

Case Study X7056BO



AOI

AXI

SPI

MXI



Danfoss Silicon Power GmbH
Effective wire bond inspection
with combined
X-ray and AOI inspection



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An excerpt from the Danfoss Silicon Power product range

Effective wire bond inspection

The Danfoss Silicon Power GmbH, based in Flensburg, Germany, is a subsidiary of the Danish Danfoss Group. Among other products, the company delivers power modules for frequency converters to customers from the industrial, automotive and renewable energy sectors. Especially because of the growing automotive business and its increasing demands, since 2006 Danfoss Silicon Power has introduced several inspection systems from Viscom. First, three Viscom X8051 X-ray inspections were deployed. By now, four Viscom X7056BO systems which combine X-ray and AOI inspection in one system have been added to them. Danfoss Silicon Power uses the Viscom X7056BO inspection systems to check wire bond connections and active components. The strengths of the combi-systems lie in reduced acquisition costs, low pseudo defect rates and a high productivity.

Danfoss Silicon Power: Effective production at the Flensburg location

Danfoss Silicon Power GmbH has been manufacturing at Flensburg since 2012. Prior to that, the electronics manufacturing was established at the Schleswig, Germany location. The relocation was used to build up

an ultra-modern and intelligently automated production on the basis of the extensive experience gained in Schleswig. This starts with the well-equipped sample and small series production, goes through effective automation systems and up to a modern warehouse with capacity for 1300 euro-pallettes. About 300 employees are occupied at Flensburg, including specialists for electrical development, process development, component selection, production and quality assurance. After the company had first established a name with standard industrial projects, for example, with the production of power modules for frequency converters, in 2003 they entered the automotive sector and later added renewable energies (solar and wind energy) as a third pillar. Then, in 2006, the successful expansion of the automotive sector led to the decision to introduce automatic in-line X-ray inspection.

Pseudo defect rate below one percent

„In the manufacture of our products, X-ray and automatic optical inspections are a matter of course,“ says Torsten Hansen, Manager Production Equipment at Danfoss Silicon Power.

„We continually check all technical processes throughout series production.“ The company inspects every single wire bond with AOI, and all active components with X-ray inspection. For bond processes, there is an additional 100 % visual inspection.

Before acquiring the X7056BO systems, Danfoss Silicon Power intensively analyzed the market offering for X-ray and AOI systems and tested different systems. „First we wanted to settle on two separate machines: one AOI and one X-ray inspection system“, reports Torsten Hansen. „Until we determined that with Viscom, both technologies can be integrated very well.“

After that the company decided for the X7056BO combi-system very quickly and matched it to their line concept. The solution of covering both inspection technologies with one machine, previously unique for wire bond inspection, was convincing. The resulting high inspection speed was also an important bottom-line criterion.

„The realization was demanding“, reports Torsten Hansen. „The concept of the Viscom X7056BO system was new and first had to be adapted to our requirements. But after the commissioning, Viscom was always at our side.“ However, already during the



One post-qualification work station for three inspection systems



View of the production at Danfoss Silicon Power in Flensburg

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course of the test phase, Danfoss Silicon Power quickly recognized that the initial expectations for inspection quality and speed could be even further exceeded by minor adjustments and adaptations.

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During the introductory phase, Danfoss Silicon Power received support through on-site training. Even after commissioning, the applications engineers from Viscom helped out with the further optimization. „Today, the pseudo defect rate in many areas is better than the rate Viscom originally confirmed“, reports Torsten Hansen with satisfaction. „Normally, we are below one percent. Defect escape is nearly zero.“

Combined AOI/AXI inspection process

First, the AOI inspection checks the quality of the bond connections. The X-ray inspection connects itself seamlessly, particularly to inspect active surfaces beneath soldered chips. On the bond wires, for example, irregular-

ities caused by wear on the bonding tool may occur. „It is especially difficult to keep the pseudo defect rate down here“, explains Torsten Hansen. „With the Viscom X7056BO system, we are in the position to restrict the bandwidth

of potential defects and so minimize the pseudo defects.“

First the AOI system inspects the course of the wire in wire bond connections. The inspection system recognizes the bond feet and uses them to analyze how the wire must lie. In the process, position, form, tail length and bond tool imprints on the bond feet are analyzed along with other features. Glossy surfaces and a straight-line course are the essential parameters for the wire. Classical areas of the AOI area such as component position and surface evaluation are also realized.

Danfoss Silicon Power deploys the X-ray inspection primarily to inspect solder surfaces beneath the active components for interfering surfaces. Pores, resulting from inclusions of liquid or air, are typical defects. The

X-ray inspection reliably recognizes these defects, because such surfaces absorb less radiation and appear as light surfaces in the image.

„The good/bad part analysis which the system transfers to the downstream machines in the process is very helpful“, explains Torsten Hansen. „This allows the process to be further accelerated.“ If the Viscom X7056BO recognizes an AOI or an X-ray defect, the parts are automatically sorted out in subsequent process steps, based on the data from the Viscom X7056BO system.

A post-qualification work station for three inspection systems

„The savings gained through the Viscom X7056 are considerable“, says Torsten Hansen. „For one, the acquisition costs already are significantly less in comparison to two individual machines. For another, productivity has distinctly increased.“

With the combined AOI and X-ray system, Danfoss Silicon Power needs fewer personnel for post-classification. Each Viscom X7056BO system has a HARAN verification station, where the results of both inspection processes appear on a single monitor screen.

„We had already become familiar with the HARAN post-qualification station with the first systems and learned to value it. Now, because of the combined processes, we only need one HARAN and have noticed that when we keep the pseudo defect rate down, even all three lines can be attended to by just one employee. Naturally this is a great advantage in productivity“, explains Torsten Hansen. And adds, „During the past years we have added a system from Viscom nearly every year. By now, we have deployed three X8051 X-ray systems and four X7056BO combi-systems. This points out how satisfied we are.“