



IMPACT OF RINSING AND DRYING in PCBA CLEANING PROCESS

How is important the process of rinsing and drying after PCBA cleaning?



WHO IS THE CUSTOMER?

Electronics designers, whose goal is to clean PCBAs in a small amount in a laboratory environment. Then, they provide the SMT manufacturers with the most suitable production process data including the proper cleaning process.

Electronics Designers → **Process Data** → **Electronics Manufacturers** → **PCBA**



WHAT IS THE CUSTOMER'S STORY?

The developers used to clean PCBAs with IPA, which is an inappropriate solution. IPA is flammable and ineffective for cleaning of modern soldering materials.

The developers searched on Google for better cleaning solutions and discovered our company. We analyzed their cleaning needs and demonstrated the effective and affordable cleaning methods for the R&D purposes.



WHAT WE TESTED?

Our laboratory specialists tested the cleaning of PCBAs polluted by soldering material in a **tabletop ultrasonic cleaner**. For comparison, we provided the customer with the cleaning of PCBs after soldering in a fully automatic cleaning system **InJet® 388 CRD** with Spray-In-Air technology.

Type of Solder Paste:

No-clean Solder Paste **SSA48-M955**



COMPLETE CLEANING SOLUTION BY DCT

A

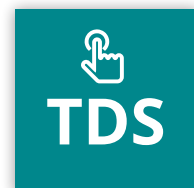
Companies with small-volume production of electronics:

→ Water-based cleaning agent **Decotron® 356S**



→ Tabletop ultrasonic cleaning machine

→ **DI Water**



B

SMT providers with larger production of electronics:

→ Water-based cleaning agent **Decotron® CP381**



→ **InJet® series** with vertical highpressure Spray-In-Air technology and rinsing with external filtration



→ DI Water

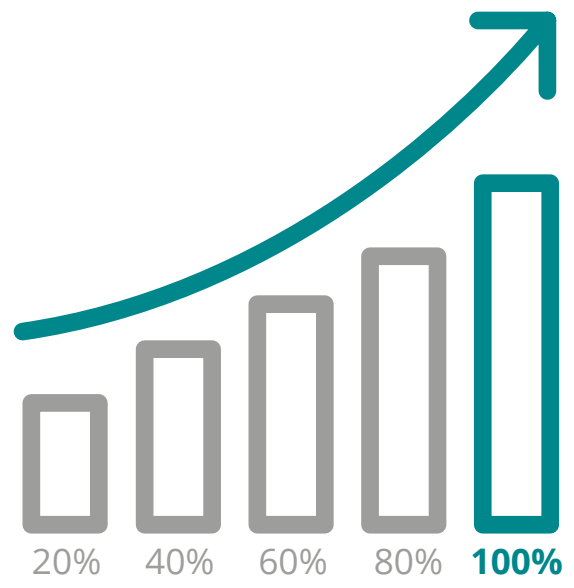


TESTING OF DIFFERENT CLEANING PROCESSES

We tested the cleanliness of PCBAs in our **Rose Tester**, which is a measuring device for the detection of the ionic contamination according to **IPC-TM-650, 2.3.25.**

We tested contamination of:

1. Uncleaned PCBA
2. PCBA cleaned in a tabletop ultrasonic cleaner with one rinsing and one drying by an air gun
3. PCBA cleaned in a tabletop ultrasonic cleaner with three rinsings and three dryings by an air gun
4. PCBA cleaned in a fully automatic cleaning system InJet® 388 CRD with an external filtration



1

TESTING RESULTS

(ROSE TESTER)

Uncleaned PCBA
had result **2,263 $\mu\text{g NaCl/cm}^2$** .



The limit for ionic cleanliness set by the IPC organization is **1,560 $\mu\text{g NaCl/cm}^2$** .

Test is compliant with standard IPC-TM-650, 2.3.25., revision D.

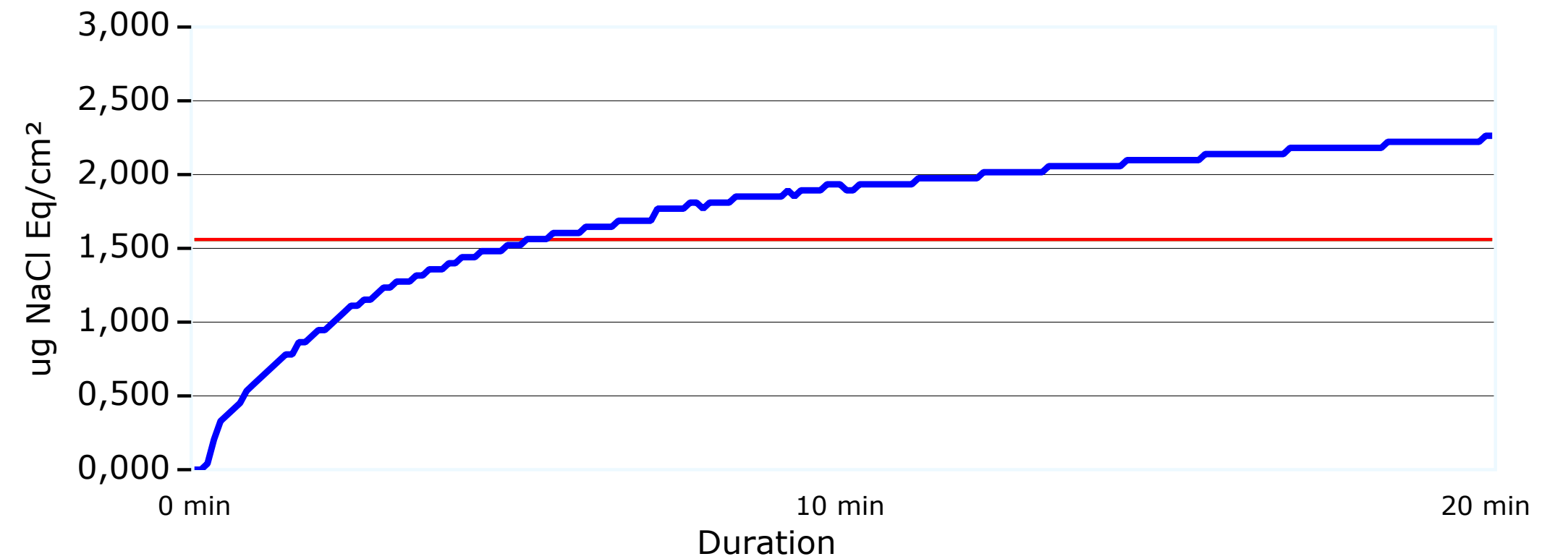
Setup:

Test name:	VELZA	Duration (min):	20
PCB part name:	XCU	Fluid type (IPA/DI water):	75/25
PCB length (cm):	11,0	Fluid temperature (°C):	21,1
PCB width (cm):	10,5	Baseline conductivity (uS/cm ²):	<0.062
PCB Surface area (cm ²):	231	Conductivity cell sensitivity (uS/cm ²):	0.0001
		ROSE SN.:	ROSE-01_v3.6

Test Status: FAULT

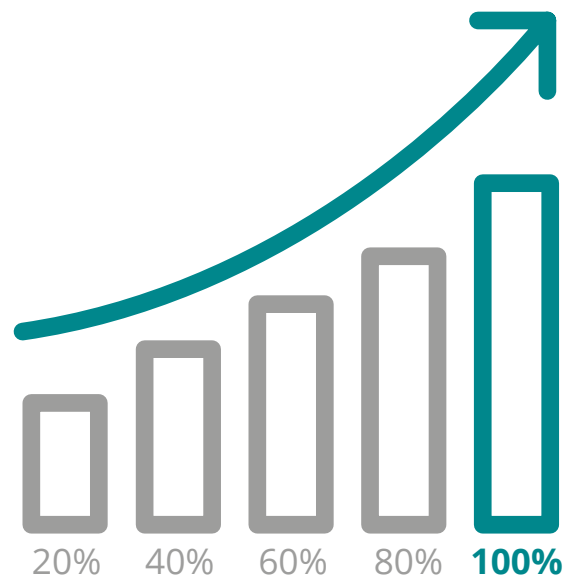
Limit ($\mu\text{gNaCl/cm}^2$): 1,560
Result ($\mu\text{g NaCl/cm}^2$): 2,263

Contamination vs. Time



Legend:

- IPC limit of ionic contamination
- Limit of ionic contamination
- Measured ionic contamination



2

TESTING RESULTS

(ROSE TESTER)

PCBA cleaned in tabletop ultrasonic cleaner with just one rinsing and one drying by air-gun had result **3,58 $\mu\text{g NaCl/cm}^2$.**



The result were worse than the result of uncleaned PCBA.
The high contamination was caused by insufficient rinsing and drying.



2

The cleaning process was following:

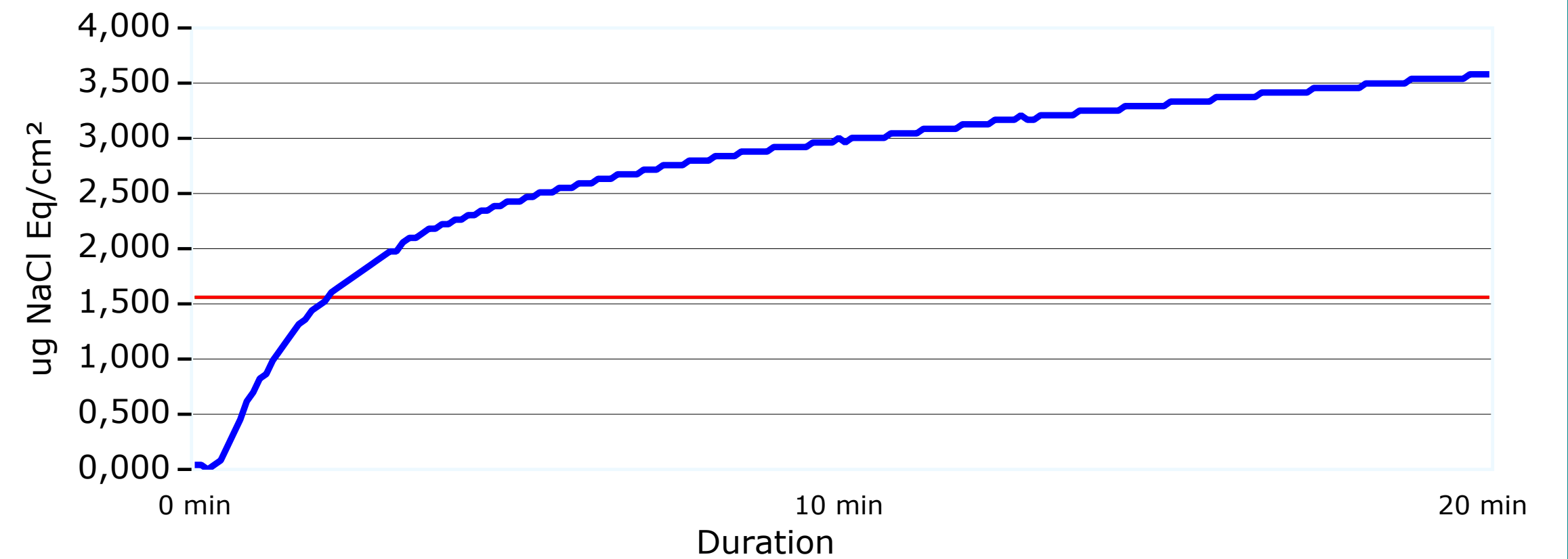
Cleaning: tabletop ultrasonic cleaner
12 minutes / 50 °C / **Decotron® 356S**

Rinsing: DI Water




Drying: hand drying by air gun

Test Status: FAULT
Limit (ugNaCl/cm²): 1,560
Result (ug NaCl/cm²): 3,58

Contamination vs. Time

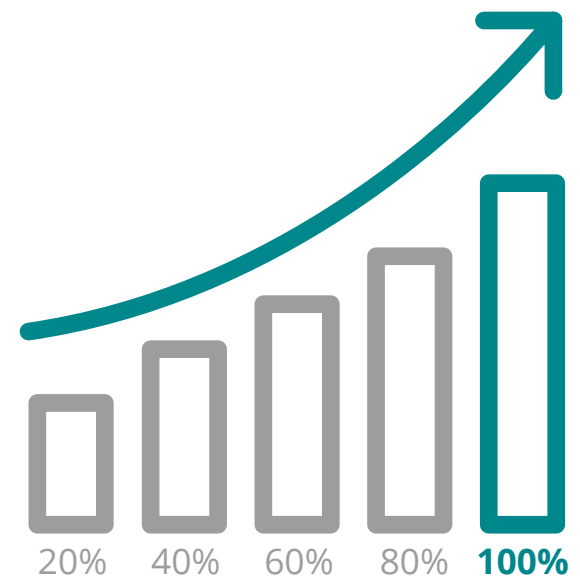


Legend:

-  IPC limit of ionic contamination
-  Limit of ionic contamination
-  Measured ionic contamination



To achieve better results we performed another test with additional rinsing and drying steps.



3 TESTING RESULTS (ROSTE TESTER)

PCBA cleaned in a tabletop ultrasonic cleaner with three-step rinsing and air-gun drying had result **0,864 $\mu\text{g NaCl}/\text{cm}^2$** .



The result was satisfying.



3

The cleaning process was following:

Cleaning: tabletop ultrasonic cleaner
12 minutes / 50° / **Decotron 356S**

1st Rinsing: DI Water

1st Drying: hand drying - air gun

2nd Rinsing: DI Water

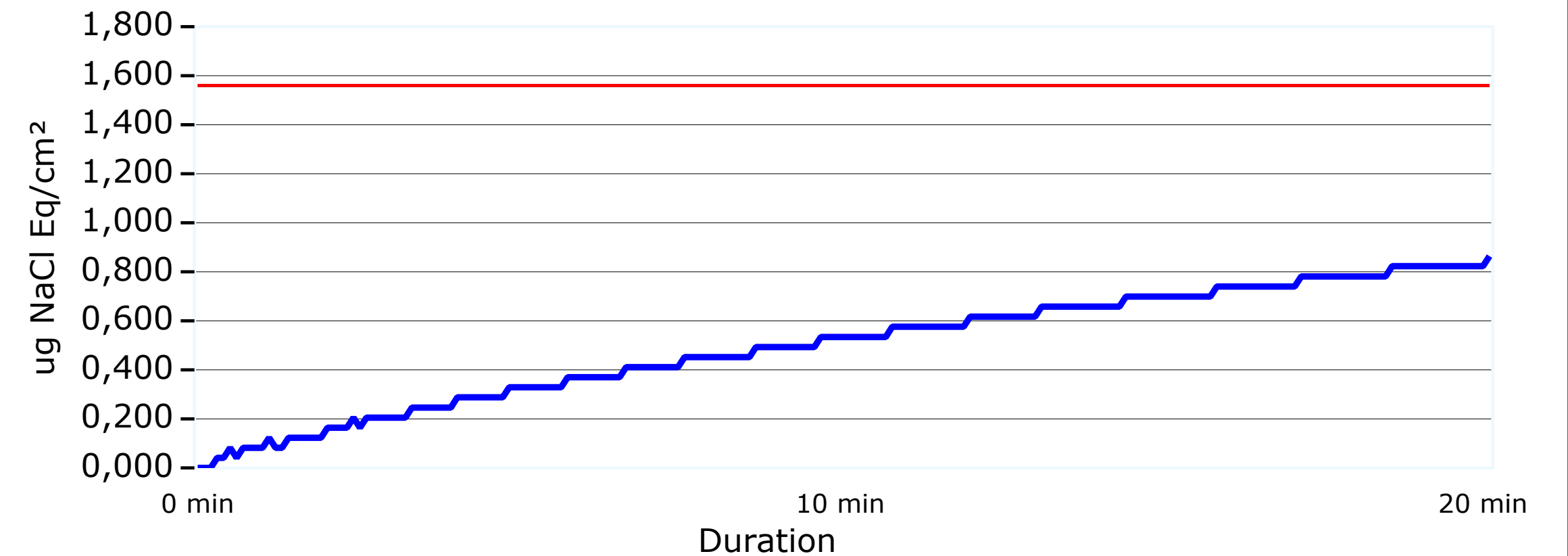
2nd Drying: hand drying - air gun

3rd Rinsing: DI Water

3rd Drying: final hand drying – air gun

Test Status: PASS
Limit (ugNaCl/cm²): 1,560
Result (ug NaCl/cm²): 0,864

Contamination vs. Time

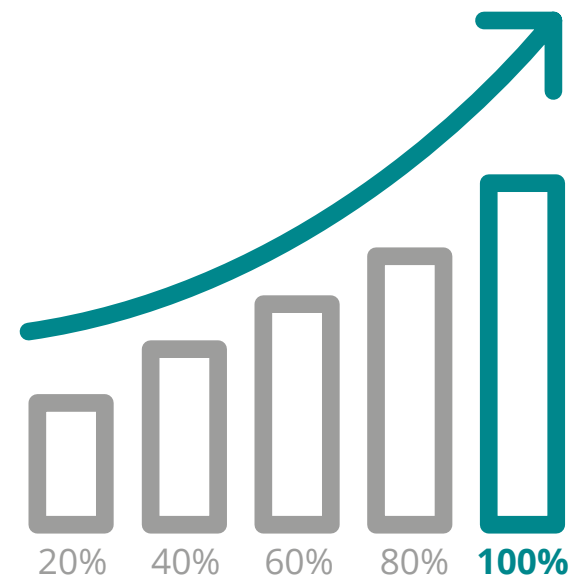


Legend:

- IPC limit of ionic contamination
- Limit of ionic contamination
- Measuered ionic contamination



The cleaning time, temperature, and cleaning agent remained the same as in the test n. 2, but with additional rinsing and drying steps.



4

TESTING RESULTS

(ROSTE TESTER)

PCBA cleaned in cleaning system InJet® 388 CRD with an external DI water filtration had result **0,493 µg NaCl/cm².**



We cleaned the PCBA with same contamination in our fully automatic cleaning system **InJet® 388 CRD**. The result was the best in comparison with other cleaning processes.



4

The cleaning process was following:

Cleaning system: **InJet® 388 CRD**

Technology:

Vertical high-pressure Spray-In-Air + external filtration of DI water

Cleaning:

12 minutes / 50 °C / **Decotron® CP381**

Rinsing:

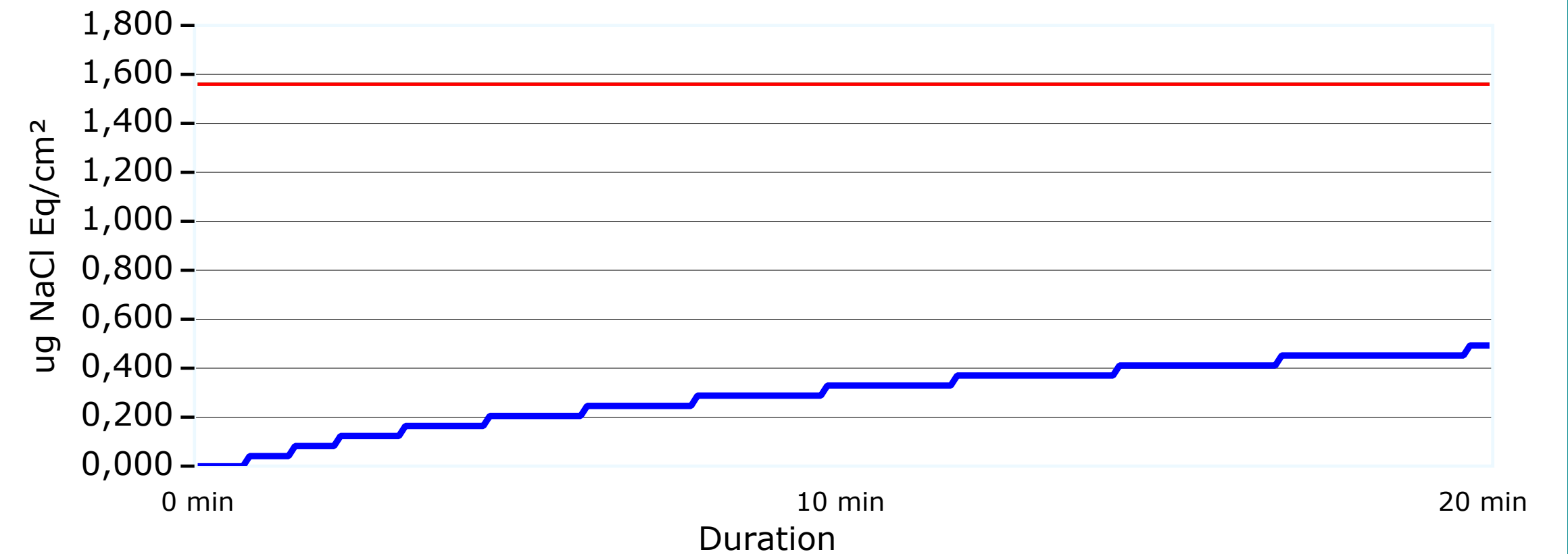
8 min / DI water / 1-3 µS

Drying:

10 min / hot air

Test Status: **PASS**
Limit (ugNaCl/cm²): **1,560**
Result (ug NaCl/cm²): **0,493**

Contamination vs. Time



Legend:

- IPC limit of ionic contamination (Red line)
- Limit of ionic contamination (Green line)
- Measured ionic contamination (Blue line)



RECOMMENDED CLEANING PROCESS

Based on the previous ionic contamination tests, we can recommend two cleaning processes addressing your specific cleaning requirements.

1 The best PCBA cleaning results:

- **Cleaning system:** InJet[®] 388 CRD
- **Technology:** vertical high-pressure Spray-In-Air
+ external filtration of DI water
- **Cleaning:** Decotron[®] CP381 / 12 min / 50 °C
- **Rinsing:** 8 min / DI water / 1–3 µS
- **Drying:** 10 min / hot air

2 Satisfying PCBA cleaning results (laboratory environment):

- **Cleaning:** tabletop ultrasonic cleaner
12 minutes / 50 °C / **Decotron® 356S**
- **1st Rinsing:** DI Water
- **1st Drying:** hand drying - air gun
- **2nd Rinsing:** DI Water
- **2nd Drying:** hand drying - air gun
- **3rd Rinsing:** DI Water
- **3rd Drying:** final hand drying – air gun



RECOMMENDED CLEANING AGENT

LABORATORY ENVIRONMENT

Decotron® 356S

- Water-based cleaning agent
- Removes flux residues from PCBAs
- Intended for clean and no-clean lead or lead-free solder pastes
- Determined for ultrasonic cleaning systems
- Works well in InJet® 388 series as well
- Ecologic – RoHS and REACH compliant, biodegradable, does not contain any halogenated compounds



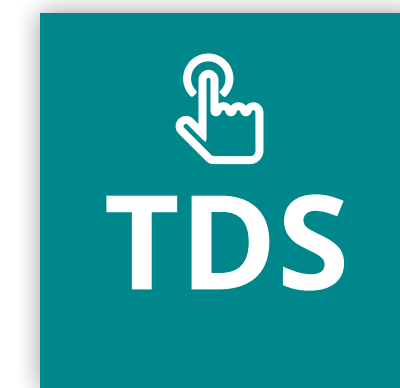


RECOMMENDED CLEANING AGENT

FULLY AUTOMATIC CLEANING PROCESSES

Decotron® CP381

- Water-based cleaning agent
- Removes flux residues from PCBAs
- Can be used for cleaning of misprints
- Intended for clean and no-clean lead and lead-free solder pastes
- Suitable for all types of cleaning machines
- Determined mainly for the high-pressure Spray-In-Air cleaning systems
- Ecologic – RoHS and REACH compliant, biodegradable, does not contain any halogenated compounds

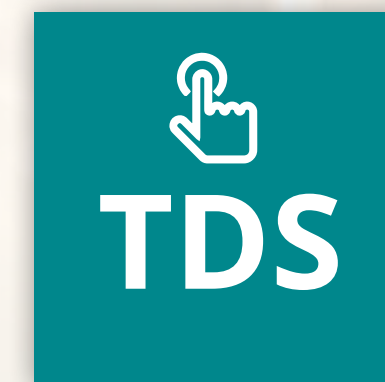


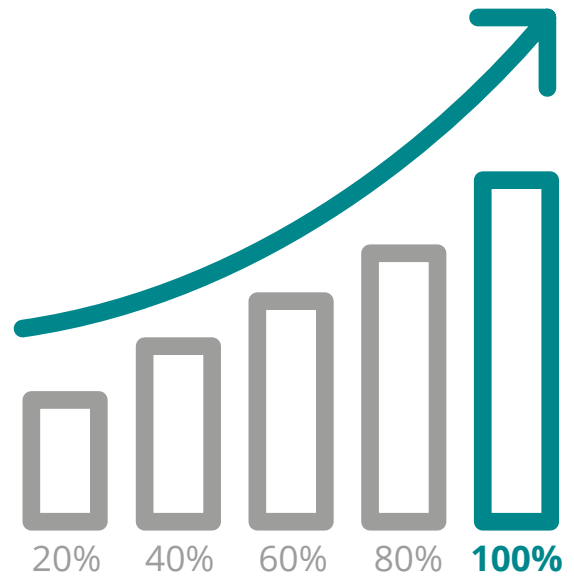


RECOMMENDED CLEANING SYSTEM

InJet® 388 CRD

with vertical high-pressure
Spray-In-Air technology
+ external filtration of DI water





RESULTS OF TESTING

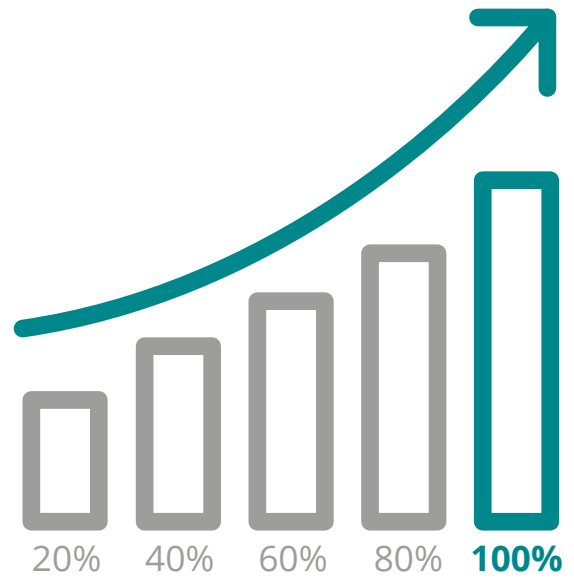
Success rate: 100%

Cleaning tests comparing PCBA cleaning in a laboratory tabletop ultrasonic cleaner with additional rinsing and hand-drying and in fully automatic cleaning system were performed.

Based on the testing results, it can be concluded **it is possible to clean PCBA in the laboratory environment** in a tabletop ultrasonic cleaner to achieve **satisfying cleaning results.**

It is important to understand the **cleaning process is complex.** All steps - cleaning with suitable chemistry, rinsing with high quality DI water, and drying, has to be done properly.

No-clean soldering materials must be either 100% cleaned, or it is better not to clean them at all.



ROSE TESTER RESULTS (Ionic cleanliness)

Uncleaned PCBA

2,263 $\mu\text{g NaCl/cm}^2$

PCBA ultrasonic cleaner - bad results

3,58 $\mu\text{g NaCl/cm}^2$

PCBA ultrasonic cleaner - good results

0,864 $\mu\text{g NaCl/cm}^2$

PCBA automatic cleaning system - good results

0,493 $\mu\text{g NaCl/cm}^2$