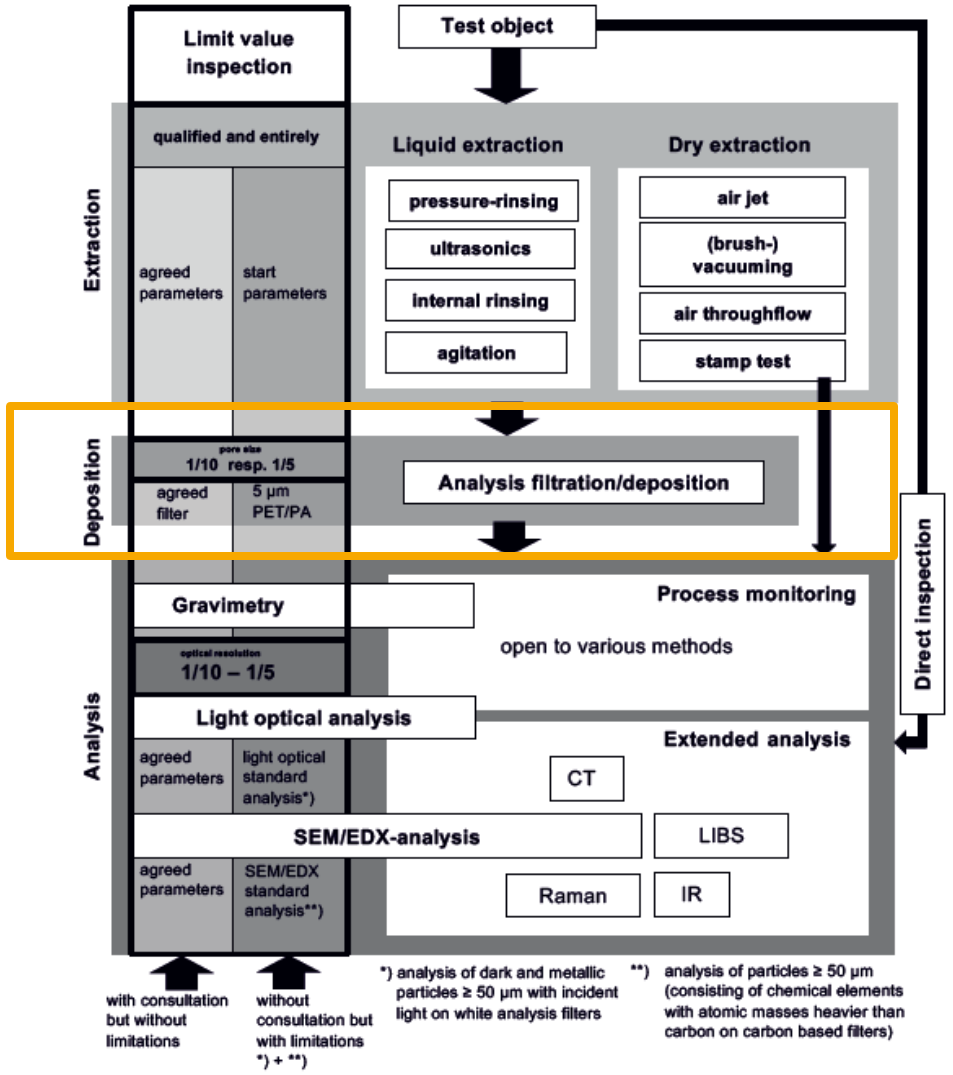


Figure 1-1: Inspection Procedure According to VDA 19.1

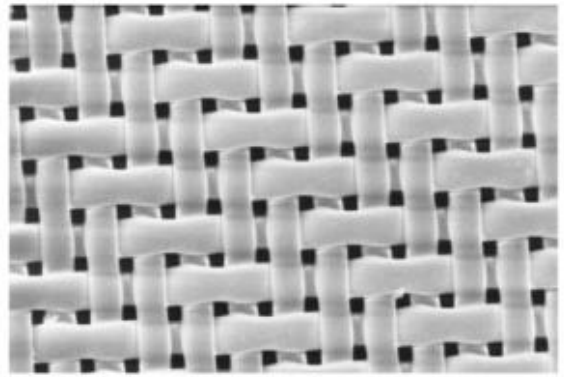
Analysis filtration

Principle

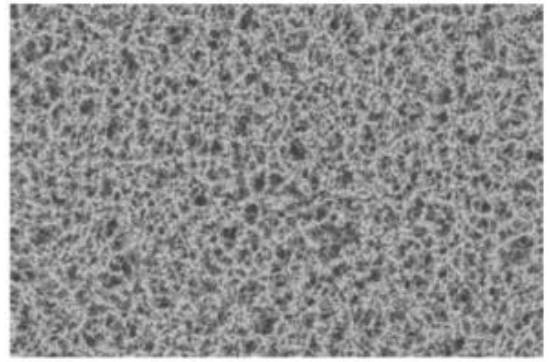
- In analysis filtration, the extracted particles contained in the test fluid are separated onto the filter membrane.

Key influencing parameters

- Chemical resistance (test medium / filter material)
- Filter material (mesh filters / foamed filters)
- Pore size (1/10 up to 50 µm and 1/5 below 50 µm)



15 µm PET mesh filter



8 µm cellulose nitrate
foamed membrane filter

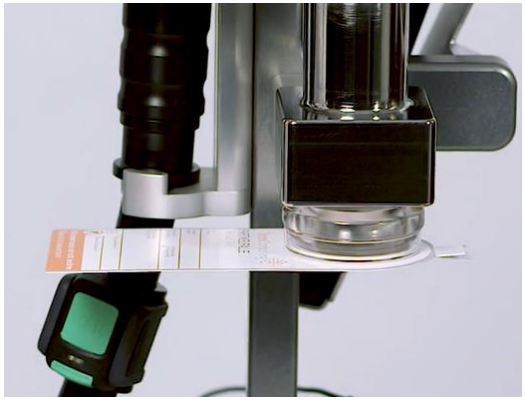
Deposition

Principle

- Extension of the term “deposition” in connection with brush-vacuuming in combination with particle traps & separation of particles onto particle stamps

.

  - The size of the separated particles cannot be controlled as it can via the filter pore size
  - No drying required; particle trap / stamp ready for evaluation without further steps
  - For extraction outside clean-air environments: close the particle trap / stamp immediately after extraction so that no ambient particles settle on it







Questions?

Chat

E-mail



seminar@cleancontrolling.de

Thank you for your attention



