

Wind energy needs Ipsen.

Hard work wins



# Wind turbines can be quite expensive. Especially for their manufacturers.

Wind turbine manufacturers are exposed to a considerable risk: While gearbox damage is infrequent, the possibility cannot be excluded completely – and if it does occur, the manufacturer usually bears the risk for the first few years of operation.



**Expensive repairs.**  
Wind turbine gearboxes operating offshore or in high elevations can often be repaired only by helicopter.

Gearboxes are being installed in more and more wind turbines. But the demands on them are extraordinarily high. Unlike most other industrial applications, the stresses are highly dynamic and are three-dimensional. In extreme weather, the shafts, gear wheels and bearings are put to the ultimate test. But turbine failures in offshore wind farms are unacceptable, because repairing them requires the deployment of special floating cranes or helicopters and is both time consuming and very expensive. And: The long service life of up to 20 years places the most exacting demands on the longevity of these gearboxes.



**Time-consuming and complicated.**  
Wind turbines are often spread out over wide areas and in some cases are hard to reach, which significantly increases the time and effort required for maintenance.

As a result, the first priority in the manufacturing process is to ensure that the components are robust. Here, the quality of heat treatment plays a decisive role. To put it another way a manufacturer who fails to make the necessary investments in the best possible heat treatment, runs the risk of incurring hard-to-estimate warranty claims.



**Automation – cost-containment.**  
Ipsen's automation stands for ease of use, efficient process control and high operating efficiency. It can significantly reduce production costs.

With its sealed quench furnace systems, Ipsen offers a compelling, sophisticated and efficient solution for heat treating large gearbox components. With Ipsen, manufacturers and their suppliers can feel confident that they have done everything to produce the best possible products.



**The gas carburising revolution.**  
HybridCarb, the innovative gas carburising process reduces CO<sub>2</sub> emissions and process gas costs by up to 90%.



A malfunctioning wind turbine results in high costs of repairs and replacement parts, as well as downtime. This can significantly reduce the operator's revenues, thereby placing the cost effectiveness of the facility in jeopardy. As a result of some catastrophic failures of gearboxes at American wind farms in the 1980s and 1990s, the American Gear Manufacturers Association developed strict guidelines for wind turbine gearboxes.



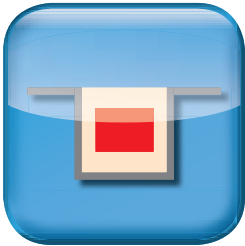
We have done the calculations.  
The result:  
Ipsen sealed quench chamber furnaces.

For decades, large gearboxes were manufactured almost exclusively using pit furnaces. But there is something better – both from an efficiency standpoint and in terms of ensuring the quality of the heat treatment results.

The pit furnaces have been known for thousands of years. Until recently, they have been considered the only solution for the heat treatment of particularly large workpieces. Today, there are alternatives. So is the pit furnace still the optimal technology?

Ipsen has researched the cost effectiveness of various heat treatment plants. We compared the costs of manufacturing large gearbox components in pit furnaces and in box furnaces, sealed quench chamber furnaces and vacuum furnaces. We included the investment, energy consumption and running costs. The result: While the sealed quench chamber furnace line costs more to buy, it generates higher profits than pit furnaces and vacuum furnaces and after three years is the clear winner in every scenario. Only the box furnace line is more cost effective; however, it requires higher unit costs, due to cleaning and grinding operations. Also oxidation occurs when the workpiece is being moved from the furnace to the quench significantly increasing the risk of workpiece failure.

Therefore, for heat treating large gearbox components, the sealed quench chamber furnace line is superior to other technologies, especially in terms of cost effectiveness and quality. So it pays off. Especially, if it is from Ipsen. You will soon see why.



**Pit furnace method.**  
The load is placed into the pit furnace and moved to the oil quench bath with the assistance of a manually operated crane system. Exposing the hot load to the air leads to the formation of scales that cannot be completely removed, even with an abrasive blasting process. Moreover, the open furnace and open oil bath are safety hazards.



**The chamber furnace principle.**  
Chamber furnaces are loaded horizontally or vertically and can be fully or semi-automated. By integrating the oil bath in the furnace, air contact with the load is avoided and consequently so is any scaling. Similarly any undesirable oxidation or surface decarburization of the gearbox parts cannot happen. In the long term, this represents the most efficient solution. With a box furnace, the heated load transported through air to the quench bath. The consequence: scaling, which can lead to early failure of the gearbox part.

Comparison of system concepts

	Pit furnace	Chamber furnace without oil bath	Chamber furnace with integral oil bath
High heat treatment quality	–	–	+
Low scale formation	–	–	++
Low surface oxidation	–	–	++
Low surface decarburization	–	–	++
Uniform quenching	–	+	+
High core strength	–	+	+
Short cycle-/cycle times	–	+	+
Simple automation	–	+	+
Complete documentation	–	+	+
High safety	–	+	++
Short payback time	–	+++	+++



Modern planetary gears are high-tech machines. Amazingly, manufacturers are still heat treating components using a furnace method that has been around since the Bronze Age: the pit furnace, which is basically a big, fiery hole in the ground. A sealed quench furnace is not only the safer, more reliable and higher-quality alternative for treating large transmission components, but also the one that is substantially more cost-effective.



# Ipsen. If only every decision were this easy.

Ipsen is the only company offering one-stop shopping for all heat treatment components. From simple furnaces to complex systems – all incorporating the latest technology. The latest success from Ipsen's Research & Development center: HybridCarb – a revolutionary gas-carburising process. HybridCarb is an innovative gassing technique: Instead of being burned off, the process gas is fed back into the heating chamber in a recycling process. This reduces both CO<sub>2</sub> emissions and process gas costs by up to 90 %.

Other Ipsen technologies also facilitate the efficient heat treating of gearboxes: Process control software and hardware make operating one of our systems as easy and reliable as possible. Every component is fine-tuned to match the underlying furnace technology, thereby yielding markedly better results including reduced production time and costs, increased quality, improved repeatability and the highest level of operational safety and reliability. And with SuperQuench®, the high-performance oil bath, Ipsen delivers the technology that makes it possible to significantly improve the case depth in critical gear areas.

All Ipsen heat treatment systems are distinguished by their long service life and ability to provide fast, uncomplicated and cost-effective production. Ipsen provides excellent service – 24 hours a day, 365 days a year. Ipsen supplies everything that wind turbine manufacturers need for heat treatment. So, if you have to make a decision, what could be easier than this?



**HybridCarb lowers both – costs and CO<sub>2</sub> emissions.**  
It is not an exaggeration to say: in the HybridCarb process, Ipsen has revolutionized gas carburising.



**Easy to operate, higher reliability.**  
Ipsen software and hardware systems stand for ease of use, efficient process control and a high level of operational safety and reliability.



**Higher performance for better results.**  
SuperQuench®, the high-performance quenching system, is an optimized liquid quenching technique that leads to optimal heat treatment results.



**We are there for you fast – worldwide.**  
Ipsen's service has an excellent reputation around the world. Naturally, our services include both in-house and external training.



Ipsen's heat treatment plants absolutely represent the best available in terms of the materials and technology used. Ipsen continues to advance the technologies, working closely with clients, institutes of technology and universities striving for even better-quality steel and for even greater manufacturing efficiency.



# About us.

Ipsen – we deliver performance.

Ipsen stands for cutting edge heat treatment technology and systems. Few other enterprises in the world have had such a decisive impact on the development of heat treatment.

For more than 60 years Ipsen has been providing innovative technologies and methods with which to give new properties to steel. Ipsen's products combine the highest performance with outstanding reliability, which perhaps explains why our furnaces and heat treatment equipment enjoy an excellent reputation all over the world.

The company has production sites in Europe, America and Asia. This, together with representatives in 34 countries, ensures excellent customer care all around the world.

Despite the company's many important innovations, Ipsen's focus is not solely on technology: in all we do, we aim to surpass our customers' expectations.

We are not only committed to building and developing great technology. We are also passionate about providing swift, seamless, attentive service.

You can contact us by letter, email or telephone at:  
Ipsen International GmbH  
Flutstraße 78  
47533 Kleeve  
Germany  
Telephone +49 2821-804-0  
info@ipsen.de · www.ipsen.de

Hard work wins

