

STATEMENT

There are two main different types of vapour-phase soldering. One type is the unsaturated vapour; the other is the saturated vapour. ASSCON is working with the saturated vapour as this type of process has proved all the benefits of vapour-phase soldering. The Rehm system is working with the unsaturated vapour.

There are important differences between these both principles, which we want to elaborate in the following:

Optimal heat transfer and complete homogeneous atmosphere

By using the saturated vapour the optimal heat transfer is guaranteed. Immediately with the beginning of preheating the pcb is enclosed by a special inert liquid (Galden) produced by condensed vapour. As the heat transfer in a liquid is the most effective way of heat transfer the whole preheating and soldering process is done in the most gentle but also most effective way.

The unsaturated vapour consists of a mixture of vapour particles and oxygen. As this is not a homogenous atmosphere the heat is not transferred homogeneous to the pcb. ASSCON has made a lot of development with the different types of vapour and we noticed that there might be areas in the process zone where the heat transfer is not stable. It might therefore happen that some of the pbc's in one and the same cycle are soldered and some not completely. It is very difficult not to say nearly impossible to guarantee a complete ideal atmosphere soldering atmosphere in the whole process zone by using the unsaturated vapour. In the end the unsaturated vapour can not guarantee the real benefits of the heat transfer in the vapour.

Oxygen-free atmosphere

In the saturated vapour the pcb is completely enclosed by a special inert liquid (Galden) with the beginning of the preheating and during the whole soldering process. Therefore this process guarantees a complete oxygen-free soldering.

As there is always a mixture of vapour particles and oxygen in the unsaturated vapour the real advantages of the vapour phase soldering can't really benefit in this system. Preheating and soldering is done with the influences of convection. Heat transfer by convection is less effective and much less gentle than with the (saturated) vapour.

Hot spots

In the ASSCON machines the complete heating is done by the bottom of the process chamber. The fluid that is filled inside the process chamber is heated up and evaporated. The walls of the

process chamber need not to be heated by additional heaters as the complete heat transfer is done by the liquid and into the vapour.

The unsaturated vapour leads to a gas-oxygen-mixture. To achieve at least halfway effective heat transfer the walls of the process chamber should be heated as well as the bottom of the chamber. Deposits on the walls of the soldering chamber caused from the flux can be exposed to hot spots, which may break the molecular structures and set free chemical substances from the flux. This is eliminated in the saturated vapour.

Cycle times and control of process

ASSCON has in the production systems a permanent vapour blanket. This guarantees on one hand a minimum of power consumption and leads on the other hand to an effective control of the energy transfer to the vapour and the pcb during the whole preheating and soldering process.

The unsaturated vapour-systems work with lots of operating steps of heating, injection, holding time, exhausting, new injection, holding time, etc. This leads up to 13 (!) and more steps in the process. A really homogeneous temperature can thereby not be guaranteed. Energy, which was brought in the process chamber by injection and evaporation, is taken out again by a following exhaustion. The exhaustion is on the other hand necessary to find a way to influence the energy transfer. Apart from the not homogeneous heat transfer (see above) these many steps of heating, holding, exhausting lead to much longer cycle times per pcb than in a saturated vapour system.

Furthermore, even if the unsaturated vapour system controls itself several parts of the soldering process and the configuration of the parameters, the multitude of parameters can not be adequate controlled. Therefore the manufacturers of unsaturated vapour-systems warn against the risks of overheating the pcbs by not proper adjusted parameters¹. This risk is eliminated in the saturated vapour systems by the physical laws, the unsaturated vapour systems are based on.

The restrictions in the flexibility of the reflow-profiling seen by manufacturers of unsaturated vapour systems¹ can't be confirmed in the saturated vapour systems. As it is very simple and effective to control the energy transfer in the saturated vapour, these soldering systems enable a complete flexible profiling.

Maintenance and running costs

While working with the saturated vapour, ASSCON ensures that only the minimal energy is needed to heat up and solder the pcbs. No energy is taken out by exhausting or needless holding times. The ASSCON machines work out a linear profile with optimal energy transfer by smallest possible energy costs.

¹ Dr. Hans Bell, rehm Anlagenbau, Blaubeuren in EPP Elektronik Produktion & Prüftechnik, 04/2006, page 18

It is not necessary to exhaust the vapour during the preheating and soldering process. Thus there are no pumps that have to forward the vapour or the fluid with residua or outgassing from flux, solder pastes or pcbs. Maintenance costs are reduced on a minimum.

Transportation system of the ASSCON machines

ASSCON has paid highest attention to avoid moving mechanical parts or plastic belts in the process zone. We have noticed substances coming out of the soldered materials during the soldering process (we still do tests with certain partners) which can degenerate plastics. Therefore ASSCON decided to move the pcbs in the soldering zone by a specially developed pusher system.

ASSCON vacuum system patented

ASSCON was the worldwide first company that was able to build up a vacuum vapour phase soldering system. The system has been developed in cooperation with one of our customers and is protected by a patent.

The ASSCON vacuum process is attached to the soldering process. The vacuum is extracted immediately after the pcb has been removed out of the vapour. At that time the solder joint is still solvent (oxidation is no more an issue after the intermetallic zone has been generated) and the voids can be extracted. As on the other hand the inert liquid (Galden) has already evaporated from the pcb the particles of Galden soaked up with the extracted air are on a minimum level. Thus the maintenance costs as well as the fluid losses are kept on a minimum level.

As there are many vacuum systems already running worldwide for years we have also lots of experiences and feed back from the customers. We dare say that the ASSCON vacuum systems have proved themselves worldwide in the electronic production.

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