THT in-line Inspection: Contradiction or greater Efficiency?

The utilisation of Automated Optical Inspection systems has become an integral part in quality assurance of electronic assemblies. Depending on batch size and product mixture, AOI systems as Inline integration or as a stand-alone solution benefit efficiency and quality compared to manual inspection or even In-Circuit Test. Most common is the usage of AOI systems for SMD assemblies. Rather unknown is their utilisation for the inspection of THT boards, in particular large-sized PCBs and high-performance components with primarily manual assembling. Because of the PCB dimensions as well as requirements due to line integration, conventional AOI systems capabilities are exceeded.
GOEPEL electronic recently introduced its AOI system “OptiCon TurboLine”, based on a modular concept, which enables the efficient utilisation in THT assembly production under various conditions.

THT assemblies: Condemned to live longer

Through-hole components, particularly in performance electronics cannot properly be replaced and will be present on PCBs in the future. These are for instance electrolytic capacitors of high value and electronic strength, large inductors, connectors and various mechanical components. Due to size and weight of such PCBs their production presents particular requirements to the production organisation and applied equipment technology. In a production line there are often carriers utilised to ensure a safe assembly handling. This transport technology also requires the return of empty carriers from the end of the production line to the start. In such cases it is very often for a separate transport band in the lower part of the production systems to be used within which all integrated devices must be configured to support.

Image 1: Typical PCB manufactured at SMA Solar Technology

THT Production: Line Integration as a Challenge

The following requirements occur in terms of the utilisation of AOI systems in THT manufacturing with regards to coherent line integration:

1) Transport and inspection of large PCBs with or without carriers
2) Adaption to the existing handling concept belt or accumulator roller transport
3) Low-floor return of empty carriers

Based on the AOI system's modularity, an unlimited utilisation is possible. The system was developed to meet the already mentioned requirements:

1) Right from the start the system was designed for a 450mm x 400mm inspection area. Transport for PCBs of up to 490mm x 460mm is possible with or without carrier. For optimising handling times the integrated transport module was divided into three segments for loading and unloading the AOI system parallel to the test process.
2) Depending on the entire line concept, the machine can be equipped with standard belt transport or accumulator roller modules. Due to the selected version, appropriate stop and locating modules are integrated for an individual PCB or the carrier.
3) All components inside the AOI system are arranged to enable adequate free space in the machine's lower part for a trouble-free return path for the empty carriers. Accumulator roller modules of various types can be integrated for the transport.

Image 2: Part of THT Line at SMA Solar Technology

THT Component Inspection: Size Matters

Due to the mounting of large components on THT assemblies there are significant differences in Automated Optical Inspection requirements compared to SMD production. On the one hand this applies to the component clearance to transport THT boards trouble-free and without damage. The AOI system provides a collision-free PCB transport at a component clearance of 80mm on top side and 50mm on bottom side.
On the other hand there is the test task to perform all possible detections, e.g. OCR or polarity, also on top side. This demand was met in the machine in two different ways: 1st) The camera lens selection enables an extended depth of focus of 40mm. 2nd) By using a hub module the entire camera can be lifted up by 30mm during the inspection process, which results in a total inspection height of 70mm.
Test functions for captured camera images are proven algorithms for polarity check (e.g. for electrolytic capacitors), plain text recognition (e.g. type verification) or presence check. A multitude of illumination variants with regard to incidence angle and wave length enables a high-contrast display even with hard to detect characteristics.

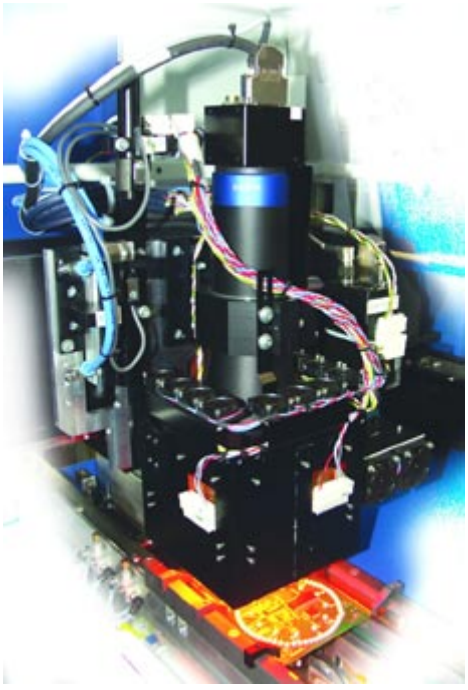

Image 3: Camera in OptiCon systems

THT Solder Joint Inspection: Flipping not required

In addition to the proper placement, solder quality on the PCB bottom side is a critical factor. If conventional AOI systems are used the PCB must be flipped upside down. Usually, either an in-line flipper station is utilised or the PCB or magazine is turned manually. This results in additional time and effort which reduces the applied test technology's efficiency and requires additional equipment and cost for an automated operation.

The AOI system offers the opportunity of doubled-sided PCB inspection within one system or in several machines. Utilising the optional camera module all unnecessary efforts in flipping the boards are omitted, which results in a cost-efficient and space-saving in-line THT solder joint inspection solution.
An innovative cleaning concept enables the safe inspection operation also with pollutions that cannot be avoided during the wave soldering process. Flexible test functions can be configured for the inspection tasks, checking solder joints for pin presence, shorts, solder quantity and meniscus characteristics following IPC guidelines.

THT in-line Inspection: Increased Efficiency and Quality

OptiCon TurboLine is a modular configurable system that in addition to standard SMD tests, meets all the demands of a THT in-line production process. Based on an innovative concept the system offers the opportunity to transport assemblies with or without carriers on conventional belt and accumulator roller module basis (incl. low-floor return conveyor for empty carriers). An optional camera module enables the inspection of both top and bottom sides within the system without PCB flipping.

The extended inspection height at the assembly top side as well as the adjusted test functions for component inspection and THT solder joint inspection enable maximum fault coverage to meet the highest of quality demands.
OptiCon TurboLine is the first and therefore unique AOI system to be efficiently utilised in THT in-line production process.

Image 4: OptiCon TurboLine with low-flow return conveyor