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FEATURE ARTICLE

Teknek shows the automotive industry a route to cleaner electronics

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There are few areas of electronics where the demand for reliability, performance and zero tolerance of defects is higher than the automotive sector. From ABS systems to satellite navigation, electronic systems are now at the core of the car industry.

A key barrier to achieving zero defects is the presence of contamination in the electronics production environment. Over the past 25 years Teknek has been working with key electronics suppliers to the automotive sector, such as TRW, Continental and Denso, to help them increase production yields and reduce reject rates by eliminating contamination.

This article looks at the problems caused by contamination and the solutions being adopted by electronics manufacturers.

The problem of contamination has become more serious as track and width gaps become smaller and the use of multilayered PCBs becomes more prevalent. With smaller components and the drive towards greater miniturisation even the smallest particle can disrupt production and lead to wasted product and expensive rework. In addition, the trend towards using greener materials such as removing lead from the production environment has had an impact. Solder flow characteristics and melting points have changed resulting in materials which are stickier. This has left the solder paste process more prone to corruption from contamination. Furthermore, during dipping, wave soldering and rework copper has a tendency to dissolve into tin rich lead-free solder alloy. This a key reason that assemblers are moving towards “zero tolerance” of rework. It is vital therefore any sources of contamination which can cause rework are removed.

PCBs are rarely processed in a clean room environment therefore there is ample scope for contamination and particulates to enter the production line from a variety of sources. Independent research has shown that 80% of contaminants enter the “clean area” from people and products, 15% is created by products themselves and 5% is produced by the room and filtration system.

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Sources of contamination

There are a wide number of possible sources of contamination such as human hair, clothing fibres, skin flakes (a prime source of airborne dust), ceilings, floors, packaging and shelving.

Even so-called “lint-free” cleaning cloths used to clean PCBs can be a source of contamination. Lint-free means the cloths are free of loose surface lint however when wiped across pad areas or stencils lint fibres can become attached to the board.

When bare boards are manufactured contamination removal systems are employed at each stage to remove contamination so in theory they should be clean when they arrive for assembly. However, after the boards are routed only the surface of the substrate can be cleaned which means that the edges can harbour loose dust which can be disturbed during transport and packing.

PCBs are formed from a fibrous material so loose glass splinters can be produced by routing or snap-outs.

When boards are misprinted in the stencil printing process they are often “wiped clean” and sent through again with the result that particles of solder paste can attach itself to the board leading to problems. Frequently PCBs come individually wrapped in paper and small pieces of paper can be attracted to the board by static.

Static

Static charges can cause major problems for assemblers. PCBs are by nature insulators and hold a static charge. Loose particles will therefore be instantly attracted to the board. Static can result from handling the boards, removing wrapping or being wiped with a cloth.

Industry Solutions

So what can be done to combat the incidence of contamination and static and its effects on production?

One of the most effective ways has proven to be the use of specialist contact cleaning

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equipment to pre-clean boards before they enter the production process. Such equipment uses special elastomer rollers which make contact with the surface of the board to lift any loose particles down to one micron in size. Unlike brush-based systems the rollers cannot damage the board's surface. Particles removed from the board are then transferred on to pre-sheeted roll of adhesive film for examination and disposal. Once the boards have undergone the cleaning process they are then passed through a static neutralization unit to remove any static charge which could attract particles and lead to recontamination.

The type of contact cleaning equipment chosen is crucial. Although rollers may look alike the chemical composition can make a huge difference to how the equipment performs and how effective it will be in removing particles and debris.

Using contact cleaning equipment to pre-clean boards can produce dramatic results. It has been shown to improve yields by in excess of 90% and reduce reject rates by over 50%.

Having boards free of contamination and static has a number of benefits:

It ensures a cleaner surface for screen printing

Solder joint integrity is improved

Stencil to board gasketing is enhanced

Rework and scrapping of boards is reduced

Failure to address contamination problems effectively can lead to a number of major problems such as:

Stencil holes can become blocked by particles so the print is incomplete.

Debris within the solder paste during reflow can cause the solder to volatilize and blow leading to a crater forming in the paste.

Tombstoning can occur whereby chip components stand on end leaving one end attached to the board and the other end free.

Fibres from cloths used to clean the boards can become trapped between pads leading to potential short-circuits

In addition to installing contact cleaning equipment proper house-keeping routines should be put in place to make sure the production environment is kept free of contamination. This should include regular cleaning of the inside of machines as cooling fans can blow debris around which could land on the boards being processed.