

# Precise and Clean Joints, Soldering Under High Vacuum Makes This Possible

*Conventional soldering methods quickly reach their limits when joining carbides, diamonds or ceramics.*

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/EINPresswire.com/ -- Clean, oxide-free solder joints and consistent results can only be achieved under high vacuum conditions. This is precisely where iew's vacuum soldering process comes into play: The systems work using precisely coordinated vacuum technology from Pfeiffer Vacuum+Fab Solutions and enable stable processes with minimal energy consumption and low maintenance effort.

To develop a new generation of vacuum soldering systems, iew needed a reliable high vacuum solution that was both technically robust and economical. Together with Pfeiffer Vacuum+Fab Solutions, a system concept consisting of a combination of turbomolecular vacuum pump and backing pump was developed. The system ensures a final vacuum of up to  $8 \times 10^{-6}$  hPa (mbar). This results in reproducible solder joints even on temperature-sensitive materials. Under these almost gas-free conditions, oxidation is prevented, heat transfer is precisely controlled and the components are joined to the solder alloy evenly. At the same time, the dry vacuum pumps reduce maintenance effort and prevent contamination in the process area – a crucial factor for ensuring the high quality of the manufactured components.

Where precision meets innovation

The company was founded as the engineering firm Schweikhart in 1996 by Dipl.-Ing. Martin Schweikhart and was the result of a thesis on the topic of induction heating. Just one year later, the company was renamed iew induktive Erwärmungsanlagen GmbH. With around 20 employees, iew now supplies customers worldwide.



Vacuum solutions from Pfeiffer Vacuum+Fab Solutions in a small VBM150 vacuum soldering system from iew. Source: iew induktive Erwärmungsanlagen GmbH.

In addition to individually configurable induction heating systems, iew's vacuum soldering systems make up a steadily growing proportion of its revenue. The company is the only provider worldwide to supply both technologies from a single source – a benefit for many customers who require both procedures for their manufacturing process.

The systems are used for applications such as soldering high-performance diamond tools, shrink fitting, annealing and hardening of metals, as well as in testing technology and research. In the field of vacuum soldering, around 80 percent of the applications are in tool technology. Manufacturers of probes and medical technology companies are also showing great interest in soldering technology.

Vacuum soldering under optimal conditions

The vacuum soldering process starts with preparing the components to be joined, which may be made of carbide, polycrystalline diamond or ceramic, depending on the application. After applying the soldering paste, the workpieces are positioned in a vacuum chamber made of quartz glass. The chamber is then evacuated until a pressure of approximately  $5 \times 10^{-4}$  hPa (mbar) is reached. This removes oxygen, nitrogen and humidity from the process area – essential to prevent oxidation and contamination at the soldering joints.

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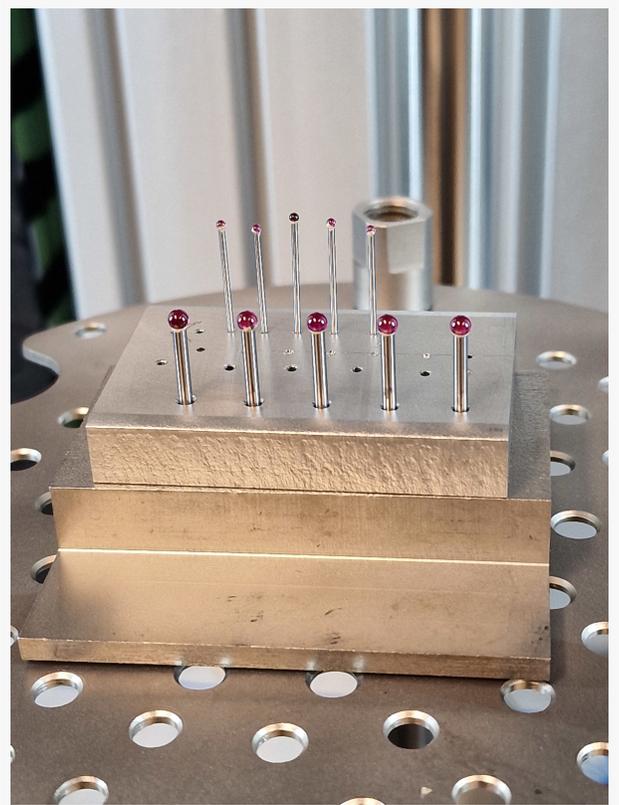
For us, Pfeiffer embodies maximum reliability, which is why we use its vacuum pumps in our vacuum soldering systems – because we want to ensure the best possible quality for our customers.”

*Simon Riefling, International Sales at iew GmbH*

During the soldering process, infrared heaters heat the components precisely. First, they are homogeneously preheated so that no stresses occur in the material. As soon as the soldering temperature is reached, the vacuum pumps reduce the pressure further to around  $5 \times 10^{-5}$  hPa (mbar). This high vacuum level minimizes heat conduction through residual gasses and ensures even melting of the solder alloy, which typically takes place around 700–900 °C.

After the soldering process has been completed, the vacuum level is further increased to approximately 8 to

$9 \times 10^{-6}$  hPa (mbar). In this virtually gas-free environment, the workpieces can cool down in a controlled manner without oxygen or nitrogen reacting with the surface. Only once the temperature has dropped to approximately 150 °C is ambient air slowly let in again. This ensures



Vacuum-soldered probes. Source: iew induktive Erwärmungsanlagen GmbH.

gentle pressure equalization.

The combination of precise temperature control and stable high vacuum conditions ensures reproducible results, tight and clean solder joints and consistently high product quality. The robust systems are designed for continuous industrial operation and impress with their long service life and minimal maintenance requirements.

Custom vacuum technology instead of off-the-shelf solutions

In 2016, iew began developing the first prototypes for vacuum soldering systems, which would later become available in two different versions – a compact variant for smaller batch sizes and a larger system for industrial series operation. The aim was to create a reliable and resource-saving alternative to conventional systems, which often worked with oil diffusion vacuum pumps. During start-up, the oil had to be brought up to operating temperature, and there was always a risk of oil vapors entering the vacuum chamber and contaminating sensitive surfaces during the process. In addition, maintenance and cleaning were accordingly time-consuming.

In response to these problems, Pfeiffer Vacuum+Fab Solutions helped create a compact high vacuum solution that eliminates the need for diffusion vacuum pumps and is significantly more efficient. The jointly realized system architecture combines turbomolecular vacuum pumps with dry or oil-lubricated backing pumps – depending on the process requirement. This combination ensures stable pressure conditions down to the range of  $8 \times 10^{-6}$  hPa (mbar), enabling clean, reproducible soldering with low energy and maintenance effort.

A [HiPace](#) turbopump and an oil-free scroll vacuum pump from the HiScroll series are used in the smaller system variant, supplemented by precise vacuum gauges, dust separators and robust valves. For higher throughputs, the larger system uses a HiPace turbopump in combination with an oil-lubricated DuoVane rotary vane vacuum pump. All components are perfectly coordinated with each other and have been designed for operation under continuously changing thermal loads with occasional accumulation of dirt – a prerequisite for high process stability in daily use.

Simon Riefling, responsible for international sales at iew, says: "In 2018, we chose the vacuum solutions from Pfeiffer Vacuum+Fab Solutions because the company stands for top quality and excellent service. As a German manufacturer with remarkable high-tech competence, Pfeiffer is the market leader with products we see time and again at universities, colleges and in renowned companies. For us, Pfeiffer embodies maximum reliability, which is why we use its vacuum pumps in our vacuum soldering systems – because we want to ensure the best possible quality for our customers." The installed vacuum solutions are characterized by easy maintenance and a long service life.

For example, the turbopumps are designed for a maintenance-free running time of up to five years.

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