

Cooling for Industrial Applications Solutions and Technologies



NISSENS
COOLING
SOLUTIONS

Nissens
COOLING SOLUTIONS

World-Class Customization for Any Product Application

Throughout 100 years, Nissens Cooling Solutions has built considerable knowledge of the growing needs of our customers in a number of industries and applications. Our reference list covers most cooling applications in the wind turbine industry and in the on- & off-road industry segments.

We offer a wide range of fully customized or pre-engineered standard cooling components, cooling modules and cooling systems to provide the optimal cooling solution for any cooling need requiring cooling of engines, gear oil, transformer oil, converters, hydraulic circuits, power electronics, etc.

EXPERIENCE & INNOVATION: ADDING VALUE TO OUR CUSTOMERS

Our experience forms an important platform for our proven performance through decades of interaction with leading industries in the world. The vast pool of knowledge that we have acquired over the years is directly reflected in our renowned ability to develop, design and manufacture innovative cooling solutions.

We add value to our customers by:

- Reducing time to market by offering first-time-right products and short lead times on prototype manufacturing
- Supporting our customers' engineering teams by taking responsibility for the product design process and for the design outcome
- Manufacturing reliable products, designed and tested for specified application needs, and respecting the highest quality standards to ensure proven product performance

GLOBAL SUPPORT & SUPPLY – INCLUDING BETTER SERVICE AND FAST DELIVERY

Nissens Cooling Solutions offers a global manufacturing and supply chain set-up located in America, Asia and Europe. Furthermore, we have local sales and engineering teams that offer design, engineering and sales support to our customers throughout the world. Our global support and supply network ensures better service on daily requests and transactions, just as we focus on providing short lead times on both customized and standardized cooling solutions within our range.

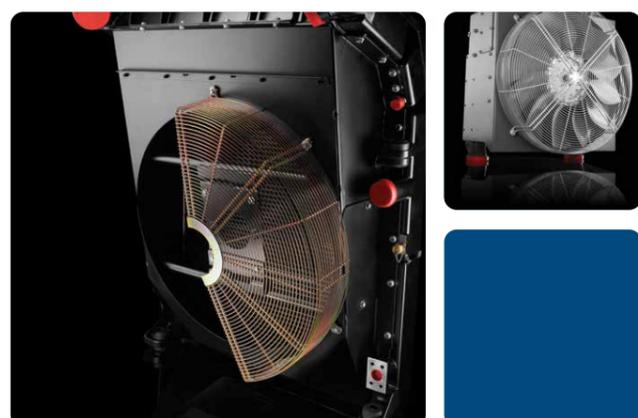
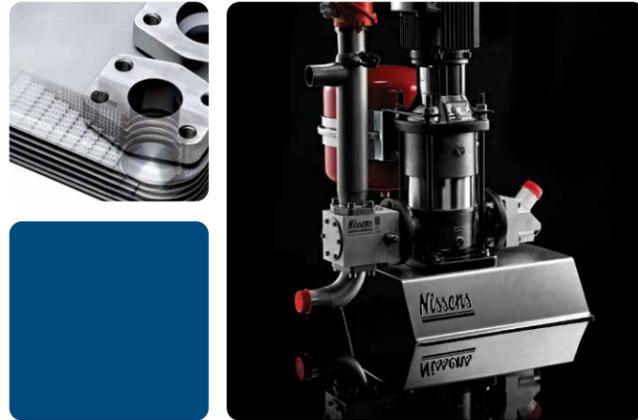


PLATE & BAR COOLERS

Plate & bar coolers are among the most typical constructions of aluminum coolers applied for high-performance industrial applications and designed for oil, water or air cooling.

The special construction of soldered plates and bars, available with a variety of fin performances, is mainly used for high-pressure cooling applications, with a working pressure up to 36 bar (522 psi). Specially formed turbulators placed between the plates improve the cooling performance considerably, and, thanks to the Controlled Atmosphere Brazing (CAB), the cooler's aluminum elements are brazed into one solid, sturdy and extremely durable construction.

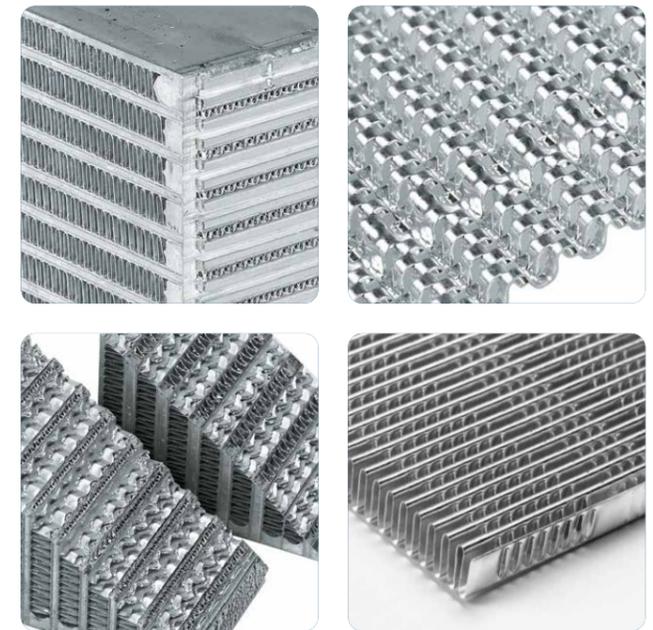
Nissens Cooling Solutions' plate & bar coolers are constructed as a modular system, allowing length and width to vary according to specified application demands and can be equipped with a deep variety of fans, shrouds, mountings, electric/hydraulic motors and connections.

PLATE & BAR COOLERS ADVANTAGES

- Excellent cooling performance
- Proven, extended durability and corrosion performance
- Compact and flexible design
- Deep variety of possible equipment and customizations

POSSIBLE APPLICATIONS

- Water/glycol cooling
- Charge air cooling
- Oil cooling
- Fuel cooling



ACCORDANCE WITH INTERNATIONAL STANDARDS

The plate & bar coolers are designed and manufactured according to the Pressure Equipment Directive PED 97/23/EC article 3.3

TECHNICAL INFORMATION

Temperature range	-40° C to 260° C (-40° F to 500° F)
Working pressure - dynamic	16 bar (232 psi)
Working pressure - static	25 bar (362 psi)
For special high pressure applications, a dedicated design can be developed to be applicable at working pressure up to 36 bar (522 psi)	
Corrosion	The cooler design is tested for off-shore equivalent to class C5 high
Cleanliness	Upon customer request, the coolers can be flushed to a cleanliness of 15/13/9 or even better acc. to ISO4406

POSSIBLE SIZES

Available thicknesses	45 / 63 / 94 / 113 / 140 / 160 mm (1.77 / 2.48 / 3.70 / 4.45 / 5.51 / 6.29 in)
Max. height	3000 mm (118.0 in)
Max. width	2500 mm (98.4 in)
Tubes	3 mm (0.118 in) oil/water 4.4 mm (0.173 in) oil/water/air 6 mm (0.236 in) air

ALUXSTREAM

A unique product innovation in the shape of an AluXstream cooler has been developed by Nissens Cooling Solutions to offer a customized cooling solution that is superior to the traditional plate and bar cooler applied in a variety of different industrial applications.

THE ALUXSTREAM COOLER IS SUPERIOR TO THE TRADITIONAL PLATE AND BAR COOLER THANKS TO:

- A more simple design consisting of fewer parts
- A light-weight construction
- A special product design for water cooling applications

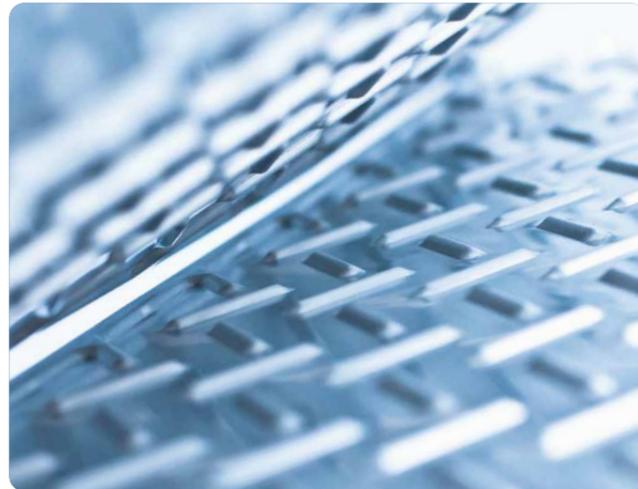
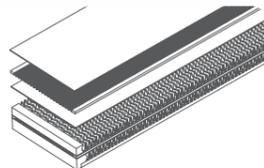
Whilst offering the above benefits, the AluXstream cooler is of course also offering the quality, flexibility and efficiency required for any water cooling need.

Our new AluXstream is an innovative hybrid construction where tube plates have been integrated with bars and a special turbulator pattern. The new design of the AluXstream radiator brings about benefits such as low weight, minimization of cost and less handling.

The new AluXstream cooler



A traditional Plate & Bar Cooler



POSSIBLE SIZES

Available thicknesses	63 / 94 / 113 / 140 / 160 mm (2.48 / 3.70 / 4.45 / 5.51 / 6.29 in)
Max. height	3000 mm (118 in)
Max. width	1300 mm (51.2 in)
Tubes	2 mm in (0.079) water



SHELL COOLERS (STANDARD)

Nissens Cooling Solutions offers a wide range of standard shell coolers. Advantages of the shell system are low weight and competitive prices, still with very good cooling performance.

The system is offered in three different thicknesses and varies from very small coolers for light equipment to larger coolers applied e.g. for big compressor. The coolers can also be used for indirect cooling of power electronics e.g. in converters.

We offers two types of shell coolers: oil/coolant coolers and oil/coolant-air combi-coolers consisting of air and oil/coolant cooling units combined.

Our shell coolers are commonly applied for compressors and similar light machinery in need of both oil and air cooling.

ACCORDANCE WITH INTERNATIONAL STANDARDS

Nissens Cooling Solutions' shell coolers are designed and manufactured according to the Pressure Equipment Directive PED 97/23/EC article 3.3

OPERATIONAL CONDITIONS

Temperature range	from -40° C to 130° C (from -40° F to 266° F)
Working pressure - dynamic	up to 13 bar (188 psi) for thickness 45, 63 mm (1.77 and 2.48 in)
Working pressure - static	up to 10 bar (145 psi) for thickness 94 mm (3.70 in) up to 18 bar (261 psi) for thickness 45, 63 mm (1.77 and 2.48 in)
	up to 15 bar (217 psi) for thickness 94 mm (3.70 in)

COOLING MEDIUM

Oil, Air, Water/Glycol

POSSIBLE SIZES

Available thicknesses	45 / 63 / 94 mm (1.77 / 2.48 / 3.70 in)
Max. height	693 mm (27.28 in)
Max. width	737 mm (29.01 in)
Possible connections	1/2" / 3/4" / 1"



ALU McCORD RADIATORS

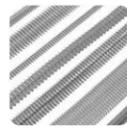
The McCord system has initially been designed for automotive applications to cover many different radiator types, from the most popular car models to commercial vehicles and super-efficient cores for vehicles running in extreme conditions. Today, aluminum McCord radiators are widely applied by many on- & off-road applications or stationery equipment.

Alu McCord radiators from Nissens Cooling Solutions are light-weight coolers made with highly efficient fins, optimally formed louvres and a very small tube distance - ensuring excellent durability and cooling performance. Coolers can be equipped with two types of water tanks: fully aluminum or reinforced plastic with fibre glass (PA66-GF30)

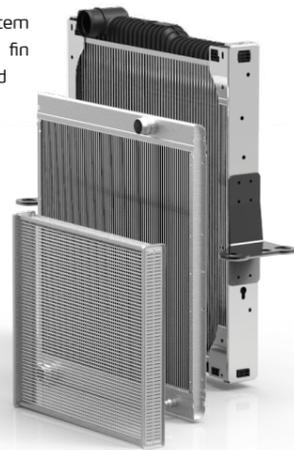
The wide variety of McCord core thicknesses makes it possible to apply this system to almost all vehicles and machinery requiring water cooling.



Possible systems - System code (B/A) identifies fin height - zig zag length and distance between tubes.



Thickness - McCord cores are available in a variety of thicknesses (B) up to 109 mm (4.29 in). The fin width indicates the number of tube rows related to the core thickness.



ACCORDANCE WITH INTERNATIONAL STANDARDS

Our Alu McCord coolers are designed and manufactured according to the Pressure Equipment Directive PED 97/23/EC article 3.3

OPERATIONAL CONDITIONS

Temperature range -30° C to 110° C (-22 °F to 230 °F)

Working pressure - dynamic up to 2 bar (29 psi)

Working pressure - static up to 4 bar (58 psi)

COOLING MEDIUM

Mixture of distilled water and ethylene or propylene glycol (minimum 30% glycol)

POSSIBLE SIZES

Available thicknesses 16 / 22 / 32 / 40 / 48 / 58 76 / 100 / 126 mm
(0.63 / 0.87 / 1.26 / 1.58 / 1.89 / 2.28 / 2.99 / 3.94 / 4.96 in)

Max. height 1300 mm (51.18 in)

Max. width 600 mm (23.62 in)

Tubes 16 x 2 / 22 x 2 / 32 x 2 / 40 x 2 mm
(0.63 x 0.079 / 0.87 x 0.079 / 1.26 x 0.079 / 1.58 x 0.079 in)

ALUXCHANGER

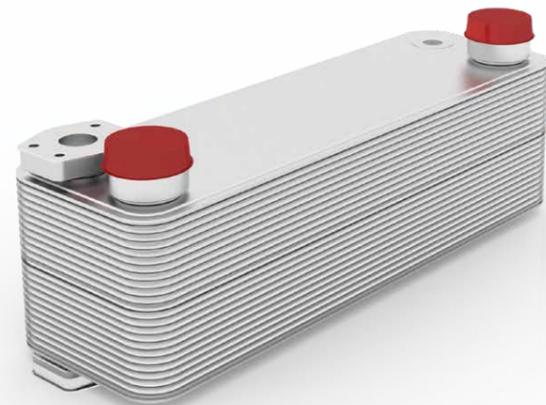
Nissens Cooling Solutions' AluXchanger is an aluminum-based plate heat exchanger for liquid-to-liquid heat exchange applications.

Heat exchangers are traditionally manufactured from stainless steel with copper-based brazing technology. With brazed aluminum as a basis for producing plate heat exchangers, our AluXchanger offers a number of crucial advantages:

- Lower weight
- Higher thermal performance
- Compact design
- Customized solutions

PRODUCT TECHNICAL INFORMATION

Temperature range	-40 °C to 130 °C (-40° F to 266° F)
Working pressure - dynamic	Up to 16 bar (232 psi)
Working pressure - static	Up to 25 bar (363 psi)
Corrosion	The AluXchanger is made of long-life aluminum alloys suitable for offshore environments.
Cleanliness	Upon request, the AluXchanger can be supplied flushed with mineral oil to cleanliness level -/13/10 according to ISO 4406.



ALUXSAFE

Nissens Cooling Solutions' AluXsafe is a safety heat exchanger. The product solution is very suitable as an integrated part of a transformer cooling system thanks to its design with two separated circuits.

With AluXsafe, Nissens Cooling Solutions has eliminated the risk of mixing water and oil since the two media have been fully separated by an air chamber. In case of a leakage on the water/glycol side, the water will leak into the air chamber and escape from the heat exchanger without entering the transformer oil circuit. The AluXsafe thus prevents the water/glycol from causing damage to the transformer.

Thanks to a full aluminum design and the application of the turbulator technology, AluXsafe offers the following benefits compared to conventional heat exchangers in the market:

- Lower weight
- Higher heat transfer
- Improved overall efficiency and performance

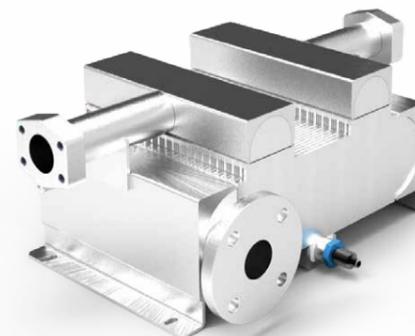
EXAMPLE OF AN ALUXSAFE SOLUTION

PRIMARY SIDE (HOT SIDE)

Medium	Oil / transformer oil
Max. operating pressure	6 bar (g) (87 psi)
Max. operating temperature	90 °C (194° F)
Min. operating temperature	-30 °C (-22° F)
Cleanliness	Flushed with a thin mineral oil (Shell Morlina HS2 or similar) to cleanliness class ISO 4406 -/14/11

SECONDARY SIDE (COLD SIDE)

Medium	Water / glycol (minimum 40% glycol) use approved coolant only
Max. operating pressure	6 bar (g) (87 psi)
Max. operating temperature	90 °C (194° F)
Min. operating temperature	-30 °C (-22° F)



ALUXAIR

In recent years, the need for air-to-air cooling has emerged in the wind turbine industry due to the significant size and power capacity of a modern wind turbine, which has also led to a steadily increasing requirement for climate control in the nacelle.

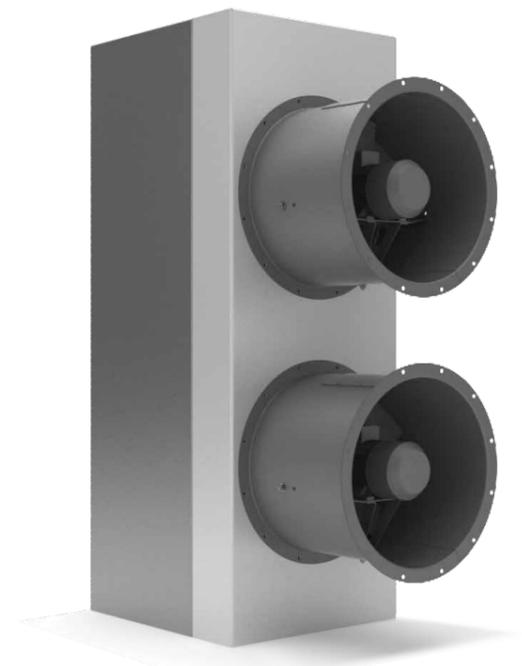
To meet the needs of the demanding wind turbine industry, Nissens Cooling Solutions has developed a unique product for on- and offshore wind applications, AluXair.

AluXair is an air-to-air cooler in aluminum, where the internal air is cooled by the ambient air through an integrated heat exchanger. With AluXair, Nissens Cooling Solutions offers a unique product solution with a number of benefits that deliver an answer to some of the most well-known challenges, when it comes to securing optimal cooling. AluXair is developed for:

- Cooling of standard generators
- Cooling of direct driven generators
- Climate control in the nacelle
- Air cooling of power electronics

ALUXAIR ADVANTAGES

- Compact and lightweight design
- High reliability
- Leakage free - fully brazed solution
- Strong corrosion protection
- Customized solutions



WCAC

WCAC is short for Water-cooled Charge Air Cooler. In this cooler type the charge air is cooled by a coolant, and not by the passing air. A traditional cooler is designed to provide maximum cooling, whenever necessary, but under normal circumstances only approximately 70-80% of the maximum cooling capacity is required. An optimal solution is thus a combination cooler like Nissens Cooling Solutions' WCAC, since the size of the cooler may be reduced significantly without affecting the efficiency.

The WCAC is a recognized and highly demanded product, that has proved its performance in demanding applications like gen-sets, marine engines and large diesel engines. It can be integrated into several cooling systems; indirect and direct cooling systems, retarder systems and heating systems.

WCAC FEATURES

- Compact design
- Low weight
- Supreme cooling efficiency
- Proven, premium durability
- Modular design enabling customizations

THE WCAC SYSTEM ADVANTAGES

The WCAC system offers various benefits depending on different application specifics and is renowned for offering the following benefits:

- **Reduced fuel consumption**
- **Reduced noise levels**
- **Faster engine response**
- **More stable fan operation**
- **Reduced fan requirements**
- **Lower pressure drop on charge air**
- **More compact installation**
- **More stable charge air temperature**
- **Easier compliance with the Euro 6/Tier 4F regulations**



ACCORDANCE WITH INTERNATIONAL STANDARDS

The WCAC is designed and manufactured according to the Pressure Equipment Directive PED 97/23/EC article 3.3

OPERATIONAL CONDITIONS

Work load – charge air	80 kPa (a) - 480 kPa (a) (11.60 psi - 69.62 psi)
Work load - coolant	80 kPa (a) - 300 kPa (a) (11.60 psi - 43.51 psi)
Temperature range – charge air	-40° C to 250° C (-40° F to 482° F)
Temperature range - coolant	-40° C to 130° C (-40° F to 266° F)

COOLING MEDIUM

Mixture of water and ethylene or propylene glycol (minimum 30% glycol)

STANDARDIZED RANGE OF CONNECTION TYPES

Coolant side	Socket: NPT 1/2" - NPT 1 1/2"
	Hose connection: 1 in - 2 in
Charge air side	Cast connection - project/ application specific



PUMP STATIONS

We offer the opportunity to place the development of a complete pump station in the hands of one preferred supplier, who can provide a customized solution where the pump unit and the rest of the cooling system form part of one integrated and optimized system.

Thanks to the compact manifold and pipe design of Nissens Cooling Solutions' pump stations, we can offer the following benefits:

- Easy installation
- High durability
- Easy maintenance

A PUMP UNIT FROM NISSENS COOLING SOLUTIONS MAY CONSIST OF THE FOLLOWING COMPONENTS:

- Pump
- Expansion tank
- Safety valve
- Heating element
- Pressure transmitter
- Temperature transmitter
- Thermo valve

The pump station design depends on the system to be cooled. The cooling of generators and gearboxes has different requirements from the cooling of converters and transformers, and Nissens Cooling Solutions takes the cooling need into consideration when designing and manufacturing the customized solution:

	Generator	Gearbox	Converter	Transformer
Pump	X	X	X	X
Expansion tank	X	X	X	X
Safety valve	X	X	X	X
Sensors/Transmitters	X	X	X	X
Heater			X	X
Thermo valve/ Mixer valve			X	X

PUMP STATIONS FROM NISSENS COOLING SOLUTIONS ARE DEVELOPED FOR THE FOLLOWING APPLICATIONS:

Direct Cooling:

- Generator cooling
- Converter cooling
- Transformer cooling
- Control cabinets

Indirect Cooling:

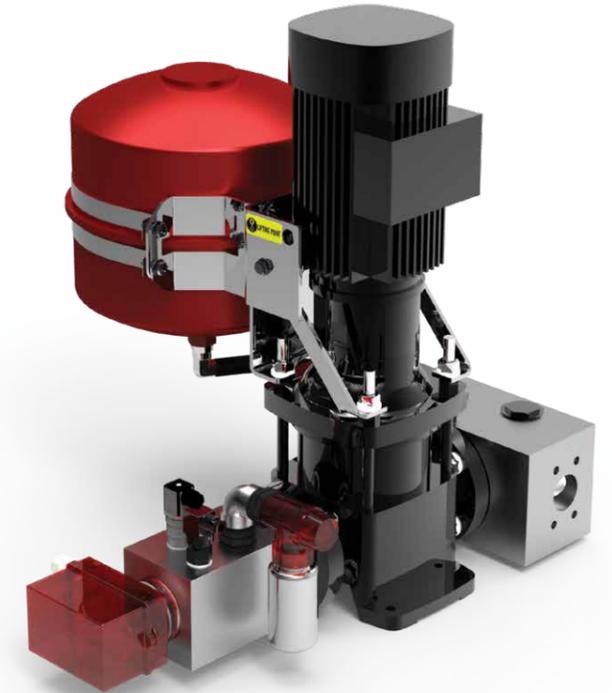
- Pitch hydraulics
- Gearboxes
- Main bearings

EXAMPLE OF PUMP UNIT

NISSENS COOLING SOLUTIONS' PUMP UNIT: NPU-DN50/H

Pump unit for converter cooling on 3MW wind-turbine featuring:

Pump	2.2 kW, 300 l/min., 2.0 bar (3HP, 79.25 gpm, 29 psi)
Exp. tank	50 liter (13.2 gallon)
Safety valve	5.0 bar (72.5 psi) opening pressure
Heater	4.5 kW (256 BTU/min)
Mixer valve	30° C (86° F) thermo bypass



HP COOLERS - HIGH PERFORMANCE COOLERS (STANDARD)

Nissens Cooling Solutions' HP-series is a wide range of standard pre-engineered products for efficient cooling of both water and oil applications. HP is short for High Performance, and our HP-series is renowned for offering efficient cooling in terms of a remarkable cooling capacity. Our special fin design, perfect finish and high-quality raw materials contribute to the proven performance of this product category. Additionally, our HP-series offers very good corrosion characteristics thanks to the application of long-life alloys. Nissens Cooling Solutions' HP-series comes with a wide selection of equipment and accessories that meet our customers' requirements for flexible, efficient and customized cooling solutions at competitive pricing.

The series of HP coolers is designed with a view to provide optimal cooling of hydraulic and lubricating oil as well as water/glycol in virtually any installation. The HP series includes 12 cooler sizes with a large variety of equipment that may be customized for different purposes and thus made to fit any cooling need. The product range has been divided into the following categories: HPC, HP and HP HYD

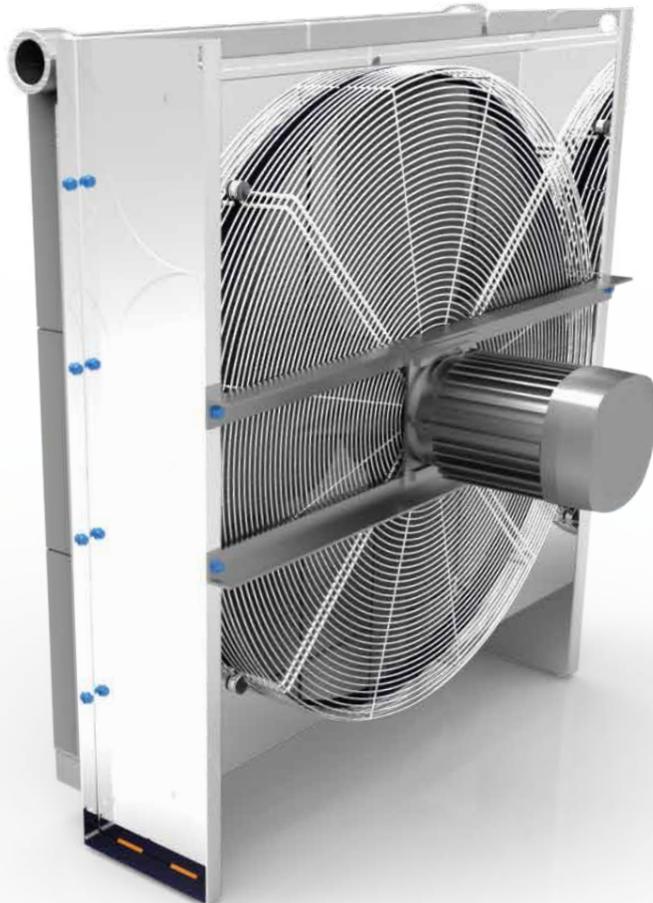
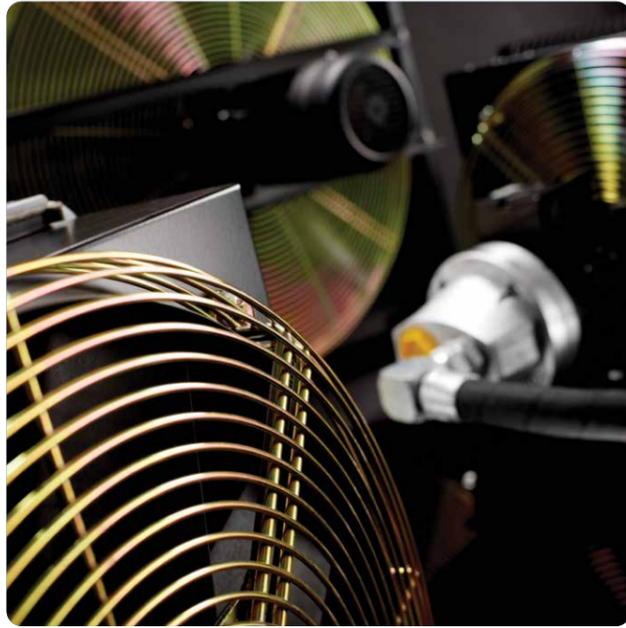
High-quality raw materials, applied features like turbulators, optimally shaped tube fins and carefully selected equipment ensure that the HP series offers excellent cooling performance and high durability. We thoroughly test all our products in Nissens Cooling Solutions' in-house test center, including tests for corrosion, thermal expansion and vibration as well as a number of other real-life tests.

HP COOLERS FEATURES

- Excellent cooling performance
- Compact design
- Low noise emission
- Flexibility (size, equipment, medium)
- High durability and low maintenance cost
- Outstanding corrosion performance

TYPICAL APPLICATIONS

- Stationary machinery e.g. press and punching machinery
- Offshore cranes
- Mobile cranes



HP Type	Media	Features
<p>HPC</p> <p>Nissens Cooling Solutions' HPC is a complete oil cooler unit consisting of cooler, fan and pump.</p> <p>The HPC oil cooler is the perfect solution for hydraulic systems in which the oil flow is unstable or in which heavy pressure peaks may occur. Furthermore, the HPC oil cooler is suitable for lubricating oil, as an integrated pressure bypass in the pump allows a very high oil viscosity - up to 2000 cSt.</p> <p>Many thermal tests have resulted in a construction with a high cooling performance combined with a low noise level which is an absolute necessity for many indoor installations.</p>	<ul style="list-style-type: none"> ▪ Oil 	<ul style="list-style-type: none"> ▪ High-performing pump with integrated pressure bypass ▪ Suitable for a high oil viscosity ▪ High flexibility - i.e. can be supplied with <ul style="list-style-type: none"> ▪ Special motor - 60/50 Hz - special voltage ▪ Galvanized steel parts ▪ Offshore design etc.
<p>HP</p> <p>With this generation of our HP coolers with a 3 x 400 V fan, we have succeeded in increasing the cooling performance, and at the same time, reducing the noise level.</p> <p>These coolers are very suitable for stationary installations - for cooling of either hydraulic oil, lubricating oil or water/glycol</p> <p>The program has been broadened by coolers with slow-speed fans with a very low noise level. To make the range of coolers as complete as possible, the small units can be supplied in a 1-pass as well as a 2-pass construction. In this way, the demand for cooling of a low as well as a high flow is met.</p>	<ul style="list-style-type: none"> ▪ Oil ▪ Water / glycol ▪ Compressed air 	<ul style="list-style-type: none"> ▪ High flexibility - i.e. can be supplied with <ul style="list-style-type: none"> ▪ Special motor - 60/50 Hz - explosion proof - special voltage ▪ Galvanized steel parts ▪ Offshore design etc.
<p>HP 12/24 V</p> <p>In this generation of the HP coolers with 12/24 V fan, the design has been changed and new high-performing fans are used. The result is a higher cooling performance.</p> <p>These coolers are very suitable for mobile installations - for cooling of either hydraulic oil, lubricating oil or water/glycol.</p> <p>To make the range of coolers as complete as possible, all 5 cooler sizes can be supplied in a 1-pass as well as a 2-pass construction. In this way, the demand for cooling of a low as well as a high oil flow is met.</p>	<ul style="list-style-type: none"> ▪ Oil ▪ Water / glycol ▪ Compressed air 	<ul style="list-style-type: none"> ▪ High flexibility - i.e. can be supplied with: <ul style="list-style-type: none"> ▪ Galvanized steel parts ▪ Offshore design etc.
<p>HP HYD</p> <p>The range of HP coolers with hydraulic motors has been considerably enlarged - to meet small as well as high cooling requirements. The coolers are very suitable for mobile and stationary installations - for cooling of either hydraulic oil, lubricating oil or water/glycol. The program is very flexible with 6 different hydraulic motor sizes to choose from.</p> <p>To meet possible requirements as to the noise level, the cooling performance of the coolers is specified at various fan revolutions in order to make it possible to choose a cooler that meets the specific requirements of each application. To make the range of coolers as complete as possible, the small types can be supplied in a 1-pass as well as a 2-pass construction. In this way, the demand for cooling of a low as well as a high flow is met.</p>	<ul style="list-style-type: none"> ▪ Oil ▪ Water / glycol ▪ Compressed air 	<ul style="list-style-type: none"> ▪ High flexibility - i.e. can be supplied with: <ul style="list-style-type: none"> ▪ 6 different hydraulic motor sizes ▪ Galvanized steel parts ▪ Offshore design etc.



Global Support & Supply

BETTER SERVICE & FAST DELIVERY

Our focus on cooling and climate solutions has been the driving force behind our transformation from a local Danish company building upon solid craftsmanship skills to a global industrial group offering local support and global supply of technically advanced cooling solutions. Today, we have experienced employees, who serve our customers on a global scale. We have in-house production facilities in Denmark, Slovakia, Czech Republic, China and the US to ensure high quality and short lead times. Our logistics services are second-to-none in the market.



■ PRODUCTION FACILITIES

CHINA
DENMARK
SLOVAKIA
CZECH REPUBLIC
USA

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