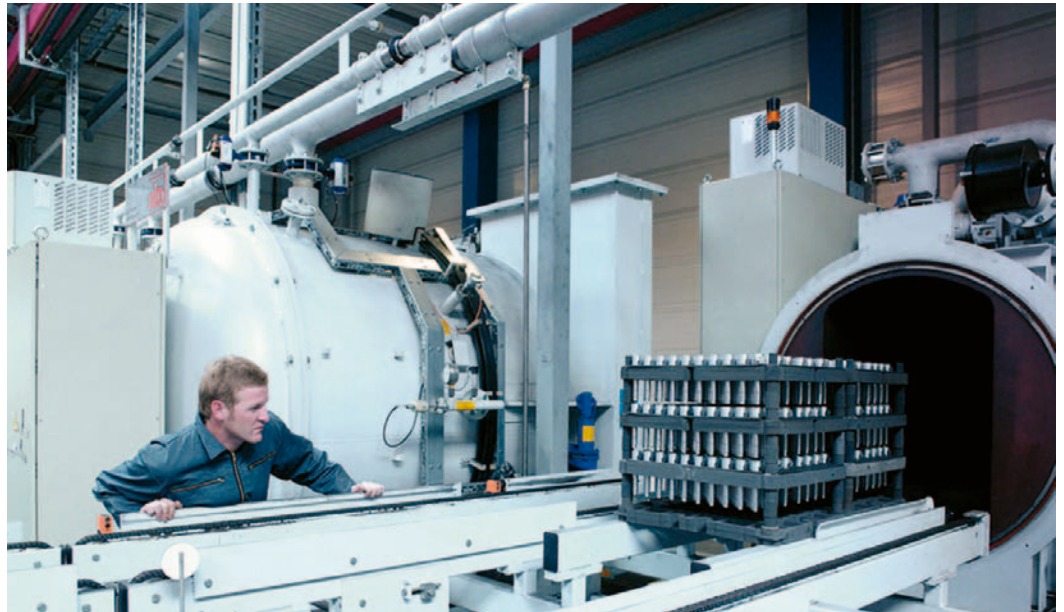


FRIOFLEX® HP. Low-pressure carburising and high-pressure gas quenching.



Loading process of a multi-chamber vacuum furnace.

Reference customer: Vacuheat GmbH

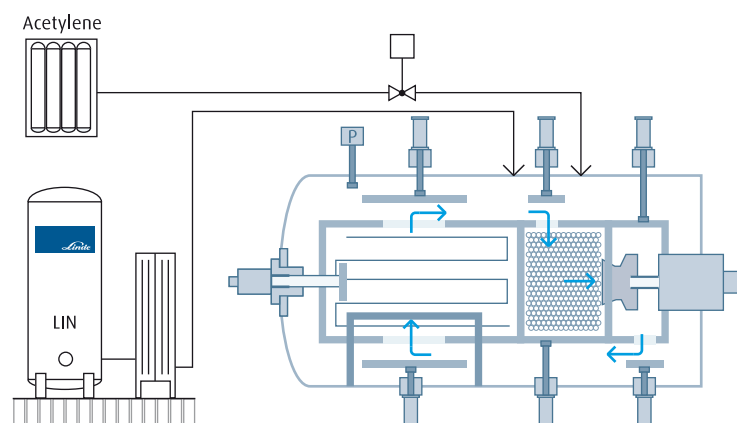
Vacuheat was founded in 1999 as an alliance between ALD Vacuum Technologies GmbH, Hanau and the Gruppe Heat GmbH, Herzberg. The products treated at Vacuheat are mainly fuel injection pumps for diesel engines. In addition to the automotive industry, Vacuheat also serves manufacturers of ship engines, locomotive engines and heat exchangers.

Installation date

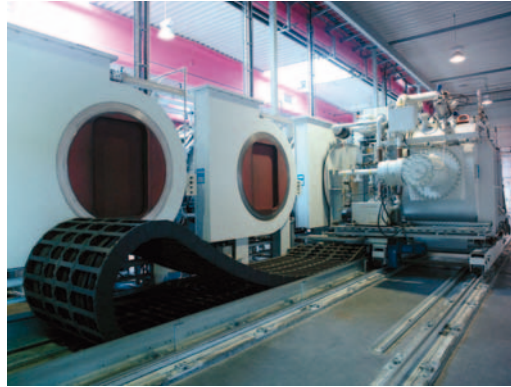
At Vacuheat, the first multi-chamber vacuum furnace was taken into operation in 1999 followed by three double-chamber vacuum furnaces and recently by another multi-chamber furnace at their new production facility.

Description

In contrast to conventional gas carburising, low-pressure carburising allows operators to increase treatment temperatures and shorten total process times. In combination with high-pressure gas quenching, this solution minimises distortions compared to oil quenching. It results in a clear and better controlled process. Post-processing steps are reduced or eliminated. Not only is this approach environmentally friendly, it also ensures optimum cooling results with respect to microstructures and hardness.



Installation diagram of a low-pressure carburising and gas quenching unit including gas supply.



The high-pressure gas quenching module can be connected to all carburising chambers.



Sub-zero treatment of the charge after carburising to reduce retained austenite.

Carburising process and medium

In low-pressure carburising, the optimum gas selection and purity play an important role in order to achieve the required heat treatment result. Vacuheat decided to use acetylene as a carburising medium due to its specific advantages. In comparison to propane, parameters such as the density of loads and the length/diameter ratio of blind holes can be increased. Furthermore, acetylene minimises the formation of soot and tar inside the carburising chamber and on the carburised parts.

Quenching medium

Depending on the required cooling efficiency, nitrogen, helium or hydrogen are used for quenching of case-hardened parts. Today, nitrogen and helium are the most common quenching mediums while the use of hydrogen is very limited due to safety concerns. Since recently, however, the utilisation of hydrogen has been promoted by the leading furnace manufacturers. Nevertheless, Vacuheat decided to quench with nitrogen (up to 20 bar) only. The main reasons for this are the comparably small parts treated as well as economical considerations. Besides the gas type, the gas velocity and the applied pressure can also be used to establish a tailor-made quenching characteristic.

Sub-zero treatment

To make sure that the retained austenite is minimal and the stability of dimension is therefore guaranteed, all critical parts at Vacuheat receive a sub-zero treatment with Linde's CRYOFLEX® technology.

Linde expertise

Linde is not your average gas supplier. In addition to reliable supply solutions, we provide you with state-of-the-art technology and the corresponding process knowledge, all in one package. We have extensive experience in dimensioning and handling acetylene supply systems and ensuring the right flow conditions. Our experts can also advise you on low-pressure carburising processes with systems that must support intermittent flows, both low and high. This is especially critical where several carburising chambers are present. Drawing on our in-depth expertise, we are able to deliver gas quenching supply systems that meet individual demands, whether it is a question of quenching tool steels at lower pressure or automotive components at 15 bar or above. Please feel free to contact us for more information: heat-treatment@linde-gas.com



Vacuheat Production Manager Mr. Marcel Roscher: "Our company has profited a great deal from the excellent support and know-how of Linde's experts. They were very responsive to our concerns and made the implementation of the processes a trouble-free experience."



Gas supply station including nitrogen tank, argon tank and acetylene cylinder packs.

- 1 Nitrogen
- 2 Argon
- 3 Acetylene

Linde AG

Linde Gases Division, Seitnerstrasse 70, 82049 Pullach, Germany
Phone +49.89.74 46-0, Fax +49.89.74 46-12 30, www.linde-gas.com