CleanControlling®

Online Basic Seminar
TECHNICAL CLEANLINESS
VDA 19.1 and VDA 19.2



Qualification and Blank Value according to VDA 19 Part 1

Lisa Riese, CleanControlling GmbH

CONTENT

Verification of the extraction method

Blank value in the laboratory

Verification of the rinsing procedure

Recovery of test particles

VERIFICATION OF THE EXTRACTION METHOD

Declining test

Why / Background

- The declining test serves as proof that detachable dirt particles are extracted from the test component as completely as possible (≥ 90%).
- As a rule, the declining test should be performed once for every new component. If changes are made to the component or the production process, the qualification should be repeated.

Procedure declining test

- Determine the appropriate inspection lot size
- Determine the blank value
- Perform the extraction procedure on the test lot using the selected start parameters
  Repeat this step six times on the same test lot
  → one analysis filter is generated per extraction step
- Calculate the ratio of the current extraction step to the sum of all extraction steps
  → The declining test was successful when the criterion ≤10% is reached at least at the 6th extraction step

VERIFICATION OF THE EXTRACTION METHOD

Declining test

Evaluation of the Declining Test

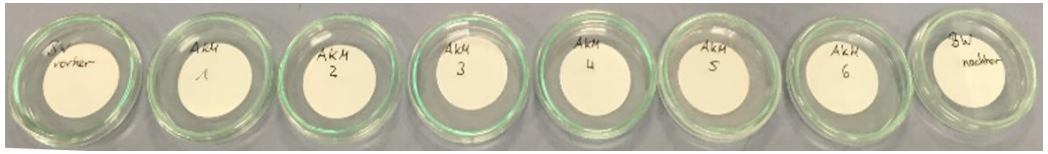
- The same measurement parameters used in the cleanliness specification are evaluated during the declining test (gravimetric and microscopic evaluation).
- If no specification is provided, all metrological quantities that can reasonably be measured are recorded.
- If low residual masses are observed during the declining test, the particle size distribution can be considered instead of gravimetric analysis.
- If additional requirements exist for specific material classes (e.g., hard particles), all detected particles may be considered in the declining test to ensure enough counting events.

VERIFICATION OF THE EXTRACTION METHOD

Declining test

Calculation example

1 Generated Analysis Filters

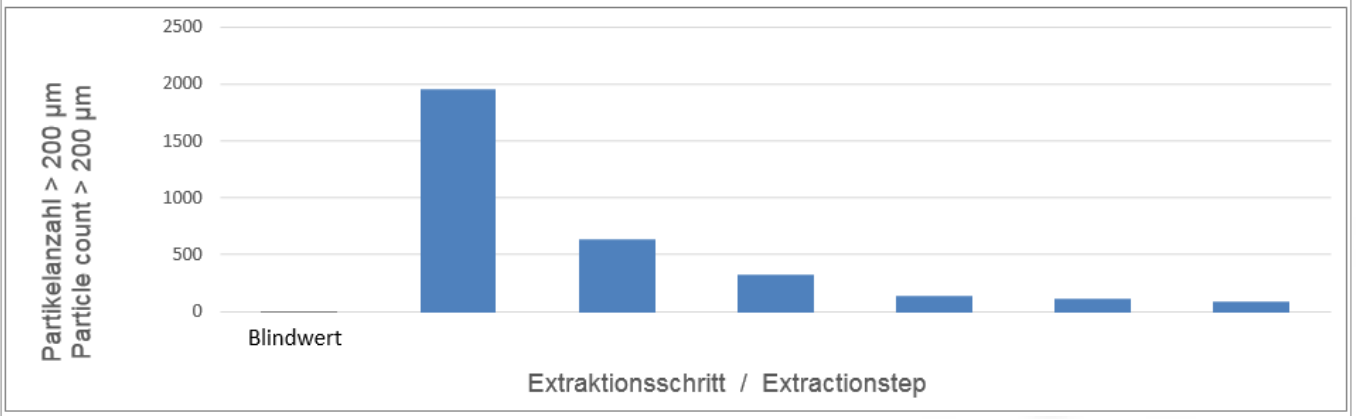


3 Ratio formation / analysis Filter

$$\text{Declining-ratio} = \frac{\text{Number of particles in the current extraction step}}{\text{Detected particle counts over all extraction steps}}$$

2 Representation of the number of particles per extraction step

Partikelgröße (µm) *Particle size [µm]*	Blindwert *Blank value*	Schritt 1 *Step 1*	Schritt 2 *Step 2*	Schritt 3 *Step 3*	Schritt 4 *Step 4*	Schritt 5 *Step 5*	Schritt 6 *Step 6*
200 - 400	8	1466	529	284	134	91	83
400 - 600	0	250	64	23	4	7	9
600 - 1000	0	160	29	9	5	9	2
1000-1500	0	45	12	8	0	1	1
1500-2000	0	11	0	0	0	1	0
2000-3000	0	11	0	0	0	0	0
> 3000	0	4	0	0	0	0	0
Partikelanzahl > 200 µm *Particle count > 200 µm*	8	1947	634	324	143	109	95
Partikelanzahl kumuliert *Particle count accumulated*		1947	2581	2905	3048	3157	3252
Verhältnis [%] *Ratio [%]*		100%	25%	11%	5%	3%	3%



VERIFICATION OF THE EXTRACTION METHOD

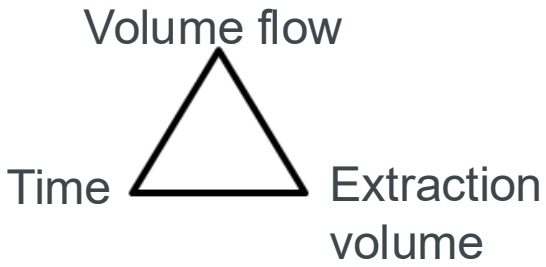
Declining test

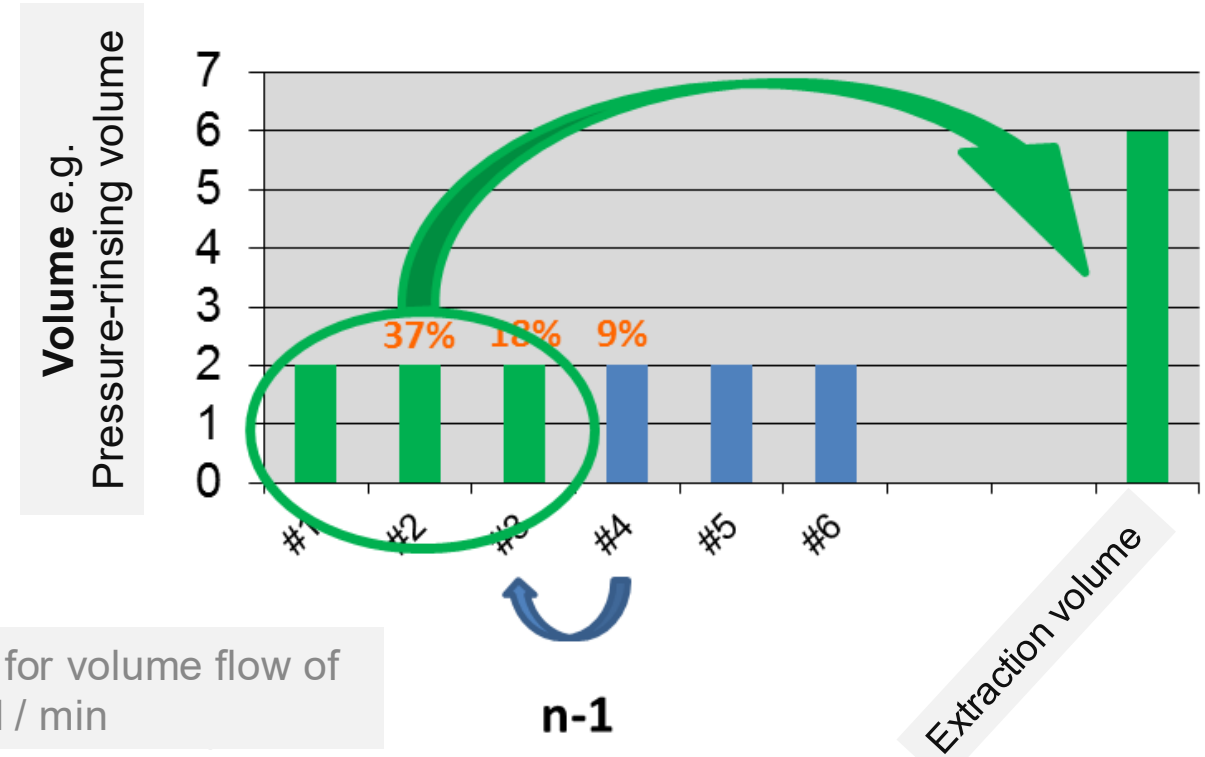
Calculation example

4 Setting the extraction quantity / time

Extraction time = (n-1) x single step

minimum value





i.e., for volume flow of 1,5 l / min

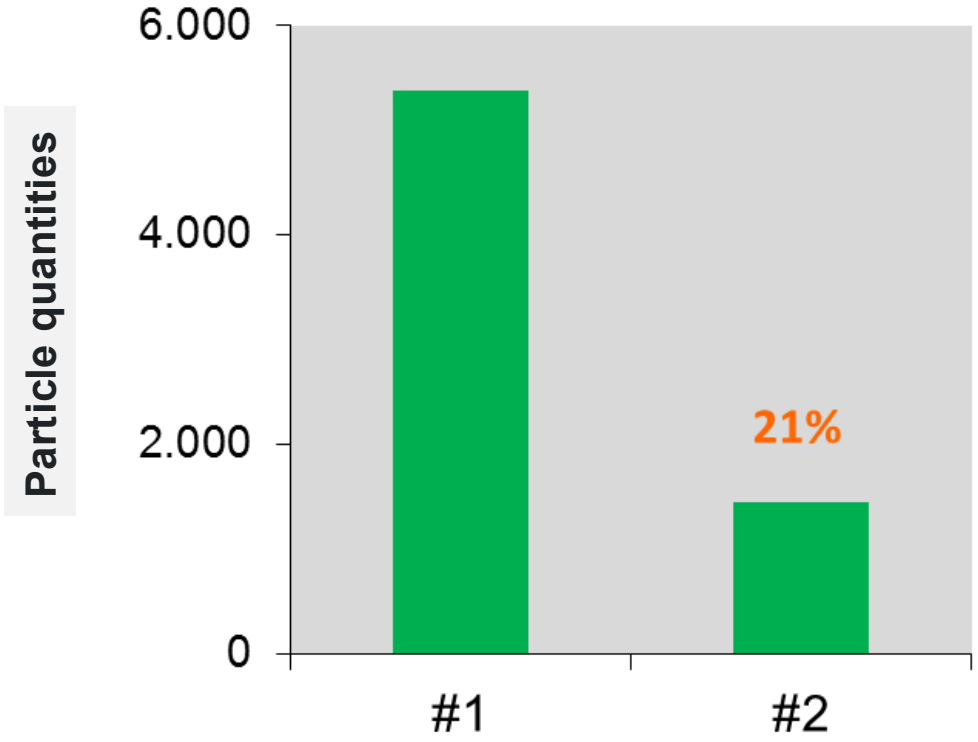
VERIFICATION OF THE EXTRACTION METHOD

Double inspection

Why / Background

- A double inspection can be performed for optional verification of a qualified routine test procedure (e.g. adoption of a testing procedure from another laboratory)

Calculation example



If the second cleanliness value is equal to or less than 30%, then the elaborated test parameters are qualified

CONTENT

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BLANK VALUE IN THE LABORATORY

Blank value definition

Why / Background

- The cleanliness analysis of the component by means of extraction involves the risk that **foreign (i.e., not from the component originating)** particles are included in the analysis result

Particle sources of foreign particles can be

- Extraction medium
- Test equipment (extraction cabinet, filtration unit, …)
- Test environment (room, air, ….)
- Personal
- Abrasion from shift mechanisms, fixtures, plugs

Specifications

- To ensure that the blank value does not have a decisive influence on the test result, it must be determined in a suitable manner.
- The blank value is determined by performing the same procedure as in the routine test, but without the test component (with a shorter duration where applicable)

BLANK VALUE IN THE LABORATORY

Blank value calculation

Maximum permissible blank values

- Particle counts
  - 10% of the permissible number of particles per size class
- Gravimetry
  - 10% of the permissible residue mass
- Particle size without particle counts
  - Calculation example

$$\frac{\text{max. particle size 600 µm}}{2} = 300\ \mu m$$

Size class	Size x [µm]
G	150 ≤ x < 200
H	200 ≤ x < 400
I	400 ≤ x < 600
J	600 ≤ x < 1000
K	1000 ≤ x < 1500
L	1500 ≤ x < 2000
M	2000 ≤ x < 3000
N	3000 ≤ x

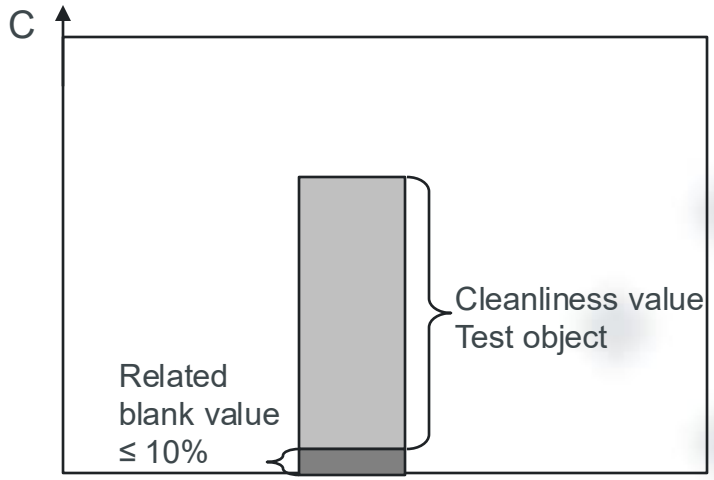
No particles in the classes above H (> 200 µm) allowed

BLANK VALUE IN THE LABORATORY

Blank value calculation

Maximum permissible blank values

- Particle counts
  - 10% of the permissible number of particles per size class
- Gravimetry
  - 10% of the permissible residue mass
- Particle size without particle counts
  - Calculation example
- Without specification
  - 10% of the determined cleanliness value of the test objects



C – Cleanliness value

BLANK VALUE IN THE LABORATORY

Blank value evaluation

Evaluation of blank value influence

- A high blank value increases the risk that a test component will exceed allowable cleanliness limits.
- For very clean components, achieving the required blank value criterion may be difficult or impossible to reach, despite significant effort.

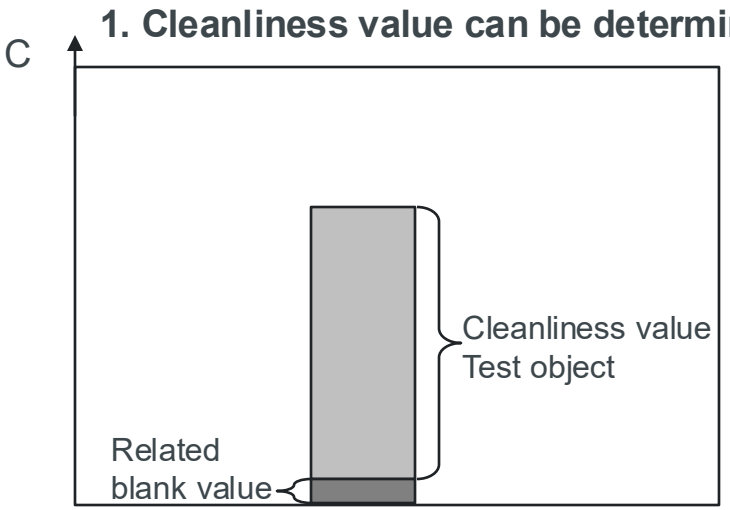
→ Conflict of objectives: Therefore, examples of how to evaluate the test results

BLANK VALUE IN THE LABORATORY

Blank value evaluation

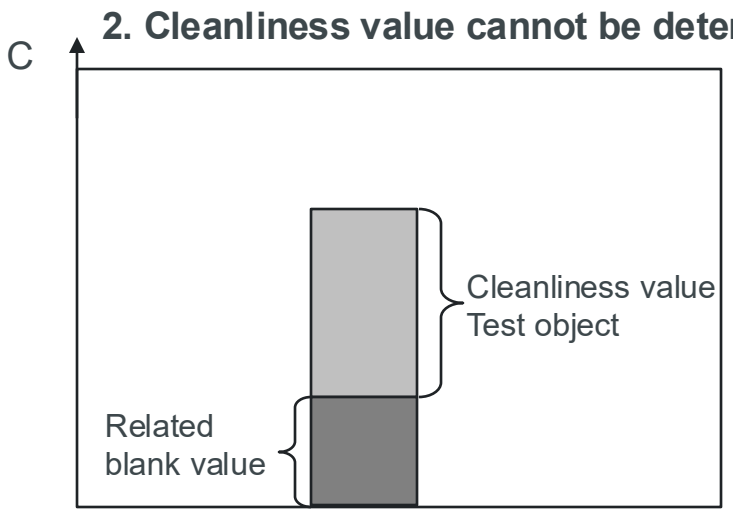
Test <u>without</u> a cleanliness specification (blank value criterion based on determined cleanliness values)

Case 1: Blank value ≤ 10 % okay
Blank value criterion fulfilled



→ A reliable cleanliness value can be determined

Case 2: Blank value > 10 % not okay
Blank value criterion not fulfiled



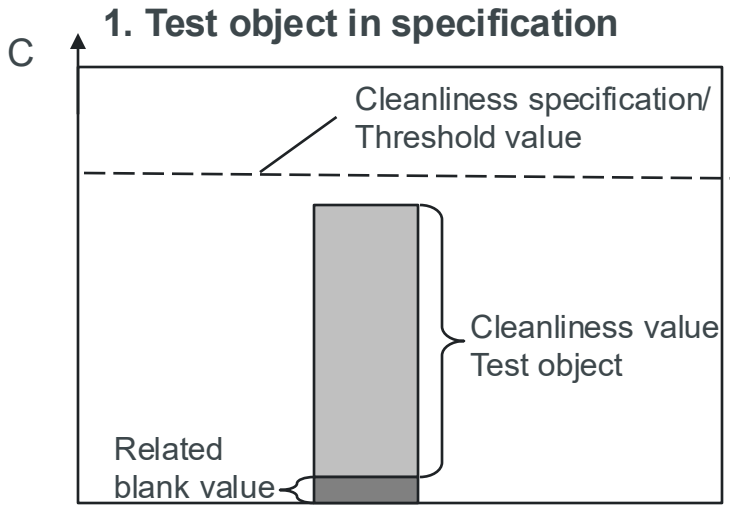
→ No reliable cleanliness value can be determined for the test object
However, it is still possible to estimate compliance with an upper limit (e.g., for very clean components)

BLANK VALUE IN THE LABORATORY

Blank value evaluation

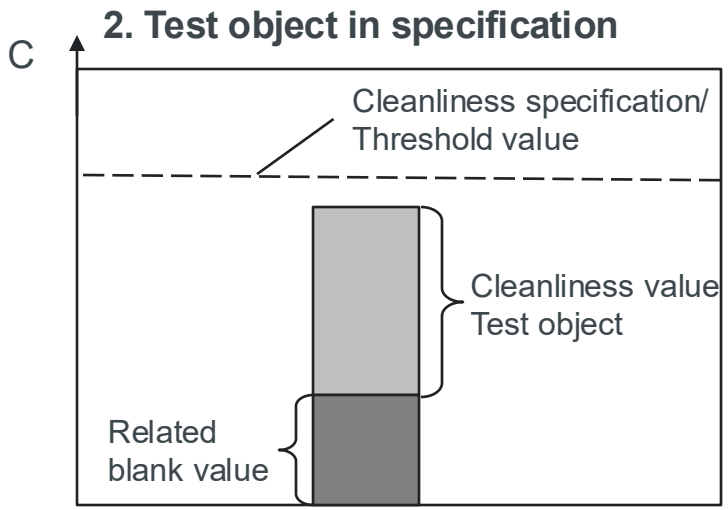
Test <u>with</u> a cleanliness specification (blank value criterion based on the cleanliness specification)

Case 1: Blank value ≤ 10 % okay
Blank value criterion fulfilled



→ A reliable cleanliness value can be determined
Compliance with the specification can be demonstrated

Case 2: Blank value > 10 % not okay
Blank value criterion not fulfilled



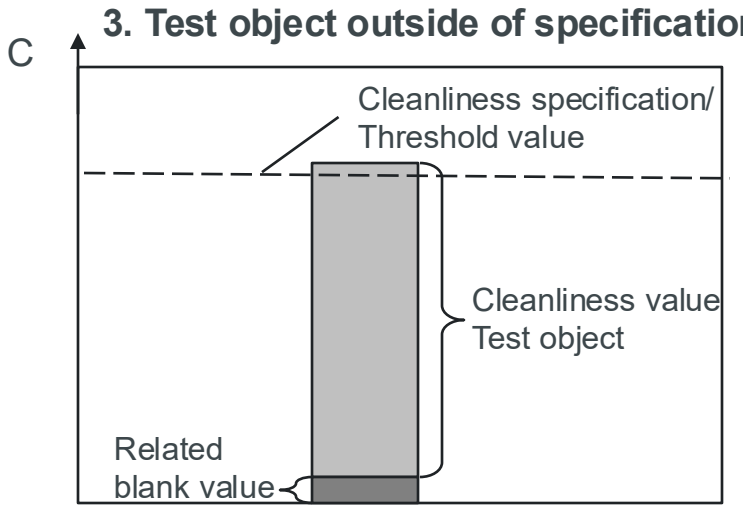
→ No reliable cleanliness value can be determined for the test object
Compliance with the specification can be demonstrated

BLANK VALUE IN THE LABORATORY

Blank value evaluation

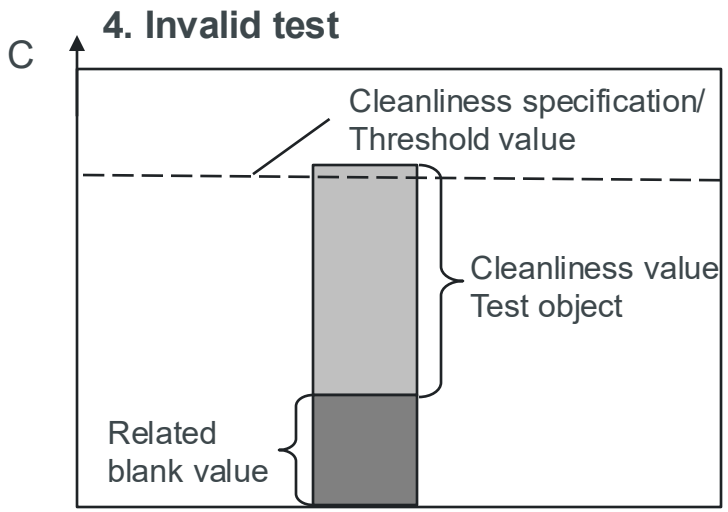
Test <u>with</u> a cleanliness specification (blank value criterion based on the cleanliness specification)

Case 3: Blank value ≤ 10 % okay
Blank value criterion fulfilled



→ A reliable cleanliness value can be determined
Non-compliance with the specification can be demonstrated

Case 4: Blank value > 10 % not okay
Blank value criterion not fulfilled



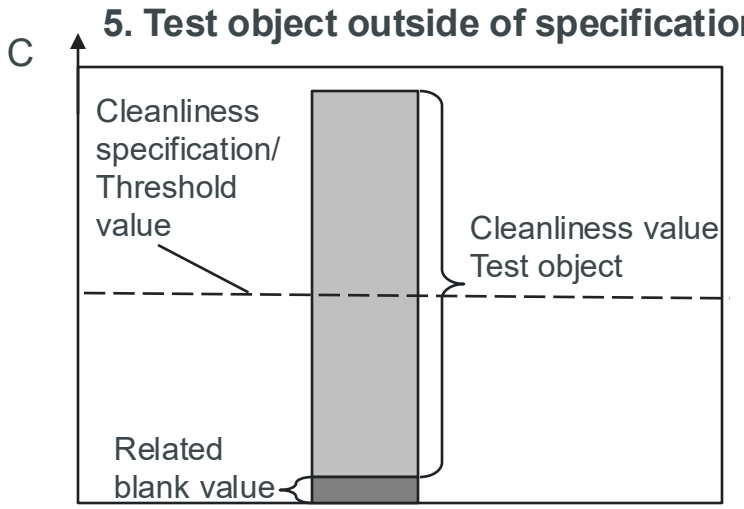
→ No reliable cleanliness value can be determined for the test object
Compliance with the specification cannot be verified

BLANK VALUE IN THE LABORATORY

Blank value evaluation

Test <u>with</u> a cleanliness specification (blank value criterion based on the cleanliness specification)

Case 5: Blank value > 10 % not okay
Blank value criterion not fulfilled



→ A reliable cleanliness value can be determined
(blank value in relation to the measured value <10%)
Non-compliance with the specification can be demonstrated

BLANK VALUE IN THE LABORATORY

Blank value

Specifications

- When combining different cleanliness characteristics (residue mass, particle counts) the blank value criterion must be met for all characteristics.
- It is not permissible to subtract the blank value from the cleanliness analysis result.
- The blank value shall be recorded in the analysis report.

Possible reasons if the criterion is not achieved

- Unsuitable analysis environment
- Adaption of test equipment if necessary (extraction cabinet, filtration unit, …)

CONCLUSION

- To obtain comparable test results, all influencing test parameters must be identical
- The declining test is essential
- The declining test ensures that the extraction method is suitable for the component
- The blank value confirms the quality of the equipment, the environmental conditions and the personnel

CONTENT

- Verification of the extraction method
- Blank value in the laboratory
- Verification of the rinsing procedure
- Recovery of test particles

VERIFICATION OF THE FINAL RINSING PROCEDURE

Final rinsing procedure

Why / Background

- Particle removed during extraction should be transferred completely to the analysis filter
- Verification is carried out by checking the blank value after the first routine test of the component

Procedure für checking the final rinsing procedure

- Prepare the test equipment
- Check blank value
- Perform routine test
- Check blank value again

  → The final rinsing procedure is suitable if the blank value criterion is fulfilled

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RECOVERY OF TEST PARTICLES

Recovery

Why / Background

- Verification that no relevant particles are lost during the cleanliness test
- Recovery shall be demonstrated for each extraction device used (initially by the manufacturer and periodically by the user)
- Recovery can be determined optically or gravimetrically

Procedure for recovery of test particles

- Provide known test particles (by mass or size / number)
- Inject the test particles into the extraction device
- Final rinse the extraction device according to the defined procedure
- Perform filtration, filter removal, filter drying and filter analysis
- Determine recovery rate (number, size or mass of the particles)

  → successful recovery attempt, if ≥ 90 % of the particles are recovered



Standard sample containing particles of a known number and size

QUESTIONS



Do you have any questions!

Chat



E-Mail

seminar@cleancontrolling.de

Thank you for your attention



TECHNISCHE SAUBERKEIT

CleanControlling®

Lisa Riese
Labor
Projektingenieur

CleanControlling GmbH
Niederlassung / Branch Dresden

Lockwitzgrund 100
D-01257 Dresden

Phone +49 7465/929 678-726
Fax +49 7465/929 678-10

l.riese@cleancontrolling.de