## The problems of manual soldering with lead-free solder and special alloys

Developments in technology:

The manual soldering process is usually conducted with a soldering iron with a solder-activated wick and a filler wire with flux. Today’s soldering irons have a greater output and enable a faster heat supply.

Soldering procedure: the soldering iron is cleaned in a water-soaked sponge, the oxidised solder is wiped off, it then cools down naturally and loses temperature so that it must then be reheated.

After this, new solder is manually applied with flux via the filler wire and transported to the soldering joint.

If, during the soldering, on account of the consumed flux, a visual inspection of the soldering joint shows it to be grey (oxidised), more filler wire is fed in so as to improve the solder melt.

After this brief soldering procedure it is then again necessary to perform the entire cleaning process - the unused solder is then wiped off and ends up in the sponge again. The solder is disposed of as used solder. An ecological and economic loss.

By using new lead-free alloys this subject becomes even more significant because higher temperatures are used here (melting temperature with leaded solder is around 180°C, lead-free 236°C). Oxidation sets in earlier, the solder is tougher and therefore requires more flux.

The manual soldering process has become the Achilles´ heel of lead-free technology.

However, lead-free soldering procedures with complex components appear more and more frequently in manual production.

It is virtually impossible to process using familiar soldering tools. A precise temperature regulation and the greater heat output required for this are insufficient for the soldering process, and you also have to create an ideal soldering atmosphere.

The filler wire with suitable flux available on the market is difficult to process and doesn’t allow a soldering process using the known soldering devices.

Either the optical impression of the soldering joint is negative (with less use of activator) or there is considerable flux residue (with too much activator use) that then has to be removed.

The main problem with particle soldering is the very fast oxidation at the solder wick.

**Solutions**

The oxidation must essentially be excluded; the oxygen must therefore remain away from the soldering joint during the soldering procedure.

Fine soldering joints can only be created in a clean environment; flux residue is the classic creator of solder bridging and, due to the insulation of the intermetallic connection, cause an unacceptable solder connection.

Filler wires have a layer of oxide on the surface that also must be reduced; therefore the flux amount in the filler wire is insufficient for a quality solder. The built-in flux just about suffices to reduce the oxide of the filler wire.

New residue-free filler wires are not expected on the market yet, a soldering technology that does not require the use of filler wires rich in flux is therefore the best method, as it is based on avoiding harmful substances.

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