

Application Note



Water Washing Transformers

By _____

Washing of products is common in the industry and while washing with alcohol is the preferred method, water washing methods are also used. Water washing products that are hermetically sealed, such as encapsulated transformers, during the post solder cleaning process of printed circuit boards is safe.

Questions arise when it comes to transformers that are not hermetically sealed and run through a wash process. Roughly half of all non-hermetically sealed transformers in the industry are water-washed during the PCB cleaning process and the other half are washed with an alcohol based cleaner. Of the ones washed in water it is quite rare for any of them to exhibit problems during their life cycle. However in some case transformers in the industry have exhibited shorted turns and opens later in the life cycle which can be attributed to the water wash process.

How can water washing cause problems later in the life of the transformer? If care is not taken in the spray direction of the water jets, in some cases water and flux have been driven into the coil of the transformer and gotten underneath the finish tape and into the magnet wire windings. This leads to two possible modes of failure which are related to each other.

1. If the wash has a cleaning agent added to it, the cleaning agent can be caustic to the magnet wire insulation and lead to insulation break down between turns or even windings. The problem can be exacerbated by any trapped water which can cause the copper itself to corrode if it comes in contact with the water. This can ultimately lead to transformer failure.
2. Another mode of failure can happen when water is trapped even if there is no cleaning agent in the water. During the winding process the insulation of magnet wire is cracked or crazed at a microscopic level due to the process of winding and bending the wire. If these cracks or crazing generates large enough cracks for water to reach the copper, this too can lead to copper corrosion.

While water washing is used by roughly half of the industry PCB cleaning processes and typically not a problem, Wurth Electronics understandably can not warrant defects that are traced back to a water wash process as we have no control in such processes. However, we can give some tips and suggestions that have helped our customers with their water wash process. Some of the suggestions that we have include the following.

1. Direct water jets such that they do not spray at angle that would lead to water and flux penetrating under finish tape.
2. Be sure that the drying cycle leaves the transformer completely dry on the exterior.
3. If possible do not use cleaning agents in your wash.
4. Wire of small diameter is much more susceptible to wire cracks and crazing to penetrate to the copper. Use larger gauge wires where possible and bury small wires to the very inside of the coil.
5. Specify P180 wire where possible as it exhibits very good resistance to water wash processes.

The Wurth Electronics Custom team in general takes precautions during the design process to make the transformer as robust as possible to withstand the water wash process. If you do have concerns about your water wash process be sure to follow as many of the five tips provided in this application note. Feel free to contact the Wurth Electronics Custom team if you have questions or would like further clarification.

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