

The Solution



**ALD Vacuum Technologies**

High Tech is our Business

# SyncroTherm<sup>®</sup>

One-Piece-Flow-principle  
in heat treatment



## 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, Heraeus and De-



Wilhelm Carl Heraeus



Ernst Leybold

gussa, 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 and 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.

## Efficiency which pays off

ALD Vacuum Technologies can look back on more than 40 years of experience in the production of vacuum heat treatment plants. Now, for the first time, heat treatment can be integrated directly into the mechanical production line because of the latest development, vacuum heat treatment module, type SyncroTherm®.



### Vacuum heat treatment

Heat treatment of parts in vacuum prevents damaging oxidation which occurs in standard protective atmospheres. Case hardening in vacuum is carried out through low pressure carburization at high temperatures using acetylene as a carbon source. The parts are carburized without surface oxidation in a clean, non-polluting process. Subsequent high pressure gas quenching with nitrogen provides dry and clean parts with reduced distortion.

### New perspectives

Modern heat treatment plants for low pressure carburization and high pressure gas quenching are generally installed in the near vicinity of the production site. However, they are not integrated directly into the mechanical production line. ALD Vacuum Technologies, a technology leader in vacuum case hardening has developed a unique system which provides the means to integrate heat treatment directly into the production line. This enables synchronization with the production step soft machining, leading to entirely new perspectives in automation.

### Reproducible results

Heat treatment integrated in the production line leads to a more efficient and more ecological production of parts. The duration of the heat treatment is reduced to the point where the production cycle is maintained without interruptions, generating a continuous one-piece-flow. The parts are charged in one layer on one workpiece carrier instead of in one big conventional multi-layer batch. These so-called "2D-charges" produce rapid and very homogeneous heat treatment in all process steps and further guarantee reproducible results.

## World first

Increasing demands on transmission manufacturing and costs require new solutions for a more efficient production. The heat treatment module SyncroTherm® provides the means to optimize the process chain. The continuous piece flow leads to a more effective and ecological production – and improves quality.



# The One-Piece-Flow-Principle

According to the one-piece-flow-principle, the heat treatment of large batches is converted to treatment of single components. The parts are charged in one layer on one workpiece carrier. The flat-panel radiators installed in top and bottom radiate the heat directly onto each part, heating the “2D-charges” rapidly and homogeneously. The micro-alloyed steel parts are carburized at high temperatures above 1000 °C without undesired grain growth. Furthermore, the single-layer charge provides the possibility to control high pressure gas quenching which is customized for various parts, shapes and dimensions.

## Plant technology

The SyncroTherm® plant consists of a pressure-tight chamber in the front which serves primarily as quench chamber as well as loading chamber. The treatment chamber located behind

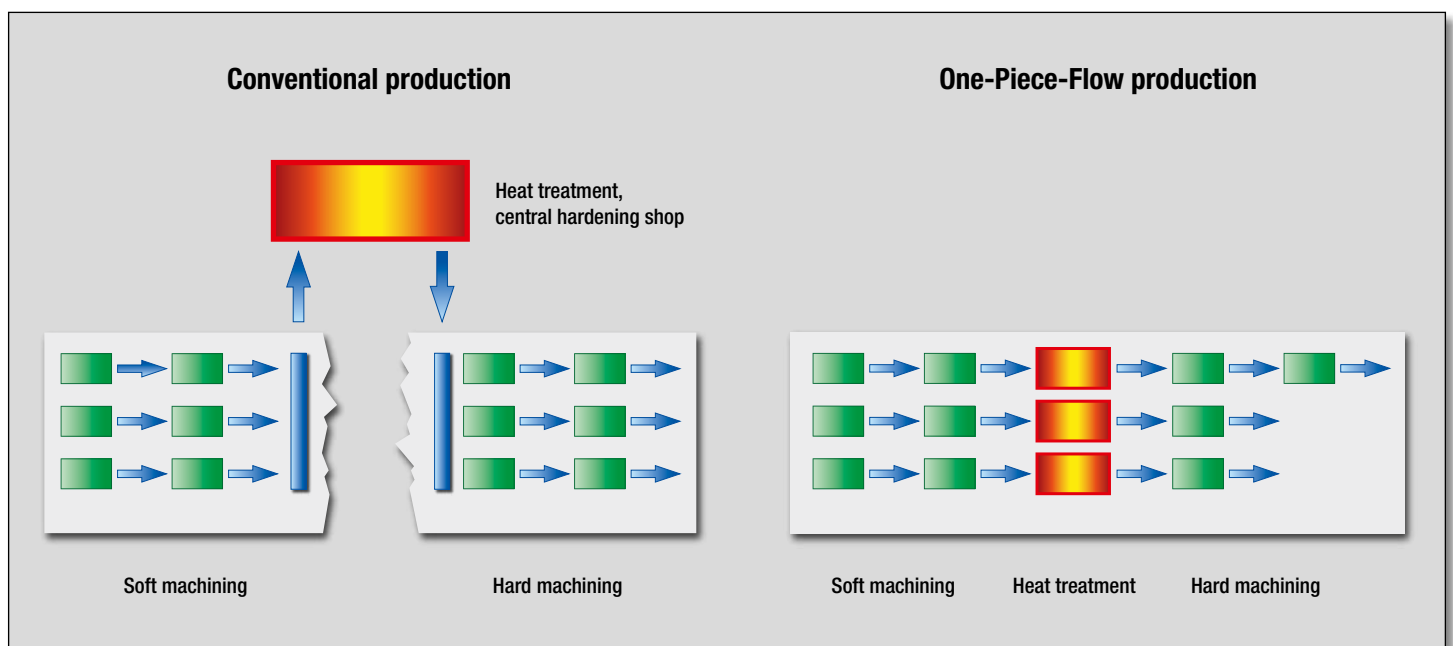
this chamber comprises a cold loading area with telescopic loader and up to six hot zones which are arranged one upon the other. Each hot zone may hold one workpiece carrier. The treatment chamber always remains under vacuum and is separated from the quench/loading chamber by a pressure-tight door.

## The Process

The external handling system places single parts on the workpiece carrier and transports it through the front opening in the quench chamber, which now serves as a loading chamber. The chamber is evacuated in order to remove unwanted oxygen. The telescopic loader, integrated in the treatment chamber, proceeds to place the workpiece carrier into a vacant hot zone. In the hot zone the strong radiant heat rapidly and homogeneously heats the parts to treatment temperature, followed by carburization

and diffusion. Temperature and process gas supply are controlled independently in each hot zone.

After carburization, the telescopic loader returns the workpiece carrier with the carburized parts to the quench chamber. The chamber is flooded with quench gas (nitrogen) to a maximum pressure of 6 bar. The installed gas circulator directs the gas flow over the parts for rapid and homogeneous quenching. Subsequently, the chamber is ventilated and the workpiece carrier containing the casehardened parts is transported out of the chamber. The handling system singularizes the parts and transports them to the respective stations for further processing.



## Everything under control The SyncroTherm® Control concept

The vacuum heat treatment module ALD SyncroTherm® is equipped with an easy to operate system to control, monitor and document all processes.

### SyncroTherm® Control

The SyncroTherm® Control controls the vacuum heat treatment module ALD SyncroTherm®. This data-base hosted by a PC system supports the following functions:

- plant control
- operating modes of the plant
- recipe creation and management
- data back up
- load record generation
- alarm management
- machine parameters management
- touch-PC-solutions, integrated in switch cabinet

#### optional:

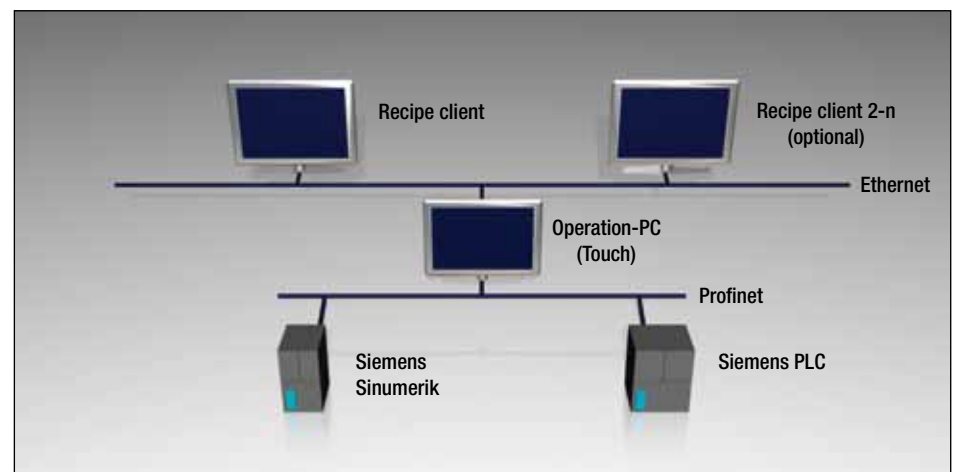
- redundant PC solutions
- connection to several recipe clients

### Plant control

The Siemens PLC manages all activities within the vacuum heat treatment module ALD SyncroTherm® and controls temperature, pressure and gas flow. The plant is operated via touch panel which communicates with a host computer, installed in the switch cabinet. The host computer manages all documentation and secures the traceability of individual processes.

### Plant operation

The control concept of the Vacuum heat treatment module ALD SyncroTherm® is designed for high operating safety standards and easy of operation. The recipe client provides convenient recipe creation and batch management. Process relevant data can be accessed and edited at all times. This saves time, prevent costs and contributes to quality management.



## Service for twenty-four-seven operation

The customer's satisfaction is our highest priority. Therefore, we have set high quality standards for ourselves. In addition to technical expertise, reliability, flexibility and highest quality, ALD is offering high service availability, creating a real added value.



### Your reliable partner

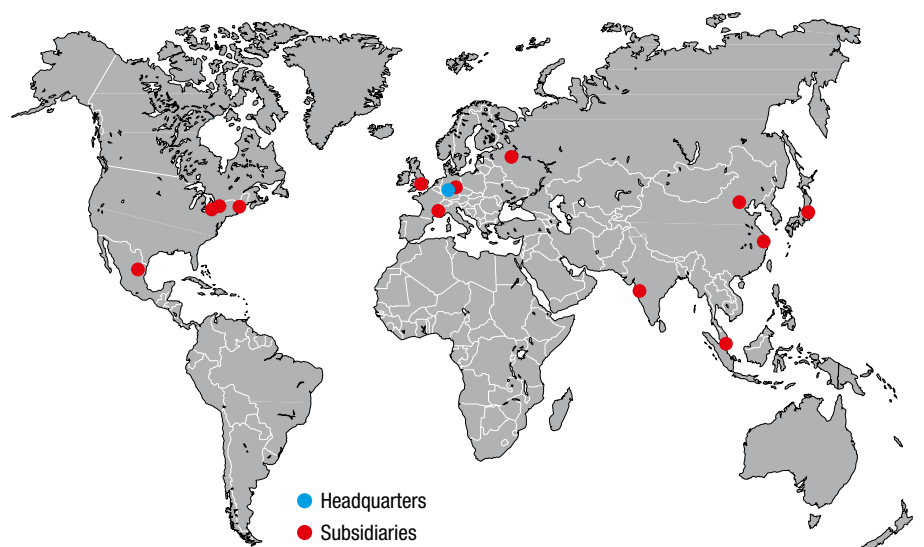
The ALD SyncroTherm® heat treatment module is designed for a 24/7 operation. In order to guarantee smooth continuous operation, ALD has set up a world-wide network of experienced specialists who offer universal service for the entire process chain. Thus, in addition to repairs, installations, preventive 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 ALD SyncroTherm® heat treatment module fast and reliably.

### Our service overview

- supply of spare parts and consumables
- repair service
- service and inspection
- modernization of plants (factory installations)
- 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 heat treatment module ALD SyncroTherm® opens up entirely new perspectives for a more effective and economic production of high-quality parts. This new and unique technology improves productivity and treatment quality – in addition to high environmental compatibility.



### Environment

- environmental-friendly process and plant technology
- dry quenching without the disposal of waste washing water
- no thermal exposure to the surrounding area of the plant
- low energy and process gas consumption
- high energy efficiency due to low thermal loss
- on-demand plant operation
- low noise emission (< 75 dB)
- no CO<sub>2</sub> emission
- clean working environment without oils, vapors and flames

### Operating efficiency

- more effective and efficient production
- rapid hardening in the sequence of soft and hard machining
- reduced cycle times
- simplified logistics
- maximum availability
- hard machining is reduced due to minimal part distortion
- easy maintenance within shortest time possible
- 24/7 service
- low consumption costs due to high energy efficiency and small gas quantities
- compact, space saving heat treatment module

### Quality

- individual processes, customized for various parts
- reduction of heat treatment distortion
- complete quality documentation for each load
- high reproducibility with easy process control
- optimal part surfaces
- high temperature uniformity
- high carburization uniformity on the part and in the charge

## Technology at a glance

The vacuum heat treatment module ALD SyncroTherm® can be precisely customized to production requirements. The most important technical data is listed as follows:

<b>Charge dimensions</b>	Length 600 mm	Width 500 mm	Height 150 mm (including workpiece carrier)
<b>Charge weight</b>	Max. 50 kg (including workpiece carrier)		
<b>Max. temperature</b>	Neutral hardening 1250 °C		Low pressure carburization 1100 °C
<b>Number of hot zones</b>	3 - 6		
<b>Max. quench pressure</b>	6 (10) bar		
<b>Space requirement</b>	Length 6 m	Width 4 m	Height 3.8 m
<b>Cycle time / workpiece carrier</b>	7.5 min		

Integration of the vacuum heat treatment module ALD SyncroTherm® in the production line FELSOMAT Flexline®





## Interested in more information?

We would be glad to provide details about efficiencies and various advantages of the ALD SyncroTherm® heat treatment module and integration of this system into your production process. Please contact us!

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