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# Enhancing Reliability in Electronics Manufacturing with VDA 19-Qualified Contact Cleaning

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# Executive Summary

Modern electronics manufacturing is facing increased pressure to deliver zero-defect products – especially in sectors such as automotive, aerospace, and medical devices. With up to 75% of PCB defects linked to particulate contamination, effective control of contamination is now a prerequisite for high reliability. In line with this, the German automotive standard **VDA 19** has become a benchmark for technical cleanliness.

This paper introduces **contact cleaning with elastomer rollers** as a newly qualified **VDA 19 Part 1 extraction method**, validated by independent laboratory testing. The paper outlines how this dry, inline-compatible technology not only removes contamination from every PCB, but also provides real-time cleanliness assessment, meets ESD safety requirements, and integrates seamlessly into high-volume SMT assembly lines.



## Tekkie fact:

75% of defects linked to particulate contamination.

## INTRODUCTION

### – A Zero Defect Imperative

With the growing density of electronic assemblies and the widespread adoption of HDI and miniaturised components, the presence of even micron-scale particles can cause functional defects. While many manufacturers clean PCBs during fabrication, contamination is often reintroduced during transport and handling – just before critical assembly steps.

**Technical cleanliness, once a niche quality concern, is now a foundational requirement in electronics manufacturing.**

VDA 19 standards (Part 1 and Part 2) offer a structured methodology for measuring and managing particulate contamination at both component and process levels.

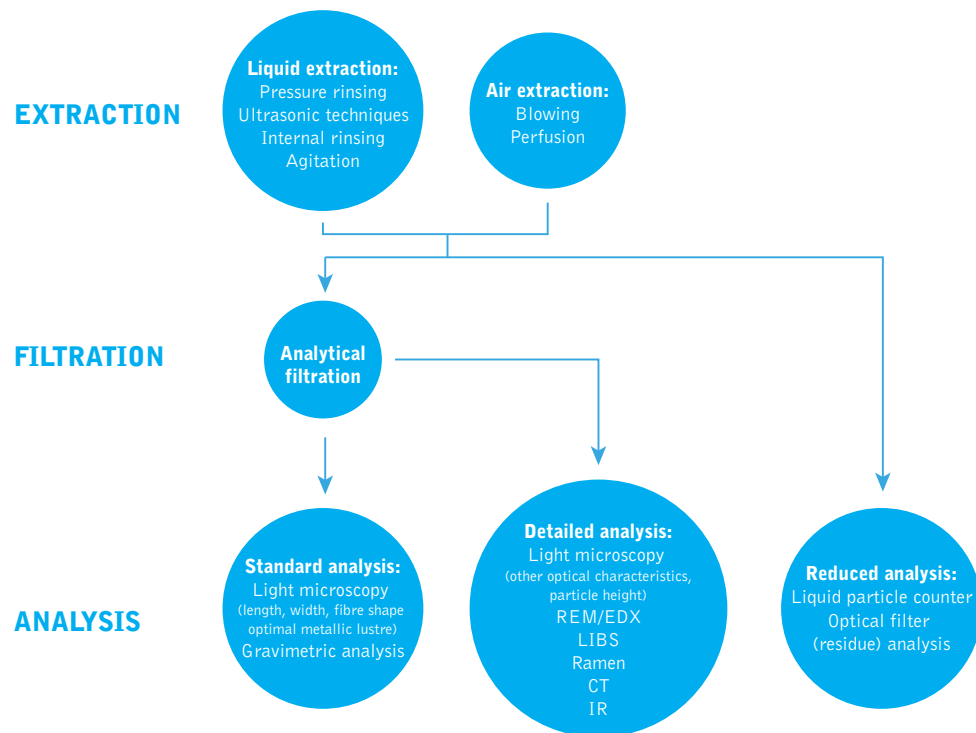


Figure 1 - VDA Part 1 Methodology

## LIMITATIONS OF THE STANDARD

### – VDA 19 Part 1 Method

The VDA 19.1 methodology – based on extraction, filtration, and microscopic analysis – is well suited for benchmarking cleanliness of components like brake lines and hydraulic parts, see figure 1. However, for SMT production environments, it presents several limitations:

#### Sampling only:

Does not guarantee cleanliness of every part.

#### Time-consuming:

Involves multiple steps including solvent use, membrane drying, and skilled microscopic analysis.

#### Off-line testing:

Not suited for real-time monitoring or in-line process integration.

A more practical method was needed – one that could be applied to every part, eliminate hazardous materials, and provide reliable cleanliness data in real time.

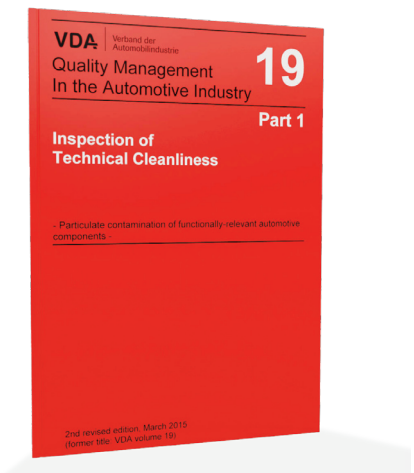


Figure 2 - VDA 19.1 - Inspection of Technical Cleanliness

# CONTACT CLEANING

## – A Qualified VDA 19 Extraction Method

To meet this need, **contact cleaning with elastomer rollers** has now been independently **qualified as a VDA 19 Part 1 extraction method**.

Using a pressure-rinsing setup and calibrated particle contamination, an accredited testing lab validated that elastomer roller extraction meets the VDA requirement for declining particle counts over six test iterations. Results demonstrated that:

1.

Over **90% of particles** were removed in just **two passes**.

2.

Both **microscopic** and **gravimetric** analyses confirmed compliance.

3.

The method is **dry**, residue-free, and does not rely on solvents or vacuum systems.

Test	Initial filter mass (g)	Final filter mass (g)	Total particulate mass (mg)
T1A	0.11315	0.1401	27.0
T1B	0.11326	0.11561	2.4
T1C	0.11311	0.11361	0.5
T1D	0.1133	0.11379	0.5
T1E	0.1128	0.11321	0.4
T1F	0.11307	0.11342	0.4

Table 2 - Gravimetric results from six tests

Particle and Fibre size (µm)	5–15	15–25	25–50	50–100	100–150	150–200	200–400	400–600	600–1000	>=1000	%Extraction >5µm
1A	118510	78551	101972	58970	25899	6513	840	6	2	1	100
1B	59465	31231	8552	366	20	13	10	3	2	0	20.3
1C	5853	2076	339	25	5	6	9	1	2	3	1.7
1D	3552	1231	275	30	5	3	9	1	0	0	1.0
1E	1267	465	141	25	2	3	1	4	1	1	0.4
1F	661	266	53	8	2	2	1	2	1	1	0.2

Table 1 - Particle counts from the six tests

This qualification allows contact cleaning systems to be used not just for physical cleaning, but also as a **quantitative assessment tool** for technical cleanliness.

## TECHNICAL CLEANLINESS IN ACTION – SMT Integration

The qualified contact cleaning system can be installed directly before the solder paste printing step – where over 60% of SMT defects occur. In this position, it delivers:

- **Real-time contamination removal**
- **Visual feedback** via adhesive capture sheets
- **Full compliance** with ANSI/ESD S20.20 (static dissipative components)
- **Improved process stability** through consistent cleaning across all boards

These sheets can be archived, overlaminated, and analysed per VDA 19 protocols, enabling traceable quality data without the need for specialised labs or solvent handling.

## EXTENDING CLEANLINESS MONITORING – VDA 19 Part 2 Compliance

Beyond cleaning individual parts, VDA 19 Part 2 emphasises the need to assess the entire manufacturing environment. Using a handheld contact cleaning unit, Teknek has developed a **Contamination Assessment Protocol** that enables auditing of environmental surfaces (e.g. conveyors, cabinets, floors) across the assembly line.

By capturing and analysing particles with the same adhesive sheet system, manufacturers can create a **contamination heat map** that:

- Identifies high-risk zones
- Validates process improvements
- Tracks the source and type of particulates

This approach offers a valuable, **non-disruptive tool** for facilities not operating in cleanroom conditions, helping close the gap between process control and real-world contamination behavior.

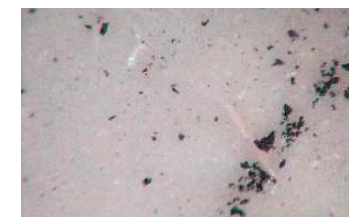


Figure 3 - Particle Capture Sheet from top of cabinet



Figure 4 - Particle Capture Sheet from under conveyor

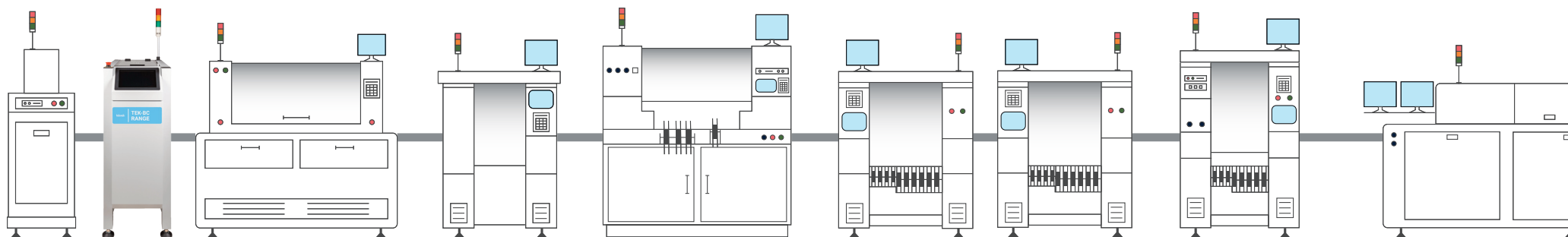


Figure 5 - Tek-BC at the start of the line



## MEASURABLE IMPACT – Real-World Results

A European EMS facility reported a significant reduction in SMT defects after implementing a qualified contact cleaning system. Key benefits observed included:

- Increased first-pass yield
- Reduced field returns and rework
- More consistent soldering performance

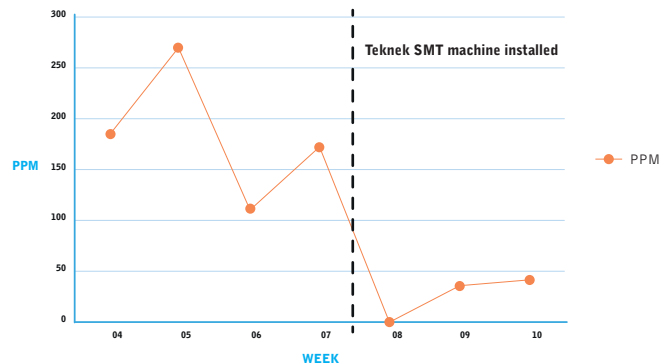


Figure 6 - Defect Reduction

Such results highlight the potential of this method to contribute directly to **Zero Defect Manufacturing**, especially in environments with tight process margins and escalating quality expectations.

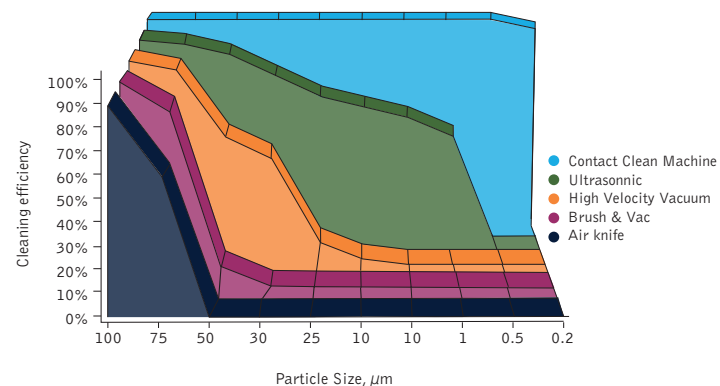
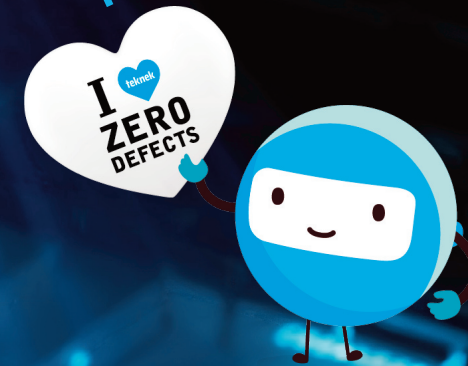


Figure 7 - Efficiency of Different Particle Removal Methods

### Tekkie fact:

Most effective at removing small particles down to nanometer size.





## CONCLUSION

Contact cleaning, now independently validated under VDA 19 Part 1 as particle extraction technology, offers manufacturers a practical and proven path to achieving technical cleanliness in PCB assembly. It combines:

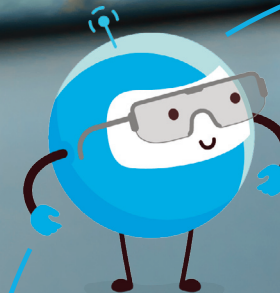
- **High-efficiency particle removal**
- **Real-time process integration**
- **Quantitative cleanliness assessment**
- **Sustainability and safety benefits (no solvents or heat drying)**

By leveraging this technology, manufacturers can reduce defects, improve reliability, and align with the latest industry cleanliness standards – without compromising speed, scalability, or cost-effectiveness.

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## About the Author

Sheila Hamilton is a technical expert in contamination control at Teknek, with a focus on applying contact cleaning solutions to high-reliability electronics manufacturing. She contributes regularly to industry discussions on technical cleanliness and Zero Defect strategies.



### Tekkie fact:

Contact Cleaning is now a validated contamination removal technology under VDA 19.1

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