

# CLIMATE-FRIENDLY NITROGEN PRODUCTION FOR ELECTRONICS MANUFACTURING



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## ONSITE GENERATION OF NITROGEN FOR GREATER FLEXIBILITY

NITROGEN (N<sub>2</sub>) IS AN ESSENTIAL RAW MATERIAL IN SOLDERING PROCESSES FOR THE PRODUCTION OF HIGH-QUALITY THT COMPONENTS. THE N<sub>2</sub> ONSITE GENERATION OFFERS A POSSIBILITY TO PRODUCE THE INERT GAS YOURSELF IN A COST-EFFECTIVE AND ENVIRONMENTALLY FRIENDLY WAY. AME, A MANUFACTURER OF HIGH-QUALITY ELECTRONIC PRODUCTS FROM THE NETHERLANDS, PRODUCES ITS NITROGEN SUSTAINABLY AND THUS REDUCES ITS CARBON FOOTPRINT. THIS IS POSSIBLE THROUGH THE USE OF INNOVATIVE PSA AND HYDROGEN TECHNOLOGIES AS WELL AS MODERN HEAT RECOVERY TECHNIQUES IN COMBINATION WITH GREEN ELECTRICITY.



The nitrogen generator PNC 9000 ConNect enables onsite nitrogen generation with high purity.



The nitrogen obtained is enriched with small amounts of hydrogen in the NKat hydrogen catalyst and thus brought to a purity of 99.999% in an energy-saving manner.

The company Applied Micro Electronics, AME for short, manufactures electronic components and products in the fields of power conversion, the Internet of Things and sensor technology with around 250 employees. The high-quality components are used in wind turbines, electric cars and household appliances, amongst others. Corresponding THT assemblies are manufactured by AME near Eindhoven as part of the selective soldering process. Since the switch to lead-free solders in 2006, nitrogen has been used for the first time in the

company's factory as part of the delivery of liquid nitrogen (LIN) in order to create the necessary protective atmosphere during the soldering process. The use of liquid nitrogen required the installation of a tank for its storage. Since production and the corresponding LIN consumption have grown significantly since then, the nitrogen has been delivered by truck at ever shorter intervals, most recently every week. The limit was reached. The possibility of increasing tank capacities was not pursued. Expensive construction measures as



well as constant monitoring, planning and purchasing processes to prevent nitrogen shortages were to be avoided at all costs. Regular truck deliveries and the associated CO<sub>2</sub> and fine dust pollution for the environment should also be reduced in the interests of sustainability.

### Eco-friendly alternative: Self-production of nitrogen with H<sub>2</sub>

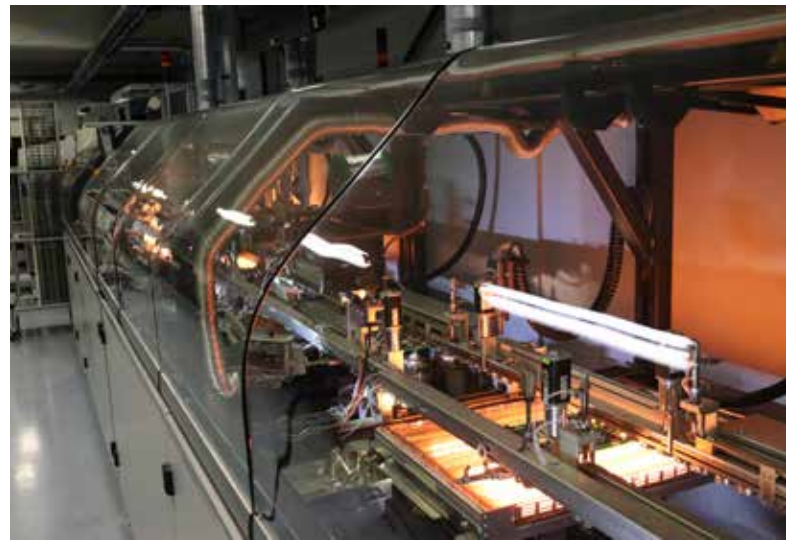
An alternative solution for the nitrogen supply was sought and so the in-house production of nitrogen directly on site with the help of generators came into view. The decisive tip finally came from the Kurtz Ersä company, which supplies the electronics manufacturer with its high-quality selective soldering systems.



The Inmatec products can seamlessly be integrated in all selective, wave or reflow soldering processes and ensure an uninterrupted N<sub>2</sub> supply, here in Versaflow soldering systems from Ersä. © AME

In addition, Ersä has been cooperating for years with Inmatec GaseTechnologie, a leading manufacturer of nitrogen and oxygen generators, in order to offer their customers the provision of protective gas for various soldering processes from a single source. The Inmatec products can be seamlessly integrated into all selective, wave or reflow soldering processes and ensure an uninterrupted N<sub>2</sub> supply.

The system, installed in March 2021, includes a PNC 9000 ConNect nitrogen generator and a hydrogen catalyst (Nkat 40). As the first product stage, the generator produces approx. 40 m<sup>3</sup> of nitrogen per hour with a purity of 99.9%. This is done using PSA (Pressure Swing Adsorption) technology, which adsorbs oxygen and CO<sub>2</sub> from the ambient air in two pressure load swing containers. Modern flow and turbulence technology of



The THT assemblies are manufactured at AME using selective soldering processes and are used in the area of power conversion, the Internet of Things and sensors. © AME

the PNC model series facilitates this process and requires significantly less compressed air than conventional technologies. The nitrogen obtained is then enriched with small amounts of hydrogen (H<sub>2</sub>) in the hydrogen catalyst. The nitrogen quality is increased to 99.999% through a catalytic reaction between hydrogen and residual oxygen. This innovative process produces high-purity nitrogen with an extremely low compressed air factor of 3.0 (compressed air consumption of 120 m<sup>3</sup> per hour). This two-stage process management reduces the power consumption for the compressed air supply to a considerable extent.

For comparison: N<sub>2</sub> production with conventional PSA generators has a compressed air factor of 10-14. Modern generators that use Inmatec's PNC technology, on the other hand, require 6.7 to 7.2 m<sup>3</sup> of compressed air to generate 1m<sup>3</sup> of nitrogen. This factor is reduced to 2.9 to 3.5 by using PNC technology with the addition of Nkat hydrogen technology. Compressed air consumption and the corresponding power consumption can be reduced by up to 80%.

### Heat recovery and green electricity

But it can be even better. The electronics manufacturer only uses sustainably generated, green electricity in its factory, which is generated from renewable energies. In addition, the heat generated in the N<sub>2</sub> generation process is reused 1:1 in-house. The electrical power required to generate compressed air is also converted into waste heat. In addition to the generator, hydrogen catalytic converter and air compressor, the complete package supplied for nitrogen production also includes a system for hot-air heat recovery. The heated air,







The heat generated in the N<sub>2</sub> production process is being reused in-house 1:1.

which is drawn in to cool the compressor, is discharged upwards via an exhaust air duct and passed on to the storage rooms. Here the waste heat is used to heat the premises, fossil fuels for this process are 100% substituted.

The annual savings that can be realized with this are enormous. For the soldering systems, which are in operation 24 hours a day, 5 ½ days a week, only 74,000 KWh of electricity are consumed instead of 247,000 KWh compared to N<sub>2</sub> production with a conventional nitrogen generator. The annual CO<sub>2</sub> saving is 93 tons.

“The solution for supplying N<sub>2</sub> via a two-stage process using PSA and hydrogen technology came at exactly the right time. We can use green energy to generate nitrogen and use the exhaust air to heat our warehouse. Overall, this is a much more scalable solution. We can expand our soldering systems in the future without having to build more large tanks on our company premises. In addition, we can easily adapt the N<sub>2</sub> purity to the respective soldering process,” says Joep Daemen, Manager Factory Innovations & Investment at Applied Micro Electronics.

### Scalability and high purity

The self-generated nitrogen is used in all soldering processes at the electronics manufacturer. This is also the case in the three Versaflow soldering systems in the THT area, where the protective gas for a total of 18 crucibles is provided. The nitrogen thus prevents oxidation of the soldering points and ensures high-quality soldering connections. Dross formation, the formation of whiskers and time-consuming rework are a thing of the past.

The self-generated nitrogen has the advantage that the purity can be adjusted for each process. A high purity of 99.999% is required for selective soldering. On the other hand, reflow soldering, which is becoming increasingly important in the factory, works with less high purities (99.95–99.99%), but with higher volume flows. Inmatec’s N<sub>2</sub> generation system is scalable at will and can therefore continue to provide the required amount of N<sub>2</sub> in the future.

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THT assemblies at AME. © AME

