kolb information

The best quality and most economically rinsing process / 1

According to IPC, the requirements for a cleaned PCB assembly are for an ion contamination of 1.56 µg NaCl eq/m2, based on ROL0 and ROL1 flux. Modern flux systems cause a much lower ion contamination (0.1-0.4 µg NaCl eq/cm^2). The current market requirements regarding residual ion contamination levels for a cleaned assembly are typically <1 to 0.6 µg NaCl eq/cm^2. Even smaller values can be achieved.

The ion contamination value of a cleaned PCB assembly is essentially dependent on the process steps and the quality of the overall cleaning process. An important step in the entire cleaning process is the rinsing process. In addition to the technical / mechanical components, the water quality used in this several rinsing stages is of importance. **kolb** cleaning systems can provide and process a rinse water with an electrical conductivity of 0 µS/cm, i.e. rinse water with very low ion contamination! Nonetheless:

Rinse water with a conductivity of 0 µS/cm is not necessarily the optimal solution in terms of quality and economy!

Extensive tests and series of measurements by **kolb**-process engineering especially during rinsing in **kolb** PCB cleaning systems have led to the following result:

Clear rinsing with de-ionized, fully demineralized (DI / DM) water with a conductivity of 5 to 30 µS/cm, or with values up to approx. 80 µS/cm, provides no change in the measurement of residual ion contamination, compared to clear rinsing with rinse water that has a conductivity of 0 µS/cm.

The technology used by **kolb** cleaning systems has an influence on the result of the series of measurements. On the one hand, residues of contaminated detergent and rinsing liquid are already thoroughly removed by the MediumWipe® function between the individual process steps. On the other hand, the cascading rinsing stage technology of pre-rinsing, rinsing and clear-rinsing ensures optimal result, in particular in the cost / benefit ratio as well as concerning the quality of the surfaces.

This means with regard to **kolb** processes* there is a qualified confirmation that the quality of the rinsing stages, in particular the clear-rinsing stage with DI- / DM-water behaves in an exponential ratio to the results of the ion contamination.

This means that the correlation, the lower the conductivity of the rinse water, the lower the residual ion contamination after rinsing, only occurs significantly beyond a value of 80 µS/cm. Simply stated:

- Up to a value of 30 µS/cm, there is no change in the measurement result compared to DI / DM water with 0 µS/cm.
- Up to a value of 80 µS/cm, there is very little change in the measurement result compared to DI / DM water with 0 µS/cm.
- From a value of 110 µS/cm, there is a clear correlation between the conductivity of the rinsing water and the amount of residual on contamination.

Accordingly, **kolb** recommends the following conductivity settings for the DI- / DM-clear-rinse water:

- **5 - 30 µS/cm for critical PCB assemblies**
- **up to 50 µS/cm for standard PCB assemblies**
- **> 50 to 80 µS/cm after consulting / test**

The adjustment to these conductivity offers the following advantages:

1. **Avoidance of osmotic stains on built-in metals of the assembly**
   (0 - 5 µS/cm / osmosis water often leads to a reaction (osmotic effect) on the built-in metals on the circuit board, since pure water (osmosis water) always endeavors to enrich itself with other substances, i.e. dissolve them in itself. This can e.g. lead to discoloration or stains on metal surfaces.

2. **Reduction of operating costs**
   No use of foam regulators necessary (The disuse also has a positive influence on the surface tension of the cleaning material)
   For the 3rd rinse stage (clear-rinsing) a DI- / DM-water quality with a conductivity of 5 - 30 / to 80 µS/cm is used.
   - Cost savings for the treatment of DI- / DM-water due to longer service life of the mixed bed resin / filter cartridges
   - The machine uptime is higher because the water treatment time is shorter

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Additional information:

Cascaded rinsing

Rinsing stages 1 and 2 (Pre-rinsing, rinsing)

- Use of a water quality provided by the customer with a conductivity of >350 µS/cm (10° dH) (= low surface tension). surface tension) or a (if necessary treated) city / tap water with this conductivity.
- The main task of the pre-rinse and rinsing process is to rinse off the remaining cleaning medium respectively the pre-rinse water with the absorbed contaminants. (Multiple rinsing with small amounts of water is more efficient than a single flush with a large volume of water.)
- Influences: Soft water / normal city water has a low surface tension and therefore the advantage of better creep and thus better rinsing properties compared to DI- / DM-water.

Rinsing stage 3 (Clear-rinsing with DI- / DM-water)

- Use of DI-/ DM-water with a conductivity setting between 5 and 30 µS/cm.
- The main task of the clear-rinsing process is to minimize the electrical conductivity of the assembly surface in such a way that the desired / required value of ion contamination - µg NaCl eq/cm^2 - is achieved.
- Influences: The adjustment of the clear-rinse water conductivity (e.g. 5 to 30 µS/cm) in the cleaning system is exponentially related to the result of the ion contamination measurement.

Water qualities

City water, tap water: (on site provided inlet water quality with a conductivity of < 350 µS/cm (10° dH)

- Advantage: Lower surface tension than DI- / DM-water and thus better creeping / rinsing properties. City water with a conductivity of approx. 140 - 300 µS/cm is optimally suited for pre-rinsing and rinsing.
- Advantage: Lower tendency to foaming - therefore requires little to no use of foam regulators.
- Disadvantage: Above a value of > 400 / 800 µS/cm, city water can form lime stains / deposits and is therefore not suitable for pre-rinsing and rinsing of sensitive parts.
- Info: If required, the necessary on-site inlet water quality can alternatively be produced in the system with the **kolb** option "decalcification". realized by means of a mixed bed ion exchanger, which provides the desired decarborization via a system.

DI- / DM- water (at avalue ofn 0 - 5 µS/cm)

- Advantage: Perfect for rinsing electronic assemblies.
- Disadvantage: Higher surface tension than city / soft water and thus worse creep properties.
- Disadvantage: 5 -10-fold foaming tendency towards city / soft water.

Measuring system

The measuring systems used by **kolb** in relevant processes in this context usually measure the value in µS/cm. Here the electrical resistance between two electrodes is measured. The measured value is additionally temperature compensated and is converted into µS/cm and displayed in the evaluation unit. Likewise, the water hardness, within the scope of its process relevance, can be determined in a ratio of dH to µS/cm via this measuring system and be used for process monitoring.

The measuring probe is mounted in the respective tank. This position is chosen because it can record multiple data for several process stages there. - the measuring unit must be maintained according to the system specifications.

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Definitions:

Electrical conductivity in aqueous solutions

The electrical conductivity of a solution is defined as the ability of this solution to carry electrical current. The electrical conductivity is generally measured in micro-Siemens. In aqueous solutions, the conductivity behaves in a logarithmic ascending curve to the concentration of dissolved solids (salts) or their ions. Means, the more salts (ions) a medium transports in dissolved form, the higher its conductivity.
The reciprocal of the electrical conductivity (S/m) gives the resistivity (Ω* m).

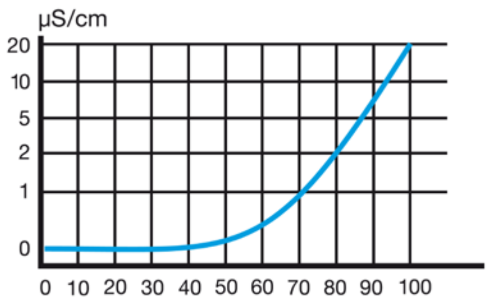
Water hardness

Water hardness is a term system of applied chemistry, due to the content of calcium and magnesium salts (so-called hardness). When determining the water hardness, the sum of all salts is recorded. The higher the dissolved salt content, the harder the water. The water hardness is responsible for calcification, clogging of pipes and for the formation of insoluble compounds such as lime and lime soap.

Water hardness and conductivity			
mmol/l	°dH	hardness	µs/cm
0 - 0,71	0 - 4	very soft	0 - 140
0,71 - 1,6	4 - 9	soft	140 - 300
1,6 - 2,67	9 - 15	light hard	300 - 500
2,67 - 3,39	15 - 19	moderately hard	500 - 640
3,39 - 4,46	19 - 25	hard	640 - 840
> 4,46	> 25	very hard	> 840

***Please note:** The results and data presented in this paper refer exclusively to processes in which **kolb** detergents are used in **kolb** cleaning systems. The use of **kolb** detergents in systems from other manufacturers or detergents from other manufacturers in **kolb** cleaning systems can lead to changed requirements for the rinsing process and thus to a necessary adjustment of the rinse water quality.

Mixed bed resin desalting performance to conductivity



ca. 100% under 20 µS/cm	ca. 90% under 10 µS/cm
ca. 70% under 1 µS/cm	ca. 50% under 0,2 µS/cm

Decarbonization

Decarbonization refers to water treatment processes in which - in order to reduce water hardness - the carbonate hardness (temporary hardness) is reduced or eliminated, but not the permanent hardness of the water. Water with too high a carbonate hardness is, without prior treatment, not well suited for use as process water for rinsing or similar applications. Rinsing water with a value >10 dH leads, among other things, to the visual formation of lime spots, precipitation of calcium carbonate, which is generally undesirable on a cleaned material.
In addition, a too high dH value can also attack the surfaces in the cleaning system, which often leads to damage / deposits in pipe systems, in tanks or in process chambers. Therefore, rinsing waters with carbonate hardness significantly above 10 °dH are disadvantageous for many practical uses in the cleaning process.

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