

# NITROGEN GENERATION ON SITE WITH HYDROGEN TECHNOLOGY



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## CASE STUDY

### SOLUTION COMPRISING NITROGEN GENERATOR AND HYDROGEN CATALYST REDUCES ENERGY COSTS

**The electronics manufacturer VTQ Videotronik produces electronic components and complete electronic devices. The core of the production consists of several soldering systems. These are filled with nitrogen (N<sub>2</sub>) to avoid oxidation on the circuit boards. In the course of modernization measures in the production, onsite nitrogen generation was also optimized. In addition to two INMATEC generators, an additional hydrogen catalyst now provides high-purity nitrogen. By using the NKat system, a significant reduction in compressed air consumption and energy costs was achieved.**

VTQ Videotronik manufactures electronic assemblies and devices for customers. The company also develops and produces its own end products in the video-audio-radio sector. The focus is on high quality and so the production was modernized and expanded recently. In the state-of-the-art manufacturing halls, which are partly in a new building complex, there are various reflow and wave soldering systems in which the electronic components are manufactured. Various parts are con-

nected to one another in the soldering systems as part of thermal processes. For this purpose, a liquid solder (tin) is used to join the materials. However, contact with oxygen during soldering can drastically reduce the quality of the solder joints. To avoid oxidation, VTQ Videotronik uses nitrogen in all soldering processes.

VTQ uses four reflow soldering systems to solder surface-mounted devices (SMD). First, a solder paste is applied to the circuit board and then equipped with the SMD components. The assembled circuit board is then heated in the reflow oven with hot air that flows out through nozzles. The tin contained in the solder paste melts and ensures a permanent and firm connection of the SMD components to the board. A common soldering error that can arise from contact with oxygen during reflow soldering is the formation of tin oxides. To avoid this, nitrogen is added to



One of the two PN 2250 nitrogen generators from Inmatec (right) with hydrogen catalyst NKat 060 in the cabinet (left).



the air flow in the reflow soldering systems from the company. In this way, extensive reworking and repairs (e.g. of whiskers, which can lead to short circuits on the circuit board) of the circuit board can be avoided and optimum quality can be guaranteed.

For soldering wired components such as connectors and power coils on the circuit boards VTQ uses the wave soldering or selective soldering method. Until recently, open wave soldering systems were used for THT (Through the Hole) assembly. Even the use of a so-called hood, under which nitrogen was blown onto the solder joints, could not completely eliminate the contact of the liquid solder with oxygen. Dross formation and post-processing of the circuit boards were often the result. As part of the modernization, an N<sub>2</sub> tunnel wave soldering

system and two selective soldering systems were purchased. In the tunnel system, the entire process, from flux application in the fluxer to preheating on the preheating section and soldering on the wave soldering section, takes place under a protective gas atmosphere with nitrogen. In the new wave soldering and selective soldering systems, residual oxygen values in the range of 100 and 10 ppm can be achieved. Especially by working under a nitrogen atmosphere, the solder connections could also be optimized here. In addition, valuable resources such as tin can be saved to a considerable extent.

At VTQ Videotronik, the required nitrogen is generated on site in the required amount and purity. The company has been using nitrogen generators from INMATEC for this purpose since the intro-

duction of the RoHS directive and the use of lead-free solders. In the meantime, two new PN 2250 generators have been installed in a technical room. With the help of the Pressure Swing Adsorption technology, they produce nitrogen on site. For this purpose, ambient air is fed into a valve block with the required pressure using an air compressor. This automatically ensures that the compressed air is alternately fed into two adsorption containers filled with a carbon molecular sieve. These alternate from filter mode to regeneration mode. In one container, oxygen and carbon dioxide molecules from the ambient air are adsorbed in the sieve, while the sieve in the second container regenerates under pressure relief. The nitrogen thus obtained is fed into a product container. Adsorbed oxygen is led outside through an exhaust air



The production hall with wave soldering system.





**Above left: Selective soldering system for soldering wired components such as connectors and power coils (THT assembly).**

**Above right: Reflow soldering system for connecting SMD components to the circuit board.**

**Right: The Inmatec NKat 060 hydrogen catalyst ensures that the generated nitrogen of quality 3.0 is enriched with small amounts of hydrogen and is thereby cleaned to a quality of 5.0. In the catalytic converter, the hydrogen reacts with the residual oxygen in the nitrogen.**

pipe. Each of the PN 2250 nitrogen generators produces up to 73 m<sup>3</sup> nitrogen per hour with a purity of 99.9% (3.0 / 1000 ppm residual oxygen).

The now configured hydrogen catalyst NKat 060 from Inmatec ensures that the generated nitrogen of 3.0 quality is enriched with small amounts of hydrogen and is thereby cleaned to a quality of 5.0. In the catalyst, the hydrogen reacts with the residual oxygen in the nitrogen. The technical innovation makes it possible to produce a larger amount of high-





**Compressed air: Four modern air compressors together with the INMATEC nitrogen generators flexibly generate up to 100 m<sup>3</sup> nitrogen per hour.**

purity nitrogen, especially for THT production, with smaller, more energy-saving air compressors. This way, four modern compressors, together with the INMATEC nitrogen generators, produce flexibly up to 100 m<sup>3</sup> nitrogen per hour. These are required when the plant is operating under full load. With the help of a higher-level control electronics, the amount of compressed air required is adapted and optimized to the requirements in production. Since VTQ Videotronik carries out contract work for 200 different customers, the utilization of the production can vary considerably depending on the lot sizes ordered. The proportion of set-up

times for the production of smaller quantities is comparatively high. No nitrogen is required during this time. In contrast, in the production of large batches, production runs without interruption and a large amount of nitrogen must be made available continuously. By combining the various technical measures, efficiency could be increased and significant energy savings achieved.



**With the help of the higher-level control electronics, the amount of compressed air required is adapted and optimized to the requirements of production.**

**„We have been using nitrogen generators from INMATEC since 2005. The flexible production of nitrogen on site and the associated independence convinced us. Thanks to the use of innovative nitrogen generators combined with INMATEC’s NKat hydrogen technology, energy-efficient compressors and higher-level control electronics, we can now achieve electricity savings of 15,000 to 20,000 kW or 3,000 to 4,000 euros per month. The self-generated nitrogen makes it possible to effectively prevent oxidation, reduce solder consumption, make improved solder connections and improve product quality“,** says Mario Sabbarth, Production Manager at VTQ Videotronik GmbH

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