

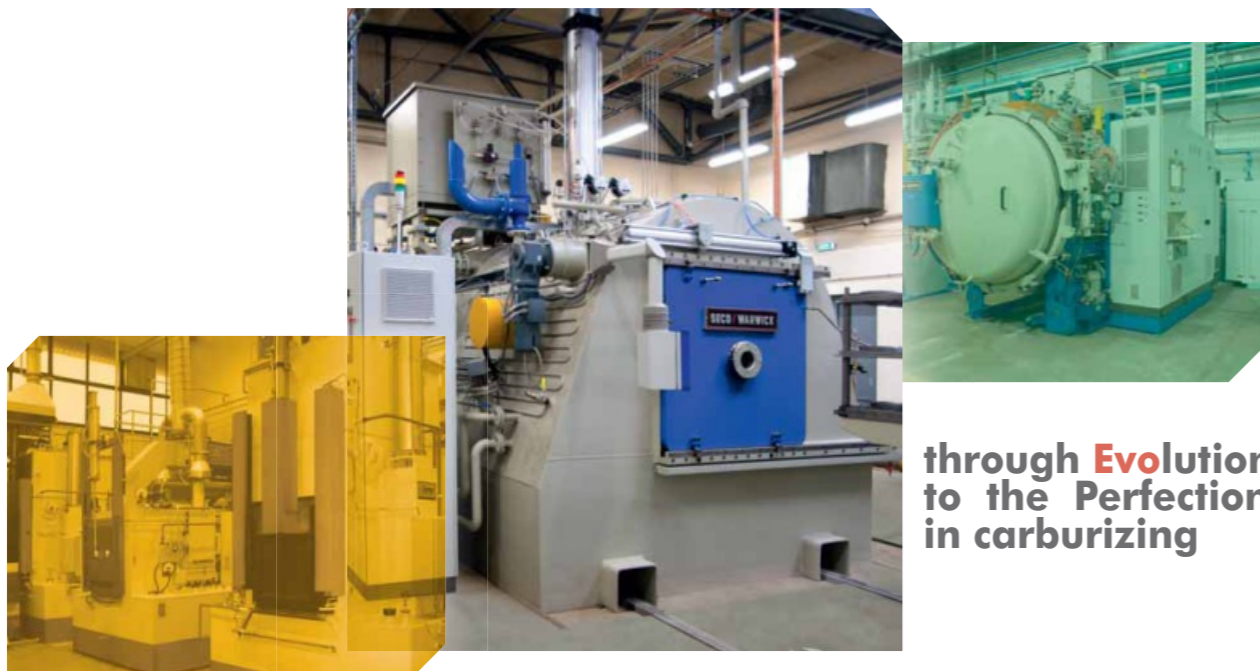


**SECO/WARWICK**

# CaseMaster **Evolution**

Spare Your Time, Save Your money  
when carburizing within state of the art furnace

# economic generation of sealed quench furnaces



through **Evolution** to the **Perfection** in carburizing



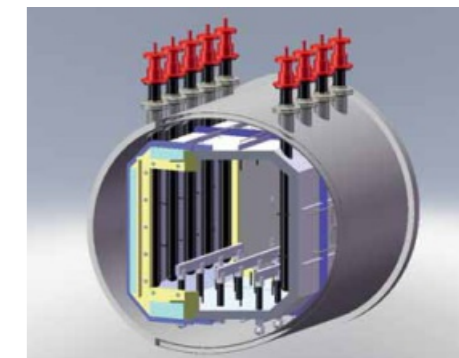
# Aviation Automotive Machine-building Bearing Commercial Heat Treating Industry

## Applicable Technologies

- ▶ High-temperature carburizing by PreNitLPC®
- ▶ Low pressure carburizing by FineCarb®
- ▶ Bright hardening
- ▶ Oxidation in the preheating chamber
- ▶ Annealing
- ▶ Tempering

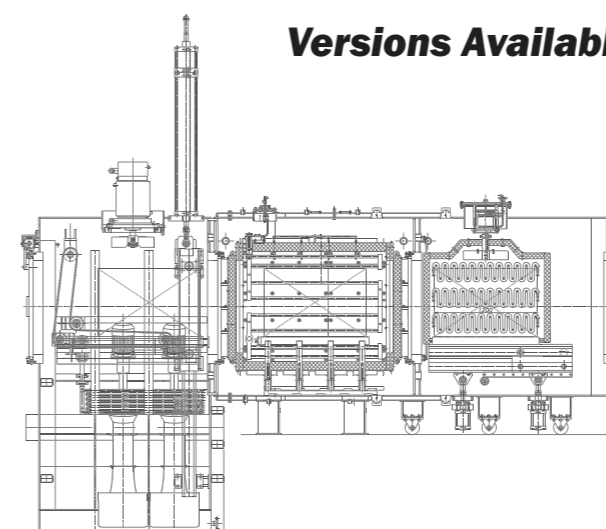
CaseMaster Evolution® MAIN TECHNICAL DATA FOR STANDARD APPLICATIONS						
Type	Size	W [mm]	H [mm]	L [mm]	Weight [kg]	Power [kW]
D/T	4	300	300	400	80	40
D/T	6	400	400	600	250	70
D/T	9	600	600	900	600	150
D/T	12	800	900	1200	1200	240
D/T	15	1000	1000	1500	2000	340

Customized version can be produced to the furnace chamber dimensions requested by customer



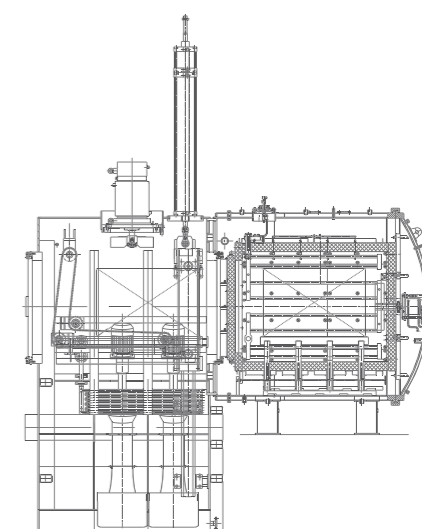
There is gas heating system available as an option – pictorial view.

## Versions Available



T – Triple chamber for continuous work flow with additional chamber dedicated separately for:

- Pre-heating, pre-oxidation,
- Pre-heating with pre-nitriding acc. to PreNitLPC® technology,
- High Pressure Gas Quenching



D – Double chamber for batch (In & Out) work processing,

**Main Advantages of CaseMaster Evolution furnaces**

Uniformity and high quality of parts following heat treatment

High temperature carburizing for the typical & special steels

High-speed & economic process performance

Very low consumption of processing mediums

Nominal temperature up to 1320°C

Oil or Gas quench features

Reduction of distortion and their repeatability

Process simulators & fully automated processing

Flexibility, no furnace idling periods, quick start up & shut down of the furnace

The furnace meets AMS2750D, AMS 2759, BAC 5621, PN-EN 98/37, PN-EN 746-1

Very short workload transport time within the furnace, fast opening & closing of internal door

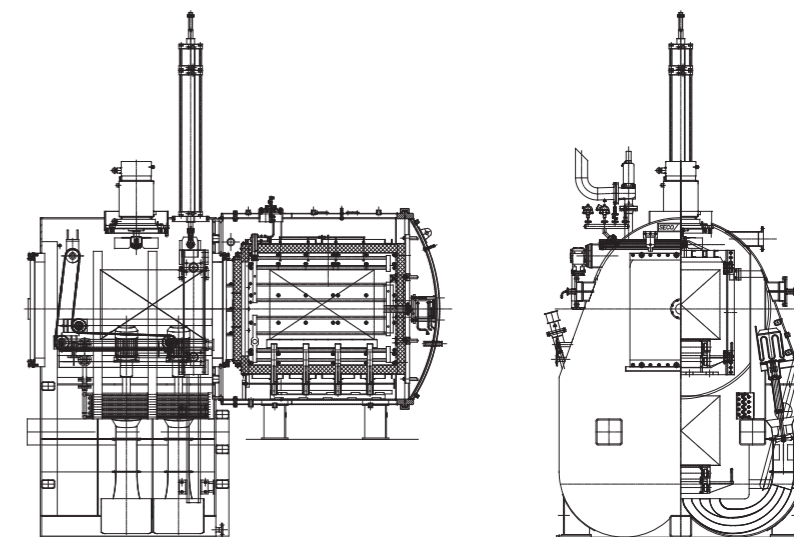
Compact and modular design

New design of an oil circulation system enabling maximum uniformity and rate of cooling



**PreNitLPC® + FineCarb® as an equipment of furnaces type CaseMaster Evolution in comparison to controlled-atmosphere furnaces type Sealed Quench allow for:**

- ▶ Shorter carburizing cycle time because of very high carbon transition into the workload & high dissociation rate in the pertinent temperature ranges of up to 1050°C
- ▶ Greater repeatability results in terms of parts and workloads
- ▶ No CO/CO<sub>2</sub> emission, no exhaust hoods, lack of atmosphere to utilize
- ▶ No Endothermic generators
- ▶ No furnace idling periods, quick start up & shut off of the furnace,
- ▶ Process flexibility
- ▶ Workplace safety improvement due to lack of flammable process gases
- ▶ Clean, non-toxic work environment
- ▶ Easy & intuitive process control



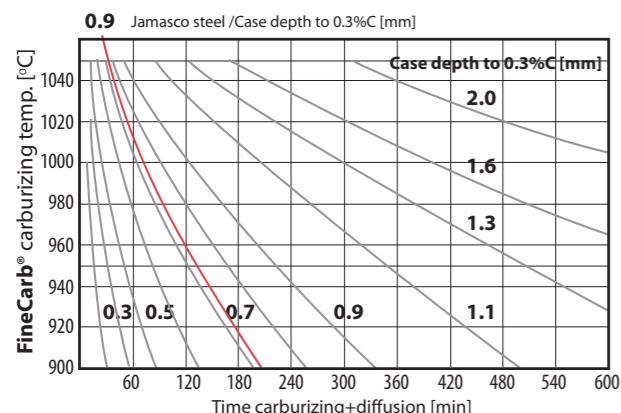


### FineCarb® – low pressure carburizing technology

Low pressure carburizing is characterized by an extraordinarily high coefficient of carbon transfer. In the initial phase of carburizing, for example, at the temperature of 950°C (1740°F), the carbon stream directed at the charge surface reaches the rate of 250 g/m<sup>2</sup>h. This means that, in the case of thin carburization layers, the process is considerably faster than the gas carburizing process.

The advantage is smaller in the case of thick layers that exceed for example, .00315 inches (0.8 mm), where the carbon transfer is much more dependent on the diffusion coefficient (DC). The low pressure carburizing process may easily be carried out even at temperatures of up to 1050°C (1900°F), within the natural temperature range of a vacuum furnace. The process temperature increases up to 950-980°C (1700-1800°F), where in comparison the traditional gas carburizing processes typically

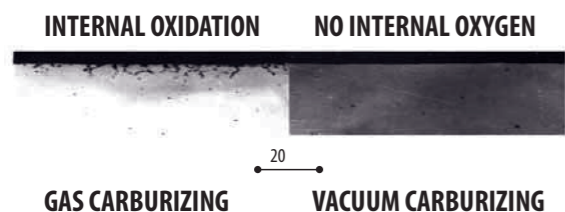
operate within a temperature range of 880-930°C (1600-1700°F). Operating at higher temperatures results in shorter carburizing cycles due to the considerable increase of the diffusion coefficient (DC). Both the increased amount of carbon in the carburizing atmosphere, and faster diffusion (Dc) are responsible for the increase of efficiency during vacuum carburizing when compared to the traditional gas carburizing.



Approximate duration of vacuum carburizing process for 16MnCr5 steels, correlated to the temperature and the required thickness of the A HT layer

- Purity of process because of multicomponent carburizing gases mixture
- Excellent carbon penetration when carburizing densely packed loads & complex shaped workpieces or blind holes parts
- Repeatable & high-speed processing
- Very low consumption of carburizing gases
- Better quality thanks to No grain boundary oxidation & precise case uniformity
- Process-simulation software package, SimVac (carburizing & gas quench simulator),
- Simplicity of carburizing of Aircraft & Alloy Steels i.e.: Pyrowear® Alloy 57, M-50 NIL, SAE 9310, Ferrium® C61 alloy etc.
- Compatible with NADCAP
- High carbon potential of carburizing gas mixture (C<sub>2</sub>H<sub>2</sub>, C<sub>2</sub>H<sub>4</sub>, H<sub>2</sub>)
- Green manufacturing process – no CO<sub>2</sub> emission

FineCarb® - The method of Carburizing Steel in an Oxygen Free Atmosphere Under Low Pressure

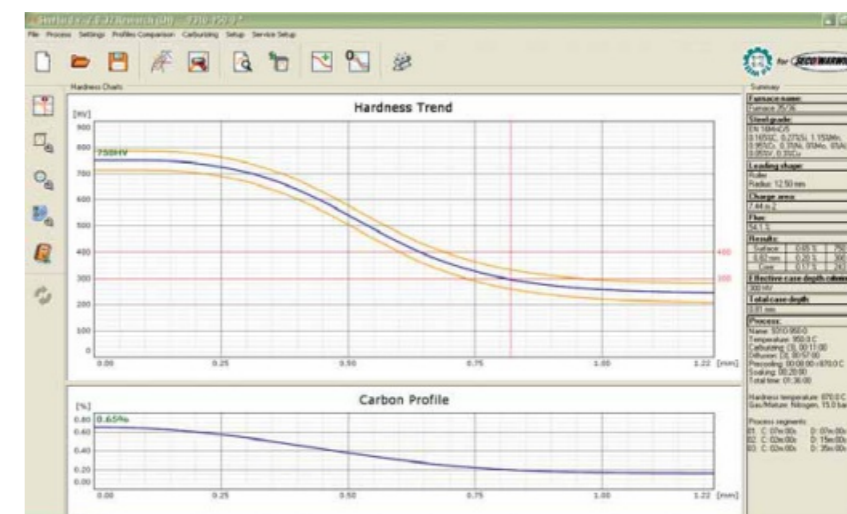
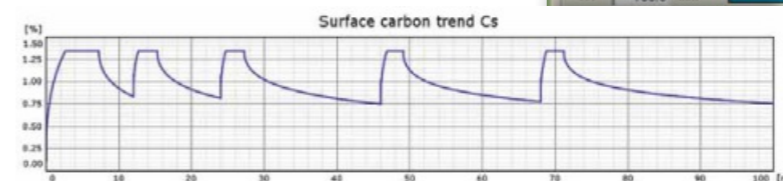


Comparison of carburizing processes

### SimVac™ – carburizing and quenching simulator

This process simulation software package enables to design and simulate the carburizing SimCarb and quenching processes SimHard, prior to running trials. Optimal design and checking of process parameters, will help to save the real process time and to avoid having scrapped parts.

- Optimal segment planning of carburizing process, divided into: carburizing and diffusion stages
- Calculations based on steel grade, size and shape of parts as well as cooling profile for hardening
- Automatic or manual simulation mode of operation
- Simulated carbon profile comparison
- Intuitive graphical interface
- Compatible with SecoVac – furnace control system

### PreNitLPC® – high Speed and economic vacuum carburizing

Pre-nitriding for low pressure carburizing, PreNitLPC®, allows the expansion of the applications of FineCarb® family of LPC Vacuum Carburizing Technology toward higher carburizing temperatures and wider range of steel grades. PreNitLPC® is a modern, fast and economic alternative of low pressure carburizing, which allows to significant intensify this process.

Through dosing of the nitrogen carrier during controlled heat up ramp, the furnace can run at higher temperatures (1000°C and above), while maintaining a fine grain structure within the

case. The strength properties are similar to work that has been conventionally carburized at lower temperatures. This technology saves process costs by reducing the carburizing

cycle time and reducing the consumption of process gases (C<sub>2</sub>H<sub>2</sub>, C<sub>2</sub>H<sub>4</sub>, H<sub>2</sub>, NH<sub>3</sub>) as measured in liters and not, as in the case of conventional technologies, in cubic meters per hour.

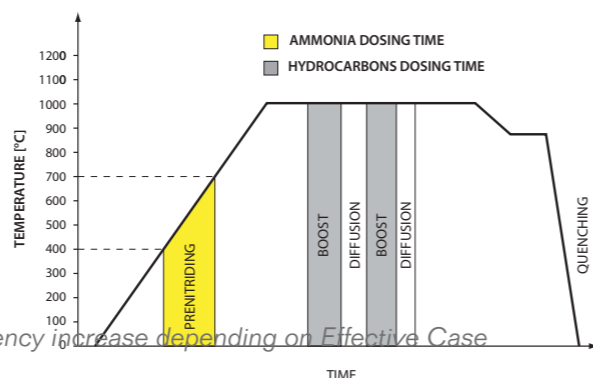


chart acc. to PreNitLPC® technology. Efficiency increase depending on Effective Case

### Technical Benefits

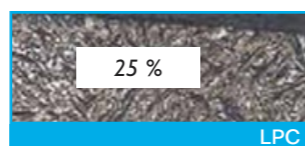
PROCESS DATA: 1000°C, 1 h, 18CrNiMo7-6

GRAIN SIZE



RETAINED AUSTENITE

PROCESS DATA: 1050°C, 18CrNiMo7-6

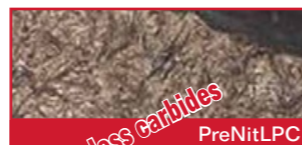


CASE DEPTH



CARBIDES

PROCESS DATA: 1050°C, 16MnCr5



### Economical Benefits

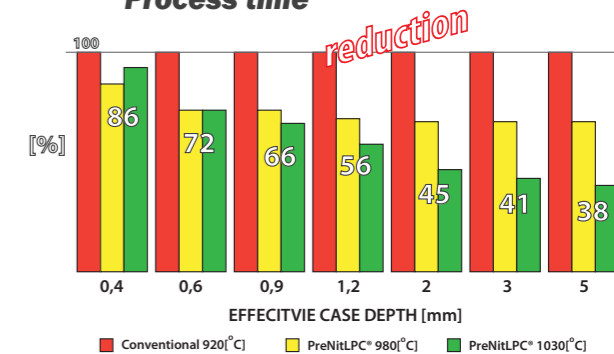
PreNitLPC® is a unique process offering total value in both cost of operation and process efficiency:

- Reduce Carburizing Cycle Time
- Lower Process Cost
- No intergranular oxidation
- Excellent Uniformity
- Optimum carbon penetration
- No CO<sub>2</sub> emissions
- Environmentally-friendly

For every 100 processes (i.e. for 0,6mm ECD) according to traditional carburizing methods, PreNitLPC® technology can offer you up to 40% in increased process efficiency. Optimum carbon penetration allows efficient heat treatment of complex shapes and the densely packed loads with superior case uniformity.

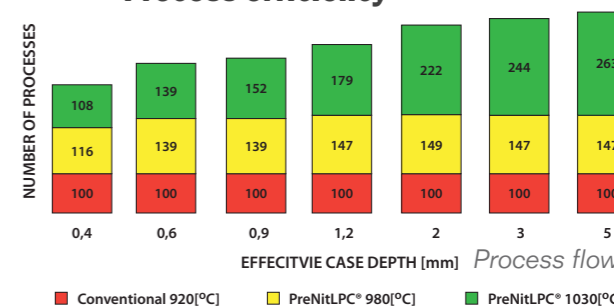
This technology is adaptable to both new and existing furnaces equipped with FineCarb® technology and may be equipped with either an oil or gas quench.

### Process time



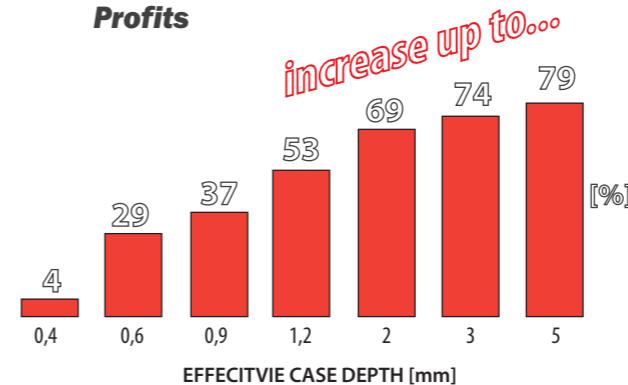
effective case depth & applied technology (Conventional, PreNitLPC®) Utility cost (electricity, carburizing gas)

### Process efficiency



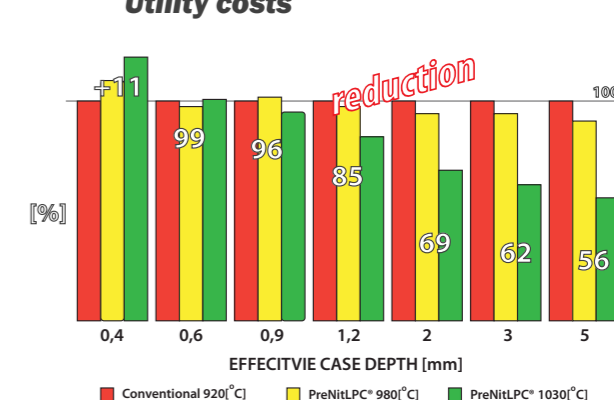
Depth The greater case depth, the greater profits increase

### Profits



evaluated on the time & utility cost reduction when carburizing acc. to PreNitLPC® Total process time reduction depending on applied technology (Conventional, PreNitLPC®)

### Utility costs





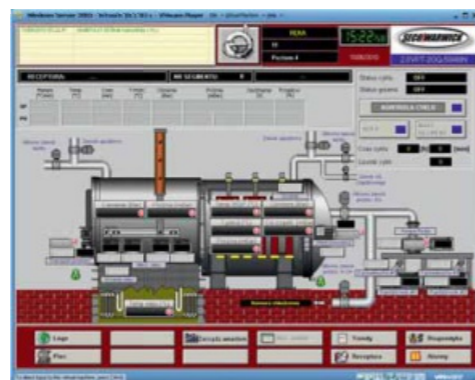
**SecoVac – automatic control systems**

**Aspects of maintenance and control**

- ▶ Functional, simple to use, intuitive system
- ▶ Full visualization, comprehensive management of emergency situations
- ▶ Automatical generation of predefined reports (graphical & numerical versions) and their export to external files
- ▶ The hierarchy of user access levels
- ▶ Custom setup of all data analysis charts and printouts
- ▶ Full integration with SCADA software – no need of extra software

**Aspects of operation management**

- ▶ Operation time counters, ability to plan periodic reviews
- ▶ Viability monitoring of the thermocouples
- ▶ History of operation of the equipment
- ▶ Media consumption counter, with an option to be informed of the need to supplement
- ▶ Two-stage warning alarm – color coding allows immediate identification of alerts
- ▶ Easy system backups



**Aspects of management**

- ▶ Integration with the superior company management systems
- ▶ Data security - different levels of user's access
- ▶ Optimization of production on the basis of collected information
- ▶ Work time saving by automation of the production

**Aspects of production technology**

- ▶ A friendly programming of the machining process
- ▶ Advanced Process Management (Unlimited number of recipes)
- ▶ System resistance to the wrong technological programs
- ▶ Programmable by a calendar delayed start of the process with an option of GSM notification
- ▶ Long-term data logging and remote access to archived information
- ▶ Application browser provides "read – only" access to data



**Auxiliary equipment**

**High & Low tempering furnaces**

**Washing machines**

**External Closed Loop Water Cooling System**

The CLWS is designed to collect the heat from all elements of the furnace which are exposed to the high temperatures, i.e. heating chamber casing, convection fan motor, power feedthrough etc.

The CLWS includes among others: coolant tank, pump assembly, heat exchanger, instrumentation, etc.

**Advantages:**

- ▶ Lack of waste water,
- ▶ Stable temperature of the furnace skin
- ▶ Maintenance of cooling medium parameters (hardness, temperature) at a preset, constant level
- ▶ Extension of the life of the furnace equipment items which require cooling
- ▶ Emergency water supply for charge & furnace protection

**Mobile loading and unloading machines**

**Loading trays**

**Gas buffer tanks**

**Others**





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