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FEATURE ARTICLE

Contamination Elimination Strategies for the Electronics Production Sector

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One of the key issues facing the electronics production environment today is the impact of contamination. Dust and other particles cause rework, reduced yields and wastage.

The problem has become more acute in recent years with the increase in multi-layered boards and track and gap widths becoming smaller. Smaller form factors and greater miniturisation mean that even the smallest particle can disrupt production and lead to ruined boards.

There has also been a tendency to use greener materials in the production environment in recent years. This has led to solder flow characteristics and melting points changing with the result that materials are stickier. The solder paste process is therefore more vulnerable to corruption from other sources of contamination. Moreover, copper has a tendency to dissolve into tin rich lead-free solder alloy which can happen during dipping, wave soldering and rework processes. This is a prime reason assemblers are moving towards "zero tolerance" on rework. The holy grail is getting it right first time every time. Therefore it is vital that any sources of contamination leading to rework are eliminated.

With the exception of some fineline circuitry PCBs are rarely manufactured in a clean room environment. You may think your production environment is clean but there is ample opportunity for contamination and particulates to enter the production line from a variety of sources. According to independent research it is estimated that 80% of contaminants enter the "clean area" via people and products, 15% is generated by the products themselves and 5% is produced by the room and filtration system.

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Sources of Contamination

Contamination and particulates can come from a wide number of sources such as human hair, clothing fibres, skin flakes (the prime source of airborne dust), ceilings, floors, packaging and shelving. Special "lint-free" cloths used to clean boards can still generate contamination. Lint-free simply means free of loose surface lint however when wiped across pad areas or stencils they can snag and produce lint fibres. To avoid this it is best to use higher quality clean room clothes. At every stage in the board production process contamination removal systems are employed. However, after routing only the surface of the substrate can be cleaned which means the edges can still have loose dust attached which can be disturbed during transport and packing. PCBs are made of a fibrous material so loose glass splinters can be caused by routing or snap-outs. Misprinted boards are frequently "wiped clean" and sent back through the production line with the result that particles of solder paste enter the production process. If PCBs come individually wrapped in paper tiny pieces of this paper can become attached to the board by static.

Static

Static is a major problem for manufacturers. PCBs are by their nature isolators so hold a static charge. Therefore any loose particles will be immediately attracted to the substrate with the static charge. Static can be generated in a variety of ways whilst the board is being handled from being wiped with a cloth to the plastic wrapping being removed..

So what strategies can be put in place to combat the incidence of contamination and static?

The most effective method has been proven to be pre-cleaning of boards before they enter the production process by using specialist contact cleaning equipment. This equipment uses a series of special elastomer rollers which make direct contact with the substrate to be cleaned. Unlike brushes these rollers cannot damage the surface. The rollers can lift loose particles down to one micron in size from the board. The particles are then transferred on to a pre-sheated roll of special adhesive roll for examination and disposal. Once the boards are cleaned they should then go through static neutralization equipment so that the boards do not become re-contaminated before proceeding to the production line. It is vital that the contact cleaning equipment is chosen with care. Rollers may appear to look the same but an inferior roller will not perform adequately with the result that traces of contamination are not removed leading to downtime, rework and lower yields.

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The results to be gained from using contact cleaning equipment are quite startling. It has proven to increase yields by 90% and improve reject rates by over 50%. PCBs which are contamination and static-free before screen-printing will ensure a cleaner surface for printing, improve solder joint integrity and offer enhanced stencil to board gasketing. This leads to substantial reductions in rework and having to scrap faulty boards.

Case study

One company which had been experiencing problems with contamination is Unal Elektronik. Unal Elektronik is one of Turkey's leading PCB manufacturers. The £10-million company provides circuit boards for leading brand television and white goods manufacturers. Last year it produced in excess of 1million sq metres of PCB and in the region of 7 million to 8 million television chassis.

Five years ago the company realised it was experiencing problems with dust on the PCBs which was leading to waste and rework and was causing some of the boards to short circuit. The boards were being cleaned manually by operators using a cloth but with ever increasing production volumes this was proving too impractical and time consuming.

Unal researched the market and discovered that Teknek could provide contact cleaning equipment designed to remove contamination from PCBs eliminating particles down to one micron in size. Subsequently the company has invested in 10 machines with automatic loaders and six machines which are fed manually. The machines have been installed in-line to provide seamless integration with the production line.

"Since installing the Teknek 'Clean Machines' we have seen productivity increase dramatically as we are no longer cleaning boards manually," said Seniz Akbulut, managing director of Unal Elektronik. "We are working with very high volumes of throughput and I would estimate productivity has grown by at least 30-40% as a direct result of installing the Teknek equipment."

In conclusion there are many factors which are driving the need to eliminate contamination in the electronics sector. The trend towards greater miniaturisation and less tolerance of defects makes it essential that the industry implements the most effective contact cleaning technologies available to remove the impact of contaminants on production yields and wastage.