



100% Inspection Coverage for Safety-Relevant Automobile Components



Application Report

100% inspection coverage for safety-relevant automobile components

Automatic optical inspection of lead-free soldered assemblies

The development of components used in electronics manufacturing is characterized by increasing miniaturization. In addition to this, the diagnosability of all safety-relevant components must be ensured and the growing quality and throughput requirements observed. As a supplier to the automotive industry, AB Elektronik is thereby subjected to high safety standards. It is, for instance, necessary to carry out co-ordinated durability inspections, which guarantee operability at the point of application, as electronic components have to fulfil high specifications with regard to temperature, humidity, vibration, corrosion and dust. It is therefore not without reason that at AB Elektronik quality is taken very seriously indeed. The quality philosophy motto here is „Zero defects through prevention“. The implementation of lead-free soldering does, however, also confront manufacturers with new challenges, requiring integrated approaches with respect to future manufacturing. In rising to these new challenges, AB Elektronik performs, amongst other things, a 100 per cent solder joint inspection using AOI – the company has been successfully inspecting lead-free soldered joints in manufacturing since 1999.



F.l.t.r.: Olaf Gutapfel, Planning Dept., AB Elektronik; Romuald Hok, Manager of Process Engineering, Planning Dept., AB Elektronik; Wolfgang Herbig, Viscom Representative, HERBIG TECHNOLOGIES

AB Elektronik: Equipped to meet all the requirements of the automotive industry

Founded in 1967 as a sales office of the British AB Elektronik, the Werne production plant became part of TT Electronics plc, which is also British, took over the parent company in 1993. The world-wide operating TT con-

glomerate is sub-divided into the areas telecommunications and automobile electronics, with most of its production facilities in Europe and the USA. In addition to Klingenberg/Saxony (Germany), the USA (North Carolina) and a new AB Elektronik works in the Ukraine, the Werne production plant plays an important part in TT Electronics' production strategy, with about half of the turnover being brought in with electronics and electrical components for the automotive industry. The TT conglomerate, consisting of some 60 companies, currently employs roughly 8,300 people in electronics manufacturing world-wide. The turnover in 2003 was about 773 million Euros.

At the Werne plant, AB Elektronik at present employs a work force of around 900 on an area of about 23,154 square metres primarily in the production of various sensors, such as angle, temperature, altitude and ABS sensors, as well as drive pedal modules, for the European automotive industry. It was here in 1978 that the first breakthrough was achieved, with a fade regulator for auto radios and the production of RPM sensors for Mercedes and BMW. According to Romuald Hok, Manager of Process Engineering of the planning department at AB Elektronik, market monitoring is used as a means of trying „in every way to be better than any comparable supplier in fulfilling the requirements of the customer. And, wherever possible, even at the development stage of a product, because this is the only way to successfully implement the zero-defect strategy.“ It is therefore not surprising that AB Elektronik supplies the entire automotive industry, from DaimlerChrysler to BMW and Bosch, all the way to VW with products.



Inspection of lead-free solder joints with the Viscom S6055



Inspection objects f.l.t.r.: Electronic drive pedal module commercial auto, electronic drive pedal module sports application, hall-effect RPM sensor, altitude sensor, level switch, temperature sensor

100% lead-free solder joint inspection of assemblies

„Because of the high demands made on our products, particularly the high temperatures, which the assemblies have to endure, we have been using lead-free solder in the manufacture of printed circuit boards since the year 1996“, says Olaf Gutapfel of the planning department at AB Elektronik. Lead-free solder has been used ever since, both in reflow and selective soldering. The manual visual inspection of lead-free soldered assemblies proved to be quite difficult as, after years of inspecting the quality of leaded solders, it was found that there were major differences when it came to assessing the quality of lead-free solders. In addition to this, higher quality standards and high wage costs resulted in a considerable reduction of the then very high proportion of manually performed work.

The decision to introduce 100 per cent solder joint inspection with the help of automatic optical inspection was eventually taken in view of the following points:

- Short process regulation loops
- Increasing complexity and miniaturization of assemblies
- Zero-defect strategy
- Customer demand for automatic optical inspection
- Higher throughput rates
- Reduction of costs
- Constant inspection quality and depth

Prior to the release of every inspection schedule, a multi-tiered test is performed to qualify the inspection algorithms. The results of the inspection systems are weighted by specially-trained personnel. This involves lots of between approximately 20,000 to 25,000 assemblies. The information thus gained serves to eliminate slippage and the reduction of pseudo-rejection prior to series release. In order to shorten the validation periods, tools such as DOE (Design of Experiments) will be used in the future. This would then result in a very low pseudo-error rate in the attuned process being achieved.

AB Elektronik has been working with automatic optical inspection systems and IBV systems from Viscom since 1999. At the present, AOI systems Viscom VPS 6053 and S6055 are being used for printed circuit board inspection and industrial image processing systems Model 3042 are in operation for the inspection of selective solder joints. In addition to this, the systems are equipped with the proprietary Viscom SPC server. This server continually logs the processed inspection data from the Viscom inspection systems and displays variation trends in the paste print, printed circuit board assembly or soldering in the form of configurable diagrams, which can be accessed on the SPC server from various locations throughout the network. In this way it is possible to spot any changes that may creep into the production process in good time. Traceability is ensured at AB Elektronik using bar codes. The printed circuit board is thereby identified prior to AOI being carried out, i.e. it is given a handle which serves to identify the individual assembly.

The decision to use Viscom AOI was at that time taken for a number of reasons. According to Olaf Gutapfel, „The fact that Viscom is a well-known company, good validation support in the initial phase, high availability of the systems, competent service and support in the area of inspection methodology, as well as good results achieved during the internal AB qualification, were decisive in taking the step to co-operate with Viscom.“

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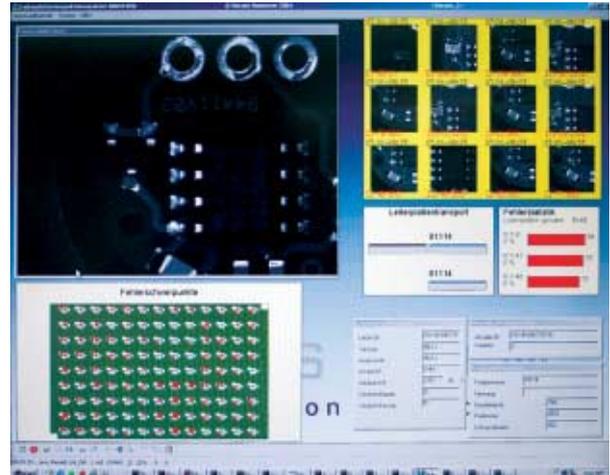


SMT production at AB Elektronik in Werne

Optical inspection: Differences between lead-free/lead

When inspecting solder joints with lead-free solder, it is a fact that depending on the alloy used, the surface of the solder compared with that of leaded solder has a duller appearance. This effect is noticeable both in the case of re-flow, as well as selectively-soldered joints. Because of the duller surface of lead-free solder, shadows, such as those caused by large components, have a much more pronounced effect. This effect initially resulted in a difference in assessments during manual visual inspections. AB Elektronik therefore introduced an internal training program to counter this source of error.

The automatic optical inspection also had to be adapted to lead-free solders. Because of the rougher surface, rays of light are reflected straight into the camera even under diffuse lighting conditions. In the region of the meniscus, this leads to a brighter background lighting than is the case with leaded solder joints. It became necessary therefore, to adapt the parameters to the solder being used, a procedure which, thanks to the flexibility of the Viscom sensor modules, was quite speedily effected. The assessment of lead-free soldered joints is in accordance with IPC-A-610- Class 3.



Viscom AOI-Software EasyPro

The conversion to lead-free assemblies will continue to be a major factor in assemblies production and inspection over the coming years. In the context of this conversion, a specialist project team is working on the entire process chain, from the supplier all the way on up to long-term product endurance trials. To date, 50 per cent of all products have been converted to lead-free solder. Viscom supports its customers during this conversion period with its knowledge, years of practical experience and an integrated lead-free inspection sample library.

Are you interested in more details on this application or do you have any questions regarding solder joint inspection? The Viscom SP Division will be glad to help you.

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