ALD Vacuum Technologies

High Tech is our Business

MonoTherm®

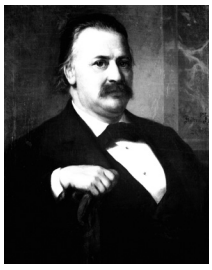
Vacuum Chamber Furnace for ultimate quality

High Tech is our Business

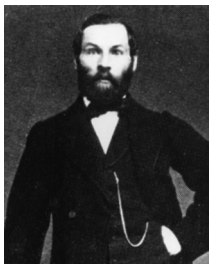
ALD is a brand name associated world-wide with innovative vacuum technology at the highest level. As one of the leading manufacturers of vacuum plants and vacuum process technology we supply all areas of vacuum metallurgy and vacuum heat treatment with high-tech products and services.

Tradition with obligation

The company's success story begins with two great entrepreneurs in vacuum technology: Ernst Leybold (1824 – 1907), founder of the Leybold company and Wilhelm Carl Heraeus (1827 – 1904), founder of the Heraeus company. The companies Leybold,



Wilhelm Carl Heraeus



Ernst Leybold

Heraeus and Degussa, which was founded by Friedrich Ernst Roessler in 1837, are the roots of ALD. Today, ALD is a member of the international AMG Advanced Metallurgical Group N.V. and is ranked at the top in vacuum metallurgy. ALD is the leader in vacuum heat treatment technology.

Technology, setting examples

Thanks to our advanced and highly sophisticated concepts ALD offers individual solutions which are geared to their respective tasks. The technological advancements in vacuum metallurgy, vacuum heat treatment and vacuum sintering technology make us a strong partner for important and growing future-oriented branches such as energy production, aviation, material production and processing for the automotive industry. Our ambition to provide the highest level of quality and technical perfection is strengthened by our determination to supply our customers with optimum service. Therefore, we are continuously developing new ecological processes, which are further improved in specialized operating companies, thus conserving resources and protecting the environment.

Service, creating additional benefits

Through consistent project management and quality management ALD has acquired a top position in the international marketplace. In addition to our high level of expertise in process and plant technology we offer a wide range of extensive services together with our representatives and partners worldwide. Our full service comprises the excellent supply of spare parts, periodic maintenance as well as servicing, modernization and integration of newly developed processes into existing plants. You can be assured - ALD is your reliable partner, today, tomorrow and in the future.

High quality treatment

ALD has more than 40 years of experience in the manufacture of vacuum heat treatment equipment. ALD provides continuous advancements in equipment and technology and offers the single chamber vacuum furnace, ALD MonoTherm®. This furnace has reproducible heat treatment capabilities with high efficiency and throughput.

Vacuum heat treatment

During heat treatment the parts can be heated to high temperatures in an oxygen-free environment. The vacuum prevents damaging oxidation which may occur in other atmospheres. The vacuum heat treatment is used especially for the treatment of high-alloyed and medium-alloyed steels as well as for brazing and sintering. With auxiliary equipment installed, the system can be expanded for additional processes such as vacuum carburizing.

Heat treatment principle

Heating in the vacuum chamber furnace can be performed in vacuum as well as under convection. Treated parts are heated very homogeneously in a temperature range between 150 °C and 1400 °C. Depending on the part geometry, quench pressure can be adjusted to a gentle cooling with 1.5 bar or high pressure gas quenching with up to 20 bar. The vacuum chamber furnace ALD MonoTherm® is suitable for annealing, hardening, tempering, brazing in fine or high vacuum, casehardening and sintering.

Reliable model for success

Commercial heat treaters and in-house hardening shops have been operating ALD vacuum chamber furnaces very successfully for many years. Because of flexibity and individual adaptability, ALD heat treatment systems are used by scientific departments and universities as well as by the aviation and aerospace indutries. Furthermore, companies in the tool manufacturing industry, automotive suppliers, manufacturers of magnets and many others also benefit from the advantages provided by the vacuum chamber furnace ALD MonoTherm®.

Successfully in use:

BMW · Linde Hydraulics · Linde · Hispano-Suiza SAFRAN Group · WEGENER HÄRTETECHNIK GMBH · KOMET GROUP

Flexibility which pays off

Through our long-term experience in the manufacture of vacuum chamber furnaces we are familiar with the various operating conditions. The vacuum chamber furnace ALD MonoTherm® is designed to be variably adapted to the respective requirements. With the modular design principles the plant is assembled according to the customer's needs.

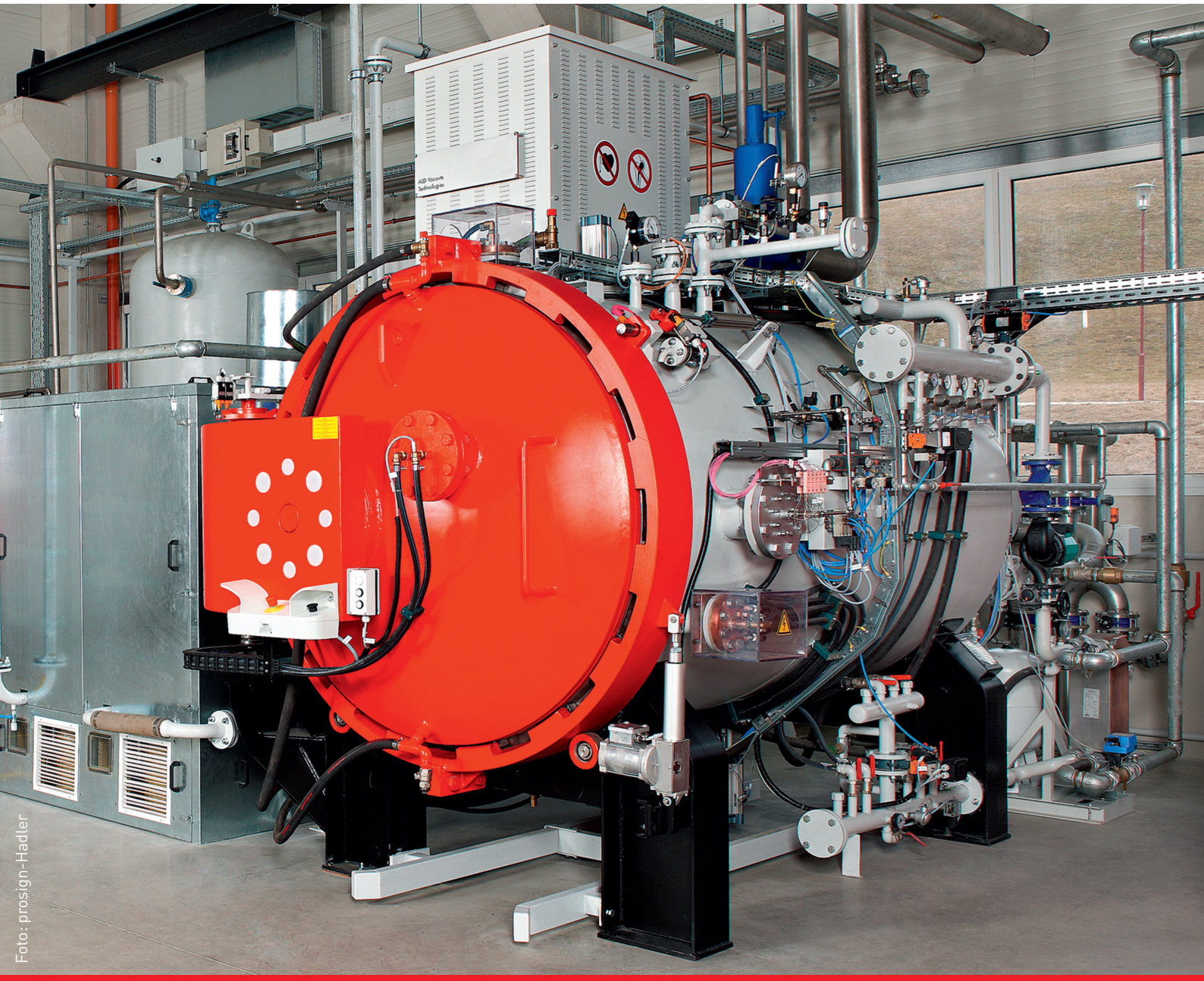


Foto: prosign-Hadler

The modular design principle

The high demands on vacuum heat treatment require greater efficiency of the vacuum chamber furnace. The configuration of the optimal system is based on the heat treatment job which depends, among other things, on the material, treatment temperature, the part's shape and dimensions as well as on the required throughput. Furthermore, the heating and cooling method must be considered. The vacuum chamber furnace ALD MonoTherm® offers a variety of possibilities to fulfill the performance criteria. Make your choice!

Sizes for different charge dimensions:
- 400 x 400 x 600 mm
- 600 x 600 x 900 mm
- 900 x 900 x 1200 mm
- additional sizes on request

Design of the hot zone in cubic or cylindrical shape, depending on the part's composition and type of heat treatment.

Heating circuits:
- one heating circuit
- optional: additional, individually controllable heating circuits

Vacuum:
- fine vacuum (10^{-2} mbar)
- high vacuum (10^{-5} mbar)
- partial pressure (1-15 mbar)
- other pressure ranges

Convective system for homogeneous and rapid heating in the temperature range of up to 950 °C.

Quench parameters:
- various pressure steps between 1.5 and 20 bar
- gas velocity selectable by frequency converter
- marquenching simulation to reduce distortion

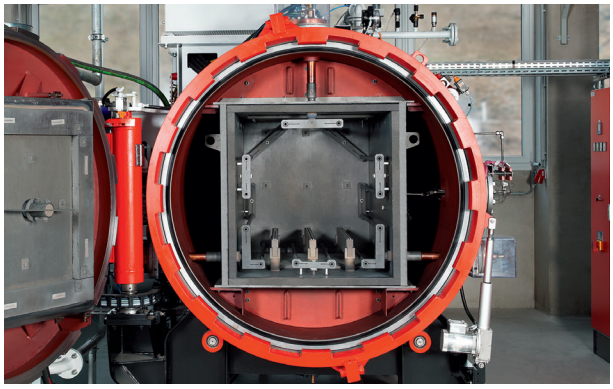
Quench gases for various applications: nitrogen, helium or argon.

Cooling directionr for high uniformity and optimum quenched parts:
- vertical – from top to bottom
- horizontal – from left to right
- reverse – reverse of the respective flow direction
- vertical / horizontal – four direction cooling
- 360° uniform nozzle cooling

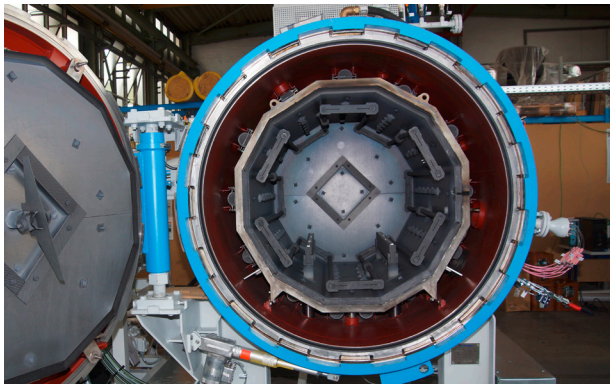
Vacuum carburizing:
- vacuum carburizing system
- vacuum carbonitriding system

Cryogenic system for transformation of retained austenite.

Accessories to optimize heat treatment plants:
- charging carts
- charging fixtures
- gas storage tanks
- gas purification systems
- gas recovery systems
- tempering furnaces
- cooling water recooling systems



ALD MonoTherm® with cubic hot zone



ALD MonoTherm® with cylindrical hot zone

Everything under control – the MonoTherm® Control concept

The vacuum chamber furnace ALD MonoTherm® is equipped with an easy to operate control system. All processes in the heat treatment plant are monitored and controlled. The PLC ensures the reproducibility of the process.

MonoTherm® Control

The vacuum chamber furnace ALD MonoTherm® is controlled by the MonoTherm® Control (MNC). The data-base hosted by a PC system supports the following functions:

- plant operation
- operating modes of the plant
- recipe creation and management
- data back-up
- load record generation
- alarm management
- machine parameter management
- data transfer to external server

optional:

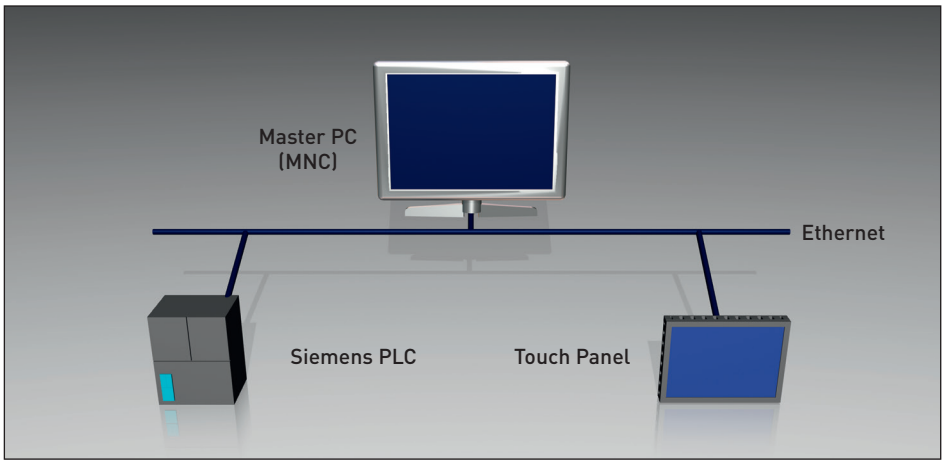
- redundant PC solutions
- touch screen PC solutions, integrated in the control cabinet
- connection of several systems to the MonoTherm® Control (MNC)
- design according to NADCAP

Plant control

The Siemens PLC manages all activities within the vacuum chamber furnace ALD MonoTherm® and controls temperature, pressure and gas flow. The touch panel which is installed in the control cabinet allows independent system operation. The master PC manages all documentation and secures the traceability of individual processes.

Plant operation

The control concept of the vacuum chamber furnace ALD MonoTherm® is designed for high quality treatment and easy operation. Recipe creation and load management are performed from the master PC (MNC). Process relevant data can be accessed and edited at all times. This saves time, prevents costs and contributes to quality management.



Our customers‘ satisfaction

Your vacuum chamber furnace ALD MonoTherm® will provide long-term, optimum performance and reliability. We have set high quality standards for ourselves. In addition to technical expertise, flexibility and highest quality, ALD offers high service-ability, creating an excellent added value.

Your reliable partner

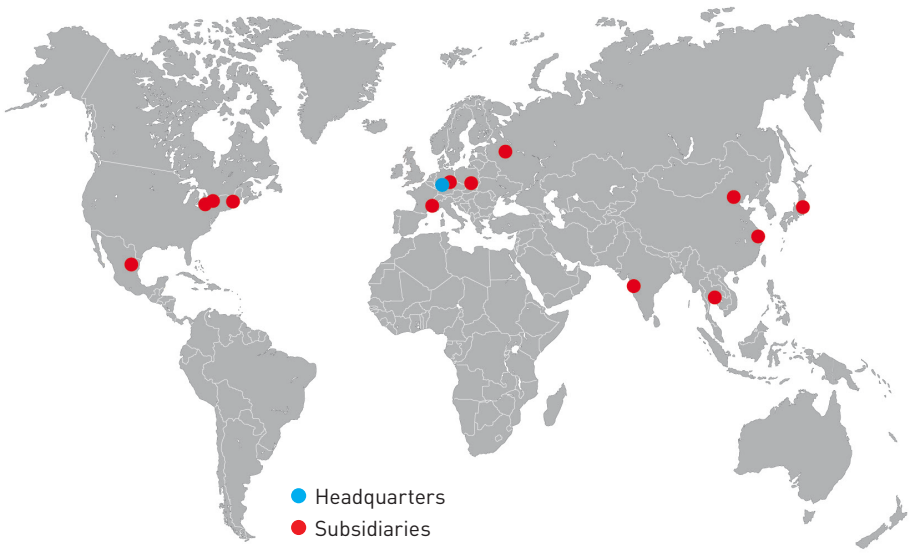
The vacuum chamber furnace ALD MonoTherm® is designed for a 24/7 operation. In order to guarantee smooth continuous operation, ALD has set up a world-wide network of experienced specialists who offer universal service for the entire process chain. Thus in addition to repairs, installations, preventive maintenance, hotline assistance and remote services are performed in a highly professional manner. We have established warehouses at strategically favorable locations, which store original spare parts to reach each vacuum chamber furnace ALD MonoTherm® fast and reliably.

Our service overview

- supply of spare parts and consumables
- repair service
- service and inspection
- modernization of plants
- operator training
- preventive maintenance
- professional support in emergencies

Own & Operate

In the past decades, ALD has established long-term know-how in vacuum heat treatment which is applied in company-owned operating corporations. The ALD Own & Operate GmbH, located in Germany, USA and Mexico, for example, offers heat treatment services to the automotive and aviation industry as well as to other industries.



Advantages at a glance

The vacuum chamber furnace ALD MonoTherm® offers all possibilities to adjust the heat treatment plant exactly to the customer's requirements. The results are reduced production costs, improved efficiency, increased productivity and environmental compatibility.

Environment

- low environmental contamination
- no CO_2 emission
- high energy efficiency due to low thermal loss
- on-demand-plant operation
- easy-control electrical heating
- low noise emission
- dry quenching without disposal of waste washing water
- clean working environment without oil, vapors, flames

Quality

- complete quality documentation for each load
- high reproducibility by easy process control
- minimal part distortion
- optimum part surfaces
- high temperature uniformity
- rapid and uniform quenching due to special copper fin-tube heat exchangers
- adjustable quench velocities
- high carburizing uniformity on the part and within the load
- longer service life of grinding wheels during hard machining
- minimal risk of overheating when grinding

Commercial efficiency

- less hard machining due to minimal part distortion
- considerable time savings due to smaller carburizing depth
- fast and easy maintenance of heating chamber, heat exchanger, quenching motor with quenching fan
- low consumption costs due to small gas volumes and efficient quench gas recovery
- high energy efficiency through on-demand technology, less thermal losses due to optimized thermal insulation
- maximum availability
- 24/7 service
- high reliability
- short cycle times due to high pressure gas quenching

Technology at a glance

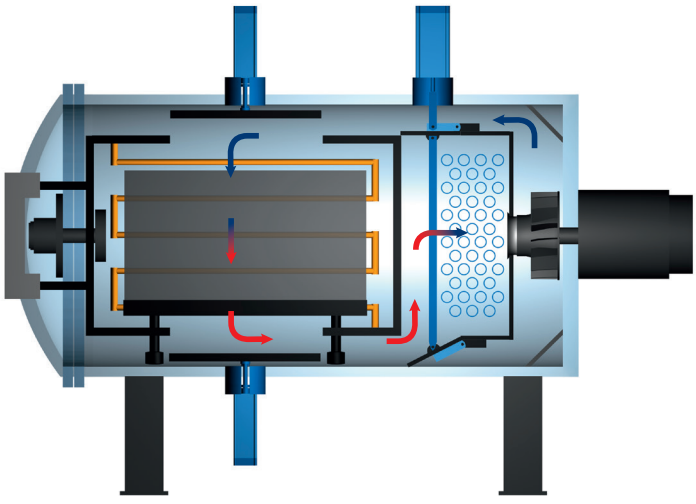
The vacuum chamber furnace ALD MonoTherm® is an all-purpose heat treatment system. Different chamber sizes and designs allow customizing of each system to meet specific requirements. The most important technical data of our current systems are listed as follows:

cubic / cylindrical working space

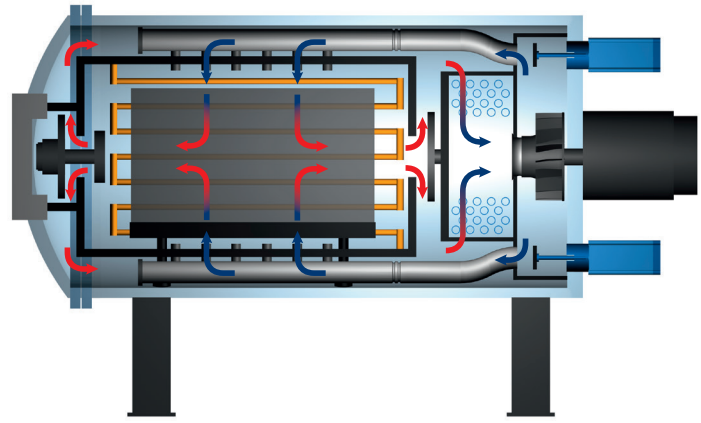
Charge dimensions (mm)			approx. space requirement of the plant (m)			Gross charge weight (kg)
width	height	length	width	height	length	
400	400	600	5	3.5	7	200
600	600	900	5	3.7	8	600 optional 1000
900	900	1200	6	4.5	10	1500

additional sizes on request

quench pressure options ($bar_{abs.}$)	quench gas options
1.5 / 10 / 15 / 20	N_2 / He / Ar



ALD MonoTherm® with cubic hot zone



ALD MonoTherm® with cylindrical hot zone

Interested in more information?

We would be glad to provide more details about efficiencies and various advantages of the vacuum chamber furnace ALD MonoTherm® and integration of this system into your production process.
Please contact us!

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