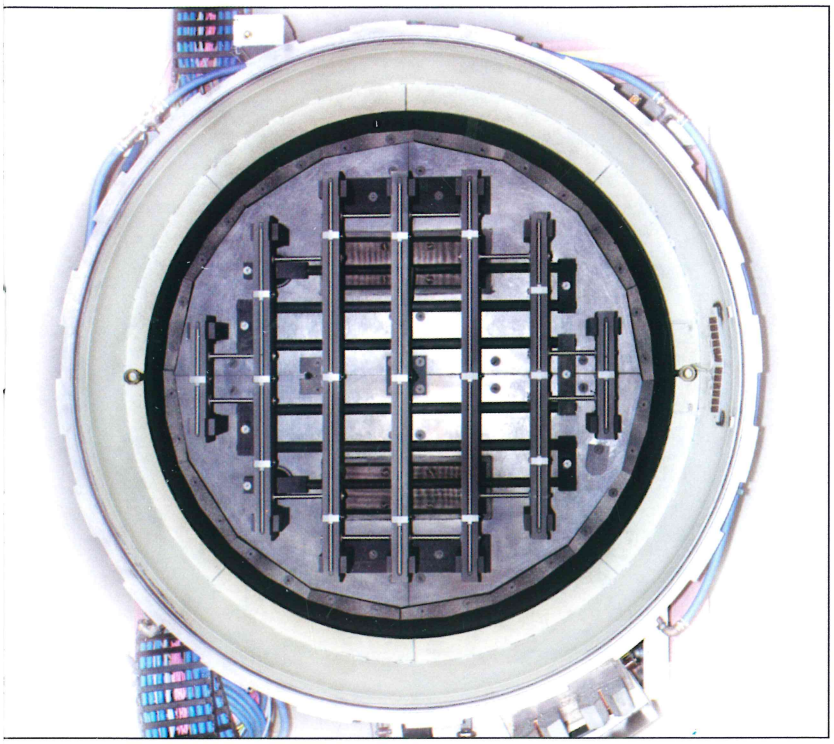
What you should know about Ipsen's vacuum technology.

Vacuum furnaces across the entire treatment range.

With Ipsen vacuum furnaces, not only can you carry out conventional heat treatments, you can also carry out more demanding treatments. Transformation of the grain structure under vacuum as well as the subsequent quenching with cooling gas result in optimum hardness and a bright workpiece surface.



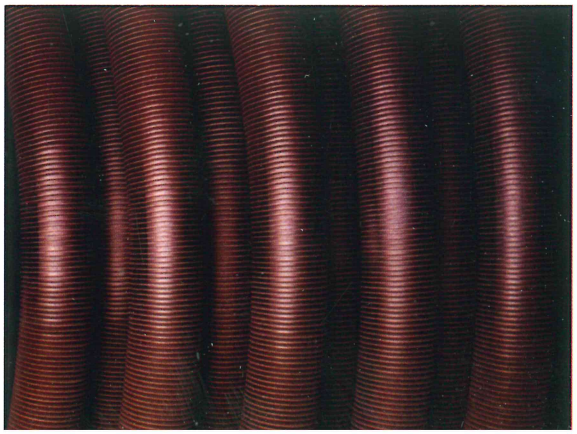
The furnace floor of a vertical vacuum furnace

Where does the use of Ipsen vacuum technology make sense? Basically wherever special steel grades are to be produced by hardening or where it is desired to keep as large as possible a number of usage options open. For example, vacuum furnaces enable the braising of joints which can be thermally or mechanically highly loaded. Therefore, the most important applications for Ipsen vacuum technology are in the aviation and aerospace industries, in jet engine assembly, nuclear technology, medical technology, not to mention contract heat treatment shops or automotive engineering.

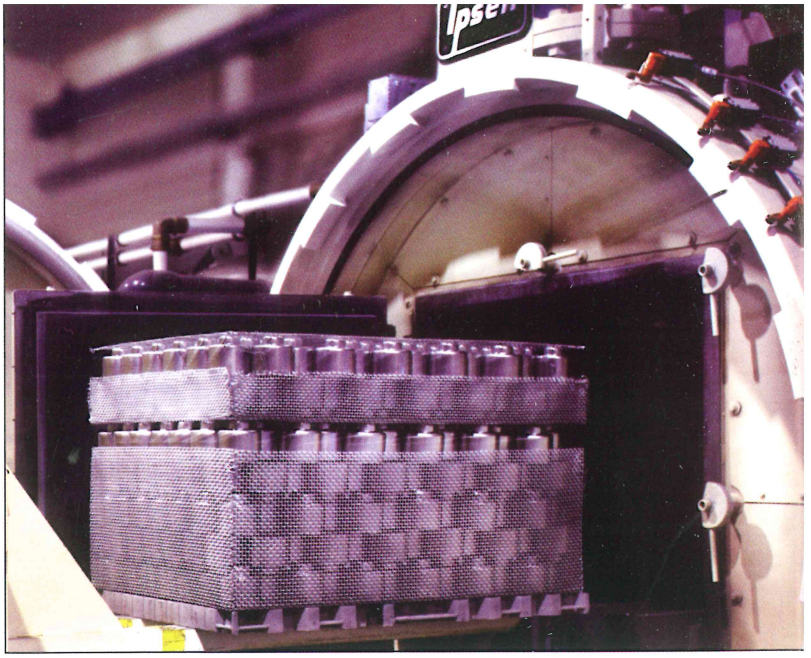
The advantages of heat treatment in an Ipsen vacuum furnace are obvious: the edge zones of the workpieces remain free of oxidation and decarburisation, also complex geometry workpieces can be treated with minimal or no distortion. Ipsen vacuum technology stands out in particular because it provides a high, constant quality level and with it ensures that desired, repeatable treatment results are always achieved.

In addition the following processes can also be carried out (in alphabetical order): AvaC® (low pressure carburisation), AvaC®-N (low pressure carbon nitriding), bright hardening, bright annealing, solution annealing, bright tempering, degassing, hard and high-temperature brazing, sintering and SolNit®.

How is a vacuum furnace constructed? At the centre of Ipsen's vacuum technology is a round or rectangular heating chamber. Its heat insulation is based on various steel plates and graphite layers. If graphite is used, it is either completely protected or protected in critical positions using a CFC (carbon-fibre reinforced carbon) barrier – a high-performance composite fibre material, because during high pressure gas quenching there is a high degree of surface wear. This considerably extends the service life of the chamber.



The ribbed and, therefore large surface area, copper heat exchanger ensures intensive recooling of the cooling gas flow.



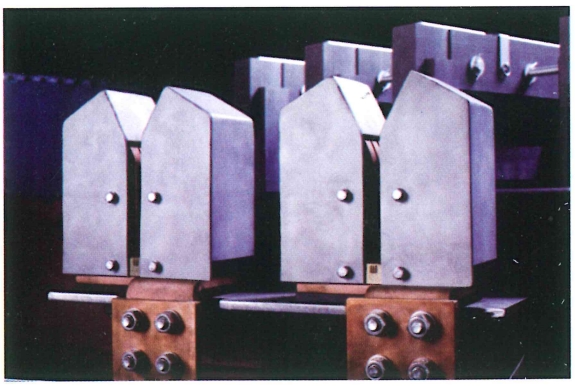
Charging a
Turbo² Treater

To heat the chamber, Ipsen uses low voltage heating elements made from molybdenum or graphite, which are distributed over the inside of the chamber walls. To achieve optimum uniformity and through heating of the workpieces, even with high charge densities, the heating circuits can be subdivided into several zones and controlled independently of each other. As a rule, Ipsen vacuum furnaces with graphite insulation are equipped with a convection heating system. In this system, after evacuation of the furnace, nitrogen is added to accelerate heating up because the nitrogen permits convection heating up to a temperature of 850 °C. As a result, not only is the heating-up time greatly reduced, but tempering cycles can also be carried out at low temperatures with very even temperature distribution.

Which explains how Ipsen's vacuum technology can be so optimised that its energy and resource consumption is extremely low. Thus, not only are the latest environmental standards met, but also a particularly economic operating mode is made possible.

High gas flow speeds and uniformity, quick and precise control of the gas flow. Its only when everything is right here that the result is also right: an optimally quenched charge. Which is why Ipsen equips all its vacuum furnaces with an optimised cooling system. Here, you can select from vertical or horizontal cooling gas flow. If workpieces are annular, large volume or especially long, use of a radial cooling gas flow may also be advantageous. To achieve this cooling, gas inlet to the heating chamber takes place via a plenum and gas nozzles, which are arranged around the entire cylindrical surface of the heating chamber.

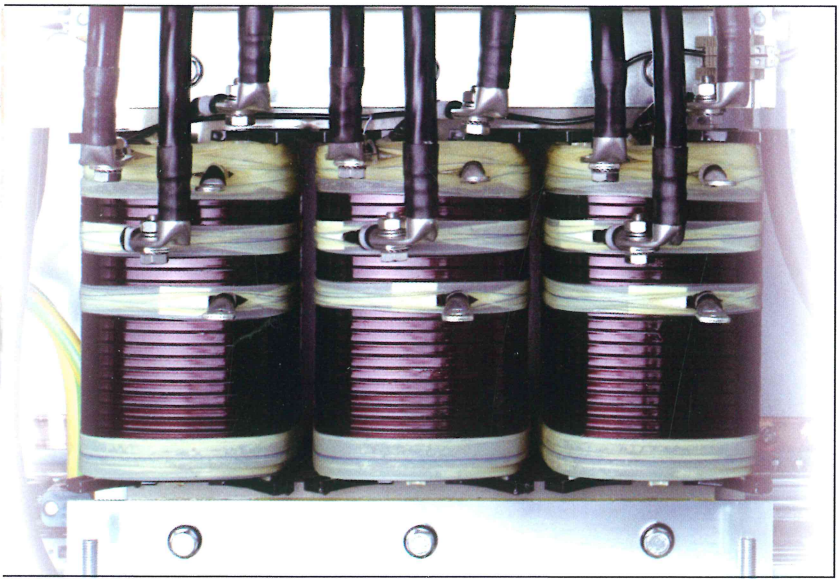
Ipsen's research and development have paid particular attention to gas dynamics within the heating chamber, as it is only by optimising the cooling gas flow that distortion can be strongly reduced or even avoided altogether. Ipsen worked closely with external institutes to investigate the cooling gas flow using mathematical models (CFD) and experimental verification in test furnaces. The results gained were, in particular, used to optimise the construction of the gas introduction equipment, the design of the gas distribution grid and the arrangement of the heat exchanger. The result: gas dynamics which ensure that the cooling gas flows uniformly through the charge across its entire extent.



Flow coupling
into a vertical
vacuum furnace

Quick and economical: The LCP start.

Energy is expensive. And therefore anything which saves energy can only be a good thing. It is just as well then that Ipsen has its patented LCP start – it considerably reduces the otherwise comparatively large energy consumption of the cooling motor used in high pressure gas quenching.

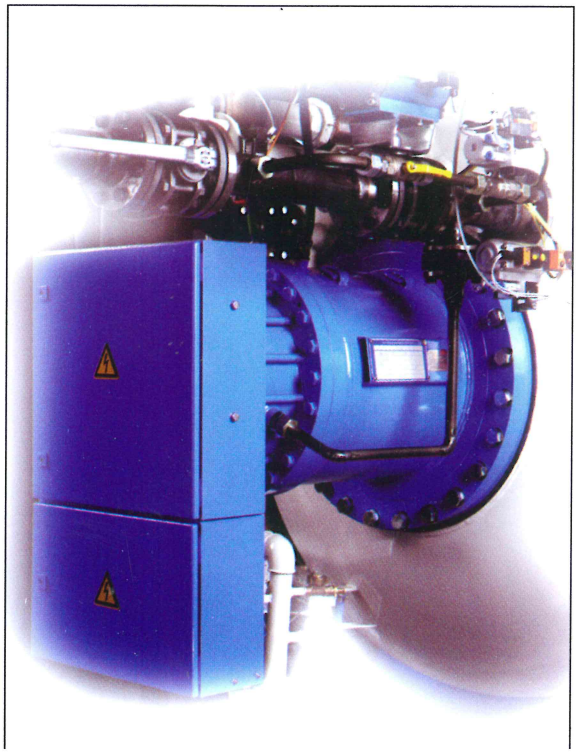


The transformers used in the LCP start of the cooling gas ventilator

Peak current is particularly expensive. It arises unavoidably when starting a cooling gas fan at the beginning of high pressure gas quenching – regardless of whether a direct or soft start is used. During a conventional start, the motor can only be started after a pressure of some 1,000 mbar absolute is achieved and then moreover only with a current 10 or 5 times the rated current. This is where Ipsen's patented LCP-Start (Low Current Power Start) really saves energy. Its use means that current consumption in the peak load range is, at 2.5 times the rated current, drastically reduced. So how does LCP start work?

In contrast with conventional systems, the cooling motor starts shortly before the cooling phase begins, i. e. while there is still a vacuum. This is made possible by an ingenious reduction of the supply voltage in the start phase. An intentional side effect of this method is the markedly increased cooling intensity at the start of cooling. After the furnace heating is switched off, the cooling gas flows into the system during a filling process until the required cooling gas pressure is reached with the cooling fan running at full speed. Therefore, the time between the end of the heating phase and attainment of the desired cooling gas pressure can be drastically reduced.

Moreover – a considerable amount of energy can also be saved here: optional cos phi switching of the heating transformers (Ipsen patent) reduces the idle current during the vacuum furnace's stop phase. Through special switching of the heating transformers, the power factor cos phi, and with it the efficiency, can be greatly increased during the stop phase, which can at the same time reduce the idle current fraction during this phase by up to 40%.



View of the Turbo® Treaters powerful cooling motor

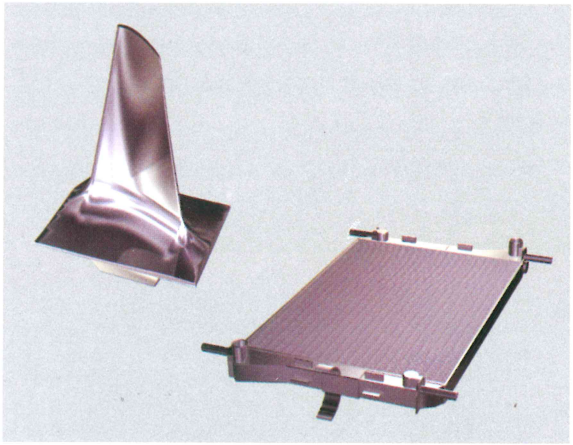
There's a better alternative: Vacuum Brazing.

The cost-effective and environmentally friendly manufacture of many high-quality products made of stainless steel, ceramics or aluminum can be done only in a vacuum. For these applications, Ipsen offers manual, semi-automatic and fully automatic single- or multi-chamber furnaces

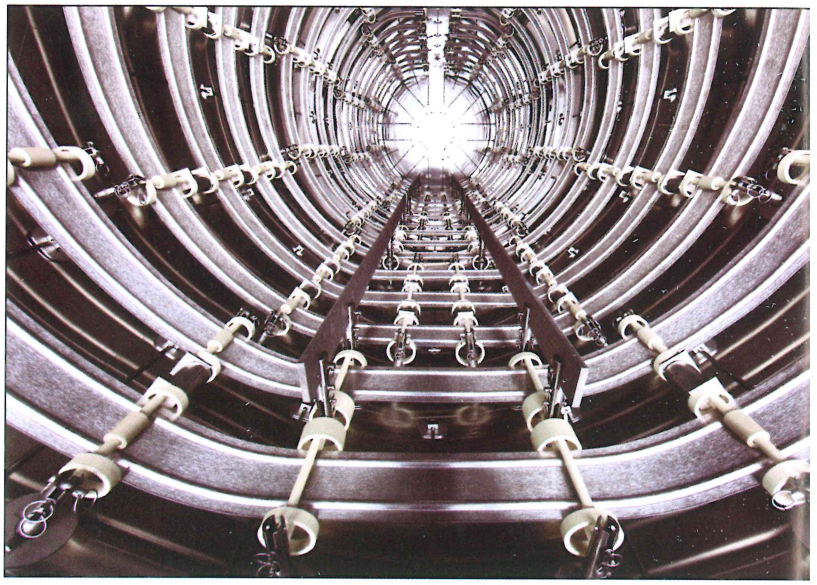
Two processes are used here: Brazing, primarily of aluminum in a high vacuum, and high-temperature brazing.

The fluxless brazing process for aluminum uses brazing alloy containing magnesium, in the form of brazing strips. Here – before the brazing alloy begins to flow – when the aluminum-oxide skin heats up, it cracks open and is then stripped off by the vaporizing magnesium.

High-temperature brazing under rough, medium or high vacuum is particularly appropriate for joints that will be subject to high thermal and mechanical loading. As a rule, nickel-based, copper-based or noble-metal-based brazing alloys in the form of crystalline foils, thin plating, powder or pastes with a liquidus temperature of over 900 °C are used.



The fluxless brazing process is particularly environmentally friendly, since no aggressive fluxes are applied, the removal of fluxing agent residues is not an issue and in addition no after-treatment of the components is required. The quality of the brazed joints is also better: By preventing flux inclusions at the interface between the base metals, which can affect the mechanical strength or corrosion resistance, they provide significantly more reliable joint strength.



The new Ipsen all metal chamber for hard brazing and high temperature brazing

So the advantages of vacuum brazing in Ipsen brazing systems are obvious: They offer precisely configurable furnace atmospheres and fast temperature control and guarantee exemplary temperature uniformity. Moreover, Ipsen's vacuum technology also offers outstanding efficiency for brazing.

TITAN – the big little one from Ipsen.

The Titan is the latest member of Ipsen's Vacuum Technology family – a highly compact vacuum furnace and the ideal universal tool for contract hardening plants or any companies or research institutes that would like to perform their own heat treatments or expand their product lines.

Easy to install and easy to operate – those were the goals Ipsen set for itself and solved with the Titan. Installation of the Ipsen Titan is a piece of cake: Because it comes pre-mounted on a base plate with casters, it can be moved to its location with the assistance of a forklift and can be up and running within one workday.

It is also easy to operate. It was designed so that even users without heat-treatment expertise can quickly learn to operate it and produce excellent results. The Titan is programmed and controlled via a 17" swiveling monitor that is attached directly to the furnace. The user guidance system supports 21 languages and all the conventional units of measure. It is self-explanatory and intuitive. And the completed processes can be directly evaluated and documented for later use.

All six of the common heat-treatment processes – annealing, hardening, brazing, solution annealing, stress relieving and tempering – can be performed quickly and easily. And with an impressively high level of efficiency. The terminal control gives the user access to over 1,000 process variations. Meaning that the Titan offers all the options you need. Because it can generate temperatures of up to 1,315 °C with a consistently outstanding uniformity of ±5 °C.

This makes it particularly well suited for use in industries that place the most exacting demands on heat-treatment quality – including the machine-building, tool manufacturing, medical technology, aviation and aerospace industries.

The Titan is particularly well suited for treating smaller loads or single workpieces, which makes operating it less resource-intensive.

Patented processes: AvaC® and SolNit®.

Ipsen proudly presents: Two innovative, patented processes, which can only be run using Ipsen vacuum furnaces – the low pressure carburisation process AvaC® as well as the SolNit® process. Both controlled using the process software Vacu-Prof®.

Vacu-Prof® enables precise and individual control of the process.

AvaC®, acetylene low pressure carburisation, is a proven alternative to conventional carburisation processes. The advantages in comparison with gas carburisation are obvious: AvaC® offers, alongside a completely oxide-free surface, the highest possible level of carbon transfer. The process can be easily controlled, while at the same time yielding highly reproducible results – amongst other things, particularly uniform carburisation, even with complex geometries such as blind holes.

In addition it stands out because of its favourable environmental credentials – both process gas and energy consumption are comparatively low. In addition, the dry, high pressure gas quenching minimizes any distortion tendency, while washing of the workpieces after quenching is not necessary. If the carburisation process is run at high temperature (e.g. 1,050 °C), then the cycle duration(taking into account the grain structure requirements) can be considerably reduced in comparison with conventional processes.

The process variant, AvaC®-N, offers low pressure carbon nitriding with acetylene and ammonia. It combines the advantage of low pressure carburisation with those of carbon nitriding. The steels hardened with this process display higher temperature resistance, improved hardness and increased resistance to wear. Both processes can be directly integrated into any production line without any special adaptations.

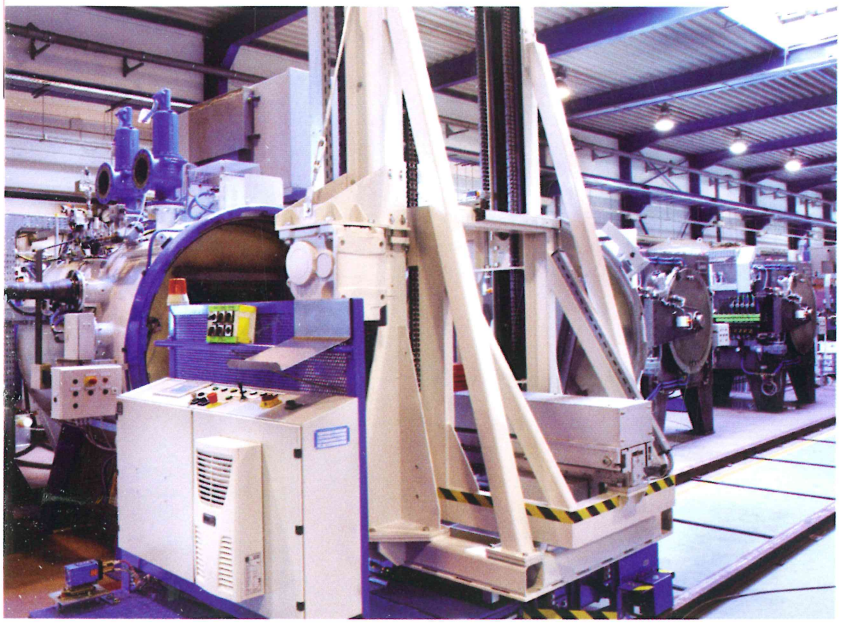
The innovative SolNit® process is particularly suited to the production of corrosion-resistant and, at the same time, particularly hard steels. By nitriding the surface layer up to a depth of 0.1 to 3 mm, austenitic as well as martensitic rustproof steels can be surface layer hardened. In so doing, inclusion of nitrogen atoms leads to markedly higher strength and, at the same time, improved corrosion resistance. The two process variants, SolNit®-M and SolNit®-A, can thus be used to produce highly loadable steels for use in roller bearings and tools, pumps and turbines as well as for medical instruments and chemical installations.

Moreover, these processes can be controlled using the Ipsen Software Vacu-Prof®, which is remarkable for its ease of use and high reliability and accuracy.

Well advanced: The transport system.

Charging and discharging of vacuum furnaces can be executed completely automatically. Not only that, the production software AutoMag® means Ipsen vacuum furnaces can also be seamlessly inserted into the production line.

Ipsen transport systems ensure reliable production processes.



To permit integration of vacuum furnaces into production and manufacturing processes Ipsen provides fully developed transport and storage systems – both automatic charging and discharging systems as well as intermediate storage systems and roller conveyors. The systems can be configured so that the charges can be accessed in any order or so that they are processed based on a “first in/first out” principle, in a saved sequence. To enable fully automatic control, automation and charging of the furnace systems and their peripherals, the proven AutoMag® production software is used. It offers a complete system overview, controls the automatic transport and permits data exchange with ERP systems such as SAP or Infor.

The Service. All included.

The optimum solution is one-stop supply: alongside its furnaces and systems, Ipsen offers optimum service, 365 days a year, 24 hours a day.

To conclude then, a few words about Ipsen’s service. Hardly any other engineering product lasts as long as an Ipsen vacuum furnace. This is because of the quality of our furnaces. Nevertheless they need professional servicing. And to achieve this we provide you and our

Nevertheless should a repair be required: You can reach our service hotline +49-172-2533910 365 days per year, 24 hours a day, so that our service technicians and engineers can help as quickly as possible. And we have got even more in stock: the largest spare parts range in the world

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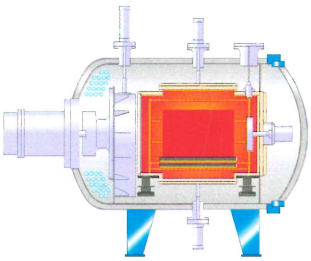
A quick look at our range.

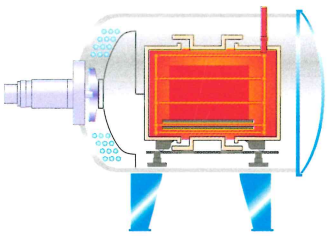
Ipsen's vacuum technology is delivered in various standard sizes. Thanks to its modular design, it can be supplied in a wide range of technical types, matched exactly to our customers' needs.

Ipsen's vacuum furnaces are available both as single chamber and as multi-chamber versions. And: Alongside standard sizes, Ipsen offers custom manufacture of special types. Essentially though, the choice is between two different types: vertical or horizontal.

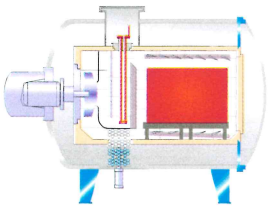
Turbo[2] Treater – increased quenching speed, uniform cooling. Flexible dynamic cooling system with vertical loading options. Can be adapted to a wide range of materials, geometries and charges. Advanced convection design with circulator. Max. cooling gas pressure: 20 bar. The Titan is the smallest furnace in the Turbo[2] Treater family.



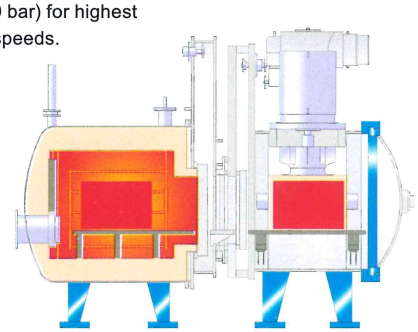
GL Type – High-temperature furnace with horizontal charging system designed for universal use. Vertical cooling gas routing from top to bottom through labyrinth apertures. Max. cooling gas pressure: 1.49 bar absolute.



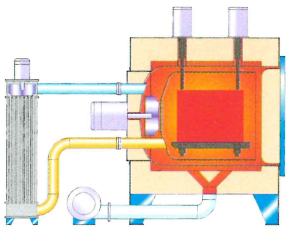
VDFC Type – Tempering furnace for inert gas heat-treatment. Treated parts have high surface quality. Very even temperature distribution. Compact, robust design, requiring little maintenance.



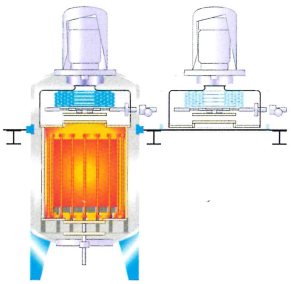
RVHT-QGP Type – Twin chamber vacuum furnace with separate heating chamber and high pressure quenching chamber (up to 20 bar) for highest possible quench speeds.



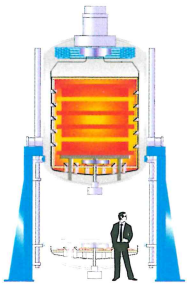
Multi Treater® Type – Specific benefits: Suspended batch table for a load up to 5 tons. The furnace comes with a retort for heat treatment under protective atmospheres. Effective atmosphere recirculation ensures very uniform temperature distribution and short heat-up times. Additional fast cooling device. Designed for a wide spectrum of possible applications. Blank annealing, nitriding, nitrocarburising, pre- and postoxidizing etc.



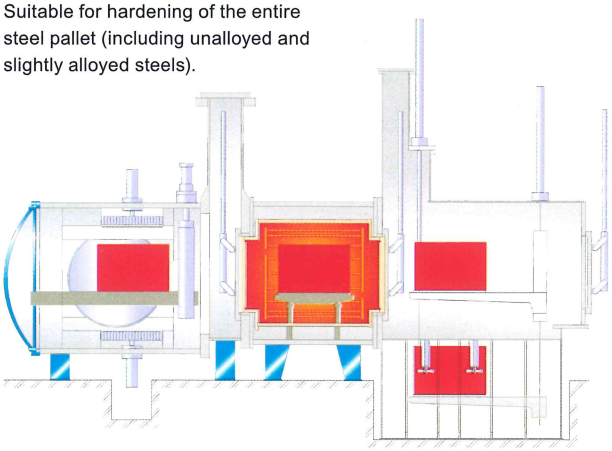
VVFC/VVTC Type – universal vertical vacuum furnace, available with recirculation fan for forced quenching. Easy charging from the top. Different charge racks allow parts to be either suspended or stand upright. Very little distortion of long and narrow parts. Cooling is either under vacuum, inert gas or recirculated inert gas. Integrated gas recooling system. Movable roof and base hatches. Max. cooling gas pressure: 20 bar.



VR/VRK Type – universal vertical vacuum furnace. Radial and axial cooling gas routing. Internal recooling gas cooling system. Recirculation fan for convection heat transfer, ensuring low gas consumption levels for combined hardening and repeated tempering. Max. cooling gas pressure: 20 bar.



FRVOQ/FRVC Type – three chamber vacuum furnace with high pressure gas and oil quenching chamber. Suitable for hardening of the entire steel pallet (including unalloyed and slightly alloyed steels).



About Ipsen.

At Ipsen, we believe that innovation drives excellence. With more than 65 years of thermal processing experience, choosing Ipsen means choosing a partner in success.

Since 1948, Ipsen has been inventing and evolving new technologies and heat treatment processes, as well as designing and manufacturing industrial vacuum furnaces, atmosphere furnaces and supervisory control systems. The outcome of our work: energy-efficient furnaces and plant systems, as well as unrivaled products that are in demand all over the world and used by leading companies. Overall, Ipsen's international product range combines the highest performance with outstanding reliability and is used in the fields of atmosphere, vacuum, braze and sinter technology.

Additionally, Ipsen's newest 360-degree service, Ipsen Customer Service (ICS), considers every aspect of your processes and the entire life cycle of your system, thus delivering top performance and high reliability. With vast technical expertise, ICS is by your side every step of the way to success – including getting your system up and running, providing speedy service that helps prevent downtime and helping ensure your equipment is optimized to take the lead.

Ipsen's sophisticated industrial furnaces and equipment are developed for a wide variety of thermal processing markets, including: Aerospace, Automotive, Commercial Heat Treating, Industrial Machinery, Medical, Tools and Wind Power. With production locations in Europe, America and Asia, along with representation in 34 countries, Ipsen is committed to providing support for customers worldwide.

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