Rework: Quality in focus

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Rework and repair of electronic components is still a must for production managers of modern factories; even the steadily growing production quality of high-precision machines and well-established quality assurance procedures cannot completely compensate the necessity of rework and repair. Thus, it is essential to make rework procedures accordingly more reliable and safe. However, the time is past when SMD components were recklessly desoldered from highly-integrated circuits by means of a modified hot air gun.

Repeatable rework quality is ranking high for the responsibles, according to the motto: If repair is necessary, then please: quick, economically and long term reliable. So, only inveterate users of hot air fans from the DIY store will continue to use them. But whoever looks for a gentle and high-quality system that also guarantees safe processes will find a few systems meeting those requirements. During the past few years these systems established on the market in the field of high-channel SMD rework – especially since BGA components have gained the market.

If one watches the market for such rework systems closely, one will realize that the manufacturers‘ R&D departments made a lot of efforts to meet the demands for a rework soldering process quality that corresponds with the qualities achieved with a production line.

Customers make high requirements:

- Rework soldering profiles within a determinable temperature range
- Repeatable process quality on a constantly high level
- Safe documentation of soldering results and process parameters without requiring any expert knowledge therefore

If these requirements are met, one keeps the quality principles and, at the same time, guarantees reliable production processes.

Apart from fully automatic systems, which sometimes comprise complex programs, many manufacturers rely on semi-automatic systems to maintain process safety as well as flexibility which is important to the operator. The trend is that customers look for systems being easy to operate and guaranteeing high-quality soldering joints. Technological efforts concerning hardware, software and maintenance must be kept at a reasonable level at the same time.

Challenge: Technologies

However the original competition between the technologies remains. The way in which the heat is transferred to the component differs, of course, depending on whether radia-

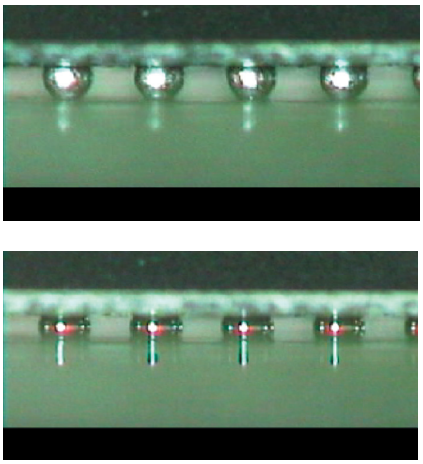

Fig. 1: Real-time picture of a BGA during reflow, recorded with the RPC 550 A (left: soldid, right: molten)

tors or hot air systems are used to get in the process heat. With some hot air systems problems like uneven heat distribution to the assembly, large space requirements of the nozzles as well as unwanted heating of neighboring components remain open issues.

For years, ERSA has successfully been using infrared radiators with long and medium wave infrared spectrum. That is why ERSA could now made a decisive step further towards process safety, which was only possible because the IR technology was maintained and optimized. The keyword is „Reflow-Process-Control (RPC)“.

What lies behind it is the simple and obvious idea that the repair procedure can be facilitated by using the same technique used for decades in hand soldering, namely the observation of the soldering spot during the soldering process. To observe soldering joints of SMDs, especially those of BGAs and similar components, certain requirements have to be met.

First of all, the components and respectively the soldering spots may not be hidden by parts of the rework system, such as hot air nozzles. Further, due to today‘s grids, the area to be observed must be magnified for visualizing reflow at the joint. This requires sufficient illumination of the relevant components.

Heat radiating systems allow visual sight to components and a comfortable working distance yields between PCB and heat source, since they do not require nozzle-enclosing parts.

Using a high-resolution zoom camera being equipped with an LED ringlight and a joint to swivel the camera in all axis, one will obtain expressive images in virtually every case.

The informative value of temperature measurements

The weak spot in rework is temperature measurement at the soldering joint. During the actual rework process, temperature measurement directly at the soldering joint is usually impossible. Contacting heat sensors such as thermocouples do not really show the temperatures which are important for the creation of a soldering joint. And precise temperature measurement directly at the joint by means of non-contacting heat sensors is, at least, impossible with the construction of hot air systems. The idea to determine the actual soldering joint temperature from a value measured with a non-contacting sensor has not existed so far. This gap is now filled by the RPC concept.

Precise temperature measurement by adjustment of visual and sensory data

Thanks to ERSA‘s extensive work in the field of visual inspection of soldering joints, the knowledge gained on the creation of hidden soldering joints like those of BGAs and CSPs can immediately be used for the rework processes. The first source of information is the camera picture of the soldering joint or its immediate vicinity. (fig. 1). The second source of information is the surface temperature measured with the non-contact temperature sensor. Further it can be taken for granted that one knows the melting temperature of the solder alloy used. The melting temperature of the common solder (Sn63Pb37) is 183 °C (361.4 °F). As lead-

Fig. 2: ERSA PL 500/550 A: precise placement (accuracy: ± 10 µm) made easily.

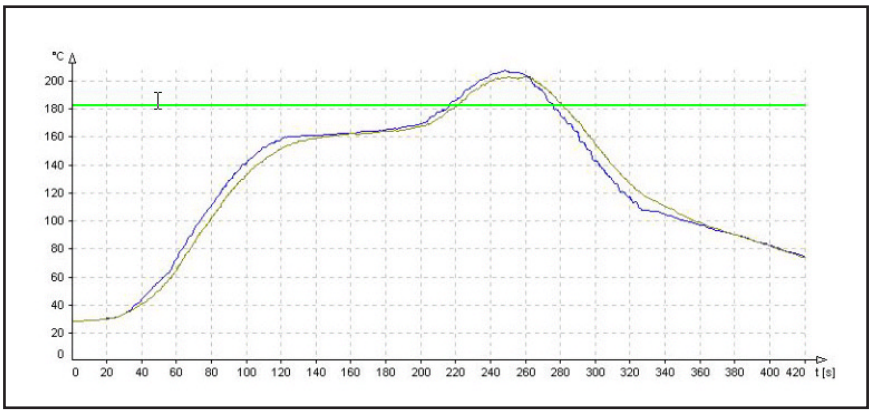

Fig. 3: Reflow temperature profile of the PL 550 A

free soldering is the future, tin-silver alloys will become very important. Their melting temperatures range between 215 °C (419 °F) to 220 °C (428 °F). The melting temperature is freely selected at the rework system depending on the solder used.

By means of the camera the operator watches the reflow of the solder joint on a monitor and adjusts, as soon as the solder melts, the displayed temperature of the sensor to the actual melting temperature at the soldering joint. In this way the operator ensures that a temperature is high enough to create a long-lasting, good soldering joint has been reached at the soldering spot. As per this temperature calibration it is guaranteed that the system will then process such boards in always the same manner. This forms the basis for repeatable processes.

For every new job the operator can quickly find the best process parameters based on adjusting the temperature sensor information to the visual camera information. Thus, it does not matter whether many circuit boards of the same type like in rework or always different ones like in repair environment are to be processed - the system is perfectly suited for both applications.

For desoldering tasks the system offers another technical highlight: As soon as the solder is liquid, the component is automatically lifted off the PCB by a spring-loaded vacuum pipette. At the same time the temperature measured by the sensor and the actual melting temperature at the soldering joint are adjusted. Now the system „knows“ the actual melting temperature at the soldering joint and can use this information for the soldering process. The system establishes a new parameter set for this component type and will treat other components of the same type as per this parameter set. This process is completely new compared with procedures already found on the market and consequently, it is patent pending.

Stored repeatability

Once a temperature profile is stored it ensures repeatable soldering processes with the same component types at constant ambiance conditions. A corresponding PC software allows to store the profiles for each componen. All process parameters are stored together with the component temperatures reached during desoldering. The rework system is fitted to the soldering job within seconds just by simply downloading the process parameters.

The temperatures reached during the soldering process are stored beside system and calibration data and thus completely meet the requirements for comprehensive process documentation, which rounds off the system.

Rework System solutions

Based on the RPC concept of visualizing the reflow, ERSA developed a complete product line. The latest product, the IR 550 A Rework System, combines IR radiator technology and non-contacting temperature measurement in processor controlled temperature marches. To visually control soldering joints, modern motor zoom cameras and powerful LED light sources are available. The established fine pitch placer completes the rework system. Easy to learn operation and placement accuracy in the micrometer range are definitely not contradictory (fig. 2). And a high-quality camera together with the high-contrast LED illumination is the base for this deceptively simple component placement as well.

The systems are of modular design and can be executed according to the customer‘s requirements. There is the perfect solution for every user: for newcomers to professional reworkers requiring high-end solutions with visual process control, precise placement and controlled high-end soldering.

Summary

Despite all the efforts of the manufacturers, it will be impossible to resign rework of electronic components in future. ERSA will stick to the principle of focusing on solutions for every budget, meeting the requirements for repeatable and high rework quality in the electronic production. For the user‘s benefits RPC technology offers unique rework systems in many respects.

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