

WIND TURBINE COOLING

A photograph of several offshore wind turbines in a row, stretching from the foreground into the distance over a calm blue sea. The sky is a clear, pale blue. The turbines are dark blue or black, with their three-bladed rotors clearly visible. The perspective is from a low angle, looking slightly up at the turbines.

**THE PROMISE
THE PROOF
HEATEX**

AIR-TO-AIR HEAT EXCHANGERS

HEATEX

HEATEX COMPLETE COOLING SYSTEMS

To ensure the life expectancy of the components inside the nacelle both the heat generated by the process of energy conversion as well as solar radiation needs to dissipate. Heatex offers customized and complete cooling systems for the nacelle, generator, transformer and converter.

When converting between different forms of energy, a part of the available energy is lost, often as heat. In a wind turbine, kinetic energy is converted to electrical energy and the losses are transferred into heat. Generally, larger generators create more heat than smaller versions.

Heatex offers a cooling system that combines the positive aspects of traditional cooling methods while minimizing the drawbacks found in filtered air and liquid-to-air solutions. Heatex air-to-air cooling systems are suitable for both onshore and offshore applications and allow for a high degree of flexibility which makes it possible to retrofit Heatex cooling solutions in existing wind turbines generators.

Main Challenges for Wind Turbine Cooling	Heatex Solutions
Secure stable AEP and reduce LCOE	State of the art heat exchanger for high cooling efficiency and optimized system design for low power consumption.
Minimize downtime and failure rates	Proven system design with low complexity, few moving components and built-in redundancy.
Minimize installation cost	Customized design with careful consideration to weight and space requirements.
Minimize maintenance cost	Heat exchanger with self-cleaning capability providing full protection of internal air from salt, sand and dust.
Maximize lifetime	Corrosion protection with very high durability for all types of environment, including offshore.

GE Renewable Energy's Haliade-X, one of the most powerful wind turbines in the world, is cooled by a Heatex custom-made closed-loop cooling system. *"With the air-to-air cooling system from Heatex we will reach the cooling required for the Haliade-X generator with a robust and proven technology"* says Anton Hoang, Head of Sourcing at GE Renewable Energy – Offshore Wind

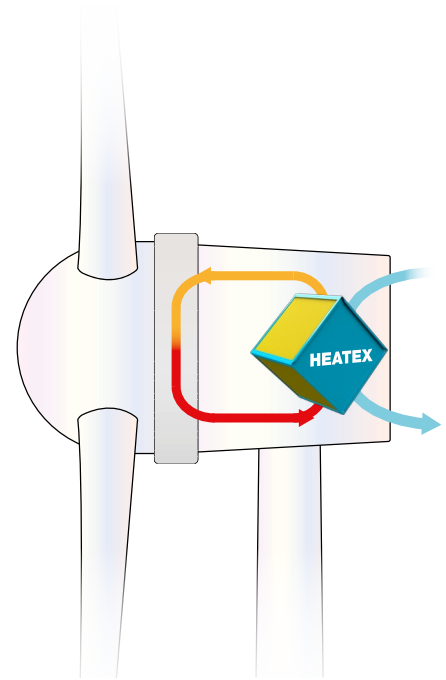


GENERATOR COOLING

Heatex develops cooling solutions for both direct drive and gearbox driven generators. The working principle is the same with a closed-loop to the generator being cooled by external air in the plate heat exchanger.

The direct drive cooling solution is designed with careful consideration to the generator airflow and temperature requirements. The complete system with ducting, fans and heat exchanger is optimized to provide sufficient cooling and low power consumption.

The gearbox driven cooling solution is based on Heatex air-to-air technology with superior performance compared to conventional tubular solutions. Heatex solution provides an optimal balance of the temperature between the drive end and non-drive end of the generator and the average temperature can be decreased, which allows for an extended lifetime or higher output.

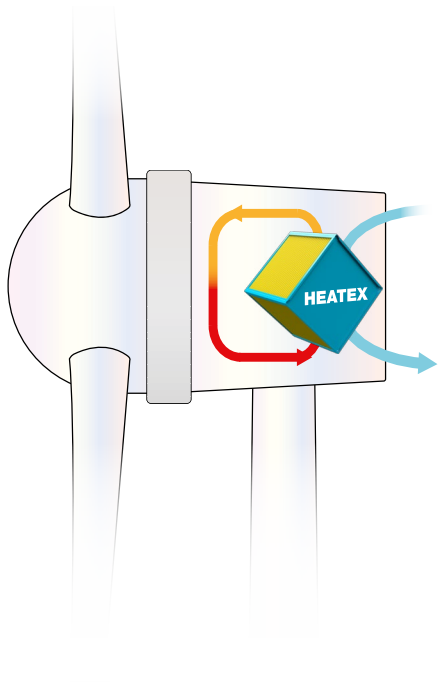


NACELLE COOLING

The objective of a nacelle cooling system is to maintain optimal working conditions for the equipment located inside the wind turbine. Heatex solution with a closed-loop design will cool the internal air without any risk of bringing sand, salt or dust inside the nacelle.

The technology is based on a crossflow plate heat exchanger and the cooling system is designed as a complete solution to ensure the best possible performance while keeping maintenance and operating costs at a minimum.

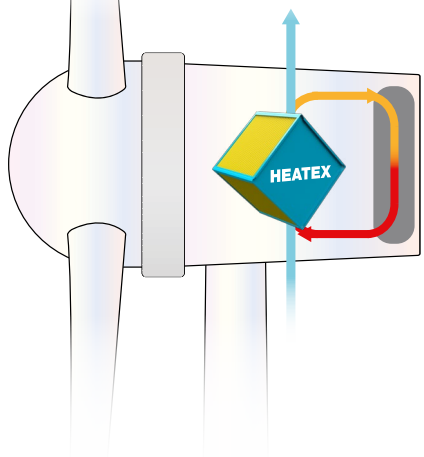
This approach allows for a flexible solution where individual components can be designed to fit the available and often tight space inside the nacelle.

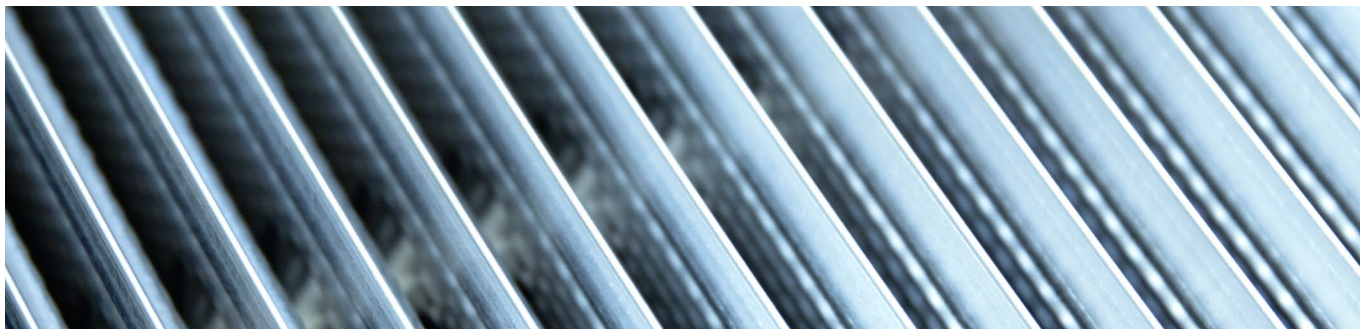


TRANSFORMER/ CONVERTER COOLING

Heatex develops cooling solutions for transformers and converters based on vast experience within electronic cooling.

The system works by letting the outside air pass through the plate heat exchanger on one side of the plate and the air from the enclosed space on the other side. The inside air is cooled by the outside air through thin aluminium plates. The outside air, contaminated with humidity and dust and, the clean, dry inside air never mix – the inside air is a closed loop. This provides a desirable environment for the sensitive electronic components inside the enclosure.





PROVEN TECHNOLOGY

Over 2000 Heatex cooling systems are successfully operating worldwide



SOLID TRACK RECORD

Heatex has over 10 years of experience in both On- and Offshore applications.



EXTENSIVE CAPABILITIES

We are delivering cooling systems to double-digit projects all around the world.

THIS IS HOW IT WORKS

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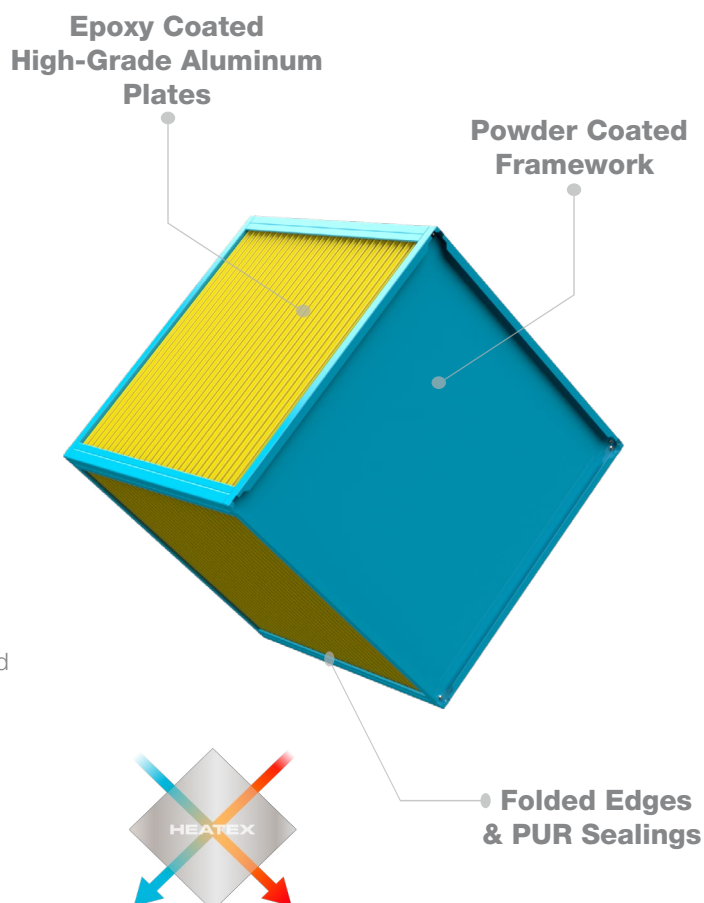
HEATEX AIR-TO-AIR HEAT EXCHANGERS

The heat from the generator and electronic equipment inside the wind turbine is efficiently removed with an air-to-air heat exchanger system.

The core of the system is the plate heat exchanger, where the air is passing through a number of channels and heat is transferred from the internal to the external circuit via thin aluminium plates. The plates are pressed in an advanced pattern allowing for efficient heat transfer and low pressure drops. The internal circuit is completely separated from the external air meaning all harmful particles such as sand, salt and dust stay outside the nacelle.

To obtain and maintain sufficient airflow, the system is equipped with fans. These are carefully optimized according to pressure, volume flow and power consumption requirements.

The final layout of the cooling system includes ductwork, supporting structures and control equipment. All designed and selected in close collaboration with the customer.





THE PROMISE:

As the leader in wind power generator cooling solutions, Heatex is the ideal partner for optimizing generator and overall turbine performance.

THE PROOF:

Together with our certified APQP4Wind Specialists, our mission is to provide high-performance cooling solutions, enabling the wind industry to produce the best, most efficient generators on the market. All systems are therefore fully customized to optimize the operation and fulfil manufacturer requirements.

Contact our specialist for more information and concept solutions.

TRUSTED AND APPROVED BY:



GOLDWIND

 **VENSYS**



Heatex is a global manufacturer of air-to-air heat exchangers. The company was founded in the 60's, and incorporated into Heatex AB in 1987.

The company uses advanced algorithms to design and improve its products. These are based on scientific calculations within fluid dynamics, the fundamentals of heat transfer and fifty years of practical experience of heat transfer processes.

Heatex products are well known for providing high energy recovery and for enabling a fast return on investment. The company has a history of steady growth and has over the years established itself as the market and technology leader of air-to-air heat transfer.