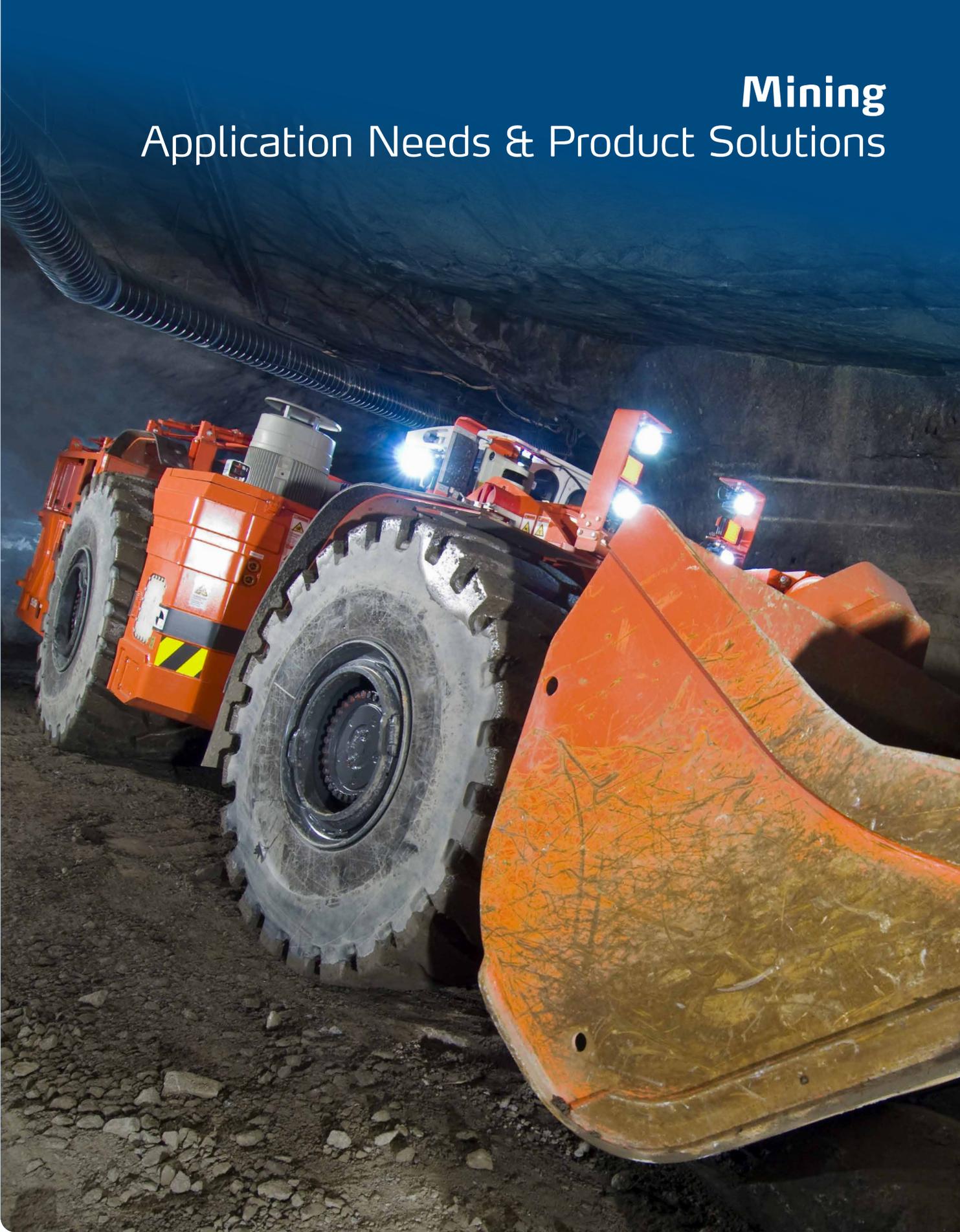


# Mining Application Needs & Product Solutions



COOLING  
SOLUTIONS  
**MINING**

**Nissens**  
COOLING SOLUTIONS

# Nissens Cooling Solutions: Delivering the Difference in the Mining Industry

## A DEMANDING INDUSTRY WITH TWO MAJOR CHALLENGES

With the automation and globalization of the mining industry, important requirements like growing productivity, improved safety and increased sustainability have had an immense impact on the development of the mining operations.

Today, the mining industry faces two major challenges: corrosion attacks and a dirty environment. Both challenges must be responded to in order to ensure a steady and efficient performance and operation.

## PROVEN PERFORMANCE IN THE ON- & OFF-ROAD INDUSTRY AS WELL AS IN THE OFF-SHORE WIND TURBINE INDUSTRY

Both corrosion and a dirty environment may have a very detrimental effect on the mining machinery and its components. The mining machinery may wear out faster, the productivity may be affected, and the costs of repair and maintenance may be significant.

For decades, Nissens Cooling Solutions has built comprehensive knowledge in the on- & off-road industry segment as well as in the wind turbine industry segment. Having found the right solutions for the significant corrosion challenges that the off-shore wind turbine industry faces in global, off-shore wind parks, it has been a natural next step for Nissens Cooling Solutions to engage in partnerships with renowned OEMs in the mining industry in order to make customized cooling solutions for the world's leading manufacturers of mining equipment and machinery.

With our proven performance in e.g. the off-shore wind turbine industry, our customized product offer to the mining industry involves design, manufacturing, support and supply of highly advanced cooling solutions that meet the individual needs of our customers.

## WE FOLLOW THE TRENDS AND MATCHES EMERGING NEEDS

In recent years, our customers in the mining segment have experienced a growing need for cost-savings, low emissions and high fuel efficiency. The aim is to ensure compliance with the Tier 4 Final emission standards and still observe the space constraints related to the mining machinery.

We add value to mining applications by supplying cooling solutions that are designed to meet the emerging needs and recent requirements of the mining industry when developing, designing, manufacturing and supplying cooling solutions for our global customers.



*"Since Sandvik is a global leader and supplier of equipment and technical solutions to the mining industry, we only work with professional suppliers, who can convince us of their in-depth technical know-how and expertise within their field of performance. Zero defect is a guiding principle for us, and it must be a guiding principle for our suppliers. We thus select suppliers, who can design and manufacture customized products that offer a solution to our challenges in surface and underground mining operations. Nissens is capable of meeting our needs for high cooling performance, and we value Nissens' ability to provide high-quality, innovative and customized cooling solutions for the challenging mining environment. Proven performance is what it takes to be a preferred supplier to Sandvik."*

Product Line Manager  
**Sandvik**

# Advanced Cooling Solutions offered to challenging Mining Applications

We offer customized cooling solutions to a number of different surface and underground mining applications and machinery types, including among many others

- DRILL RIGS
- MINING TRUCKS
- WHEEL LOADERS
- UNDERGROUND LOADERS
- UNDERGROUND HAUL TRUCKS
- MINING SHOVELS

Supplying cooling components to machinery and equipment for the mining industry is especially challenging compared to other industry segments due to extreme circumstances that demand in-depth knowledge, comprehensive experience and innovative solutions to meet the special requirements. Consequently, Nissens Cooling solutions takes special measures when designing cooling solutions for mining operations.

## RESISTING A TOUGH ENVIRONMENT: LOAD, BUMP AND VIBRATION

The conditions in both surface and underground mining operations are tough. The load of the machinery applied is very high, and the impact from bumps and vibrations requires mining equipment and components that are very solid and stable. With a unique product design for mining equipment, we customize cooling solutions for the mining application with specially designed fins and pipes.



## OFFERING CORROSION PROTECTION AT COMPETITIVE PRICING

Traditional cooling solutions for mining equipment are made in copper material, but the price of copper does not comply with the industry's requirements for cost-savings. As a result, Nissens Cooling Solutions offers a cooler in aluminum material as an attractive and high-performing alternative. In some mining applications, where the environment is very corrosive, Nissens Cooling Solutions uses special aluminum alloys for our customized mining cooling solutions, and these alloys have a remarkably improved resistance to corrosion attacks.

## REDUCING MAINTENANCE NEEDS IN A DIRTY ENVIRONMENT

One of the pronounced constraints related to supplying cooling solutions for mining applications is linked to the challenges of preserving a good performance in a very dirty environment. Instead of just facilitating the maintenance of the cooling solutions by use of steam cleaning or high-pressure cleaning, Nissens Cooling Solutions has a strong focus on developing customized cooling solutions that reduce the general need for maintenance and service thanks to the cooler's ability to prevent dirt from accumulating inside the cooler.

MINING CONDITIONS



NISSENS COOLING SOLUTIONS' PRODUCT RANGE

# Our Product Offer for the most challenging Mining Applications

Selecting the right product for a challenging application requires considerable knowledge of the application characteristics as well as of different product features. Based on proven performance, Nissens Cooling Solutions has made a specially designed aluminum plate & bar cooling solution for the most demanding mining applications that may be used for transmission and hydraulic systems as well as for cooling of both water, charge-air and oil.

**For this specially designed aluminum plate & bar cooling solution, a solid construction has been developed with special features:**

### SPECIAL PIPE COMPONENT

The aluminum pipes in Nissens Cooling Solutions' specially designed aluminum plate & bar cooling solution respond much better to bumps than the traditional copper pipes applied. With a reinforced material for mining equipment, our specially designed aluminum plate & bar cooling solution is very durable, and it has been tested to have a durability that is five times higher than the conventional aluminum cooling component available in the market.

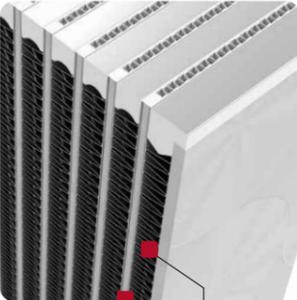
### SPECIAL FIN DESIGN

A unique fin construction with a more open fin design compared to the fin construction in traditional plate and bar coolers contributes to ensuring that our cooling solution may work in a dirty environment. Furthermore, the product reduces the need for cleaning and maintenance, since the accumulation of dirt is avoided thanks to the special fin design. This enables Nissens Cooling Solutions' specially designed aluminum plate & bar cooling solution to resist the challenges of a very dirty underground mining environment and to ensure a constantly high cooling performance.

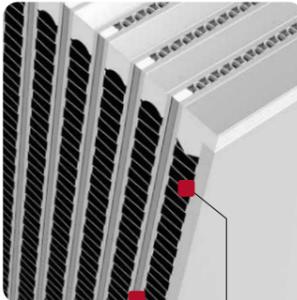
- SPECIAL PRODUCT SOLUTIONS ✓
- SPECIAL ALLOY MATERIALS ✓
- HIGH DURABILITY ✓
- SIMPLE AND EASY INSTALLATION ✓

- COOLING OF BOTH WATER, CHARGE-AIR AND OIL ✓
- SOLID CONSTRUCTION ✓
- SPECIAL FIN CONSTRUCTION ✓
- LIMITED NEED FOR CLEANING AND MAINTENANCE ✓

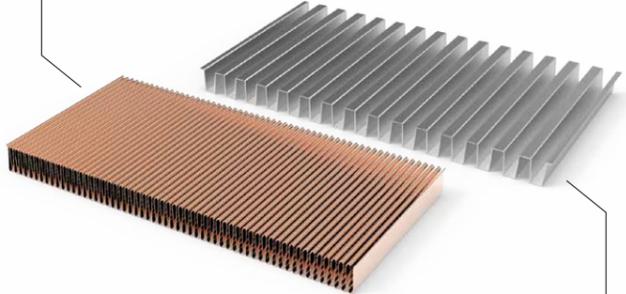
TRADITIONAL PLATE & BAR CORE CONSTRUCTION



NISSENS COOLING SOLUTIONS' SPECIAL PLATE & BAR CORE CONSTRUCTION FOR MINING



TRADITIONAL FIN DESIGN APPLIED IN OTHER MINING COOLING SOLUTIONS



NISSENS COOLING SOLUTIONS' HIGHLY EFFICIENT FIN DESIGNED FOR DEMANDING, VERY POLLUTED UNDERGROUND ENVIRONMENTS

### INCREASED COOLING PERFORMANCE ENSURES TIER 4 FINAL COMPLIANCE

Increased cooling performance throughout the entire product life time of Nissens Cooling Solutions' specially designed aluminum plate & bar cooling solution is a noticeable product feature when comparing to other product offers in the market. This is a noticeable benefit in the pursuit of meeting the emission standards of the Tier 4 Final requirements.



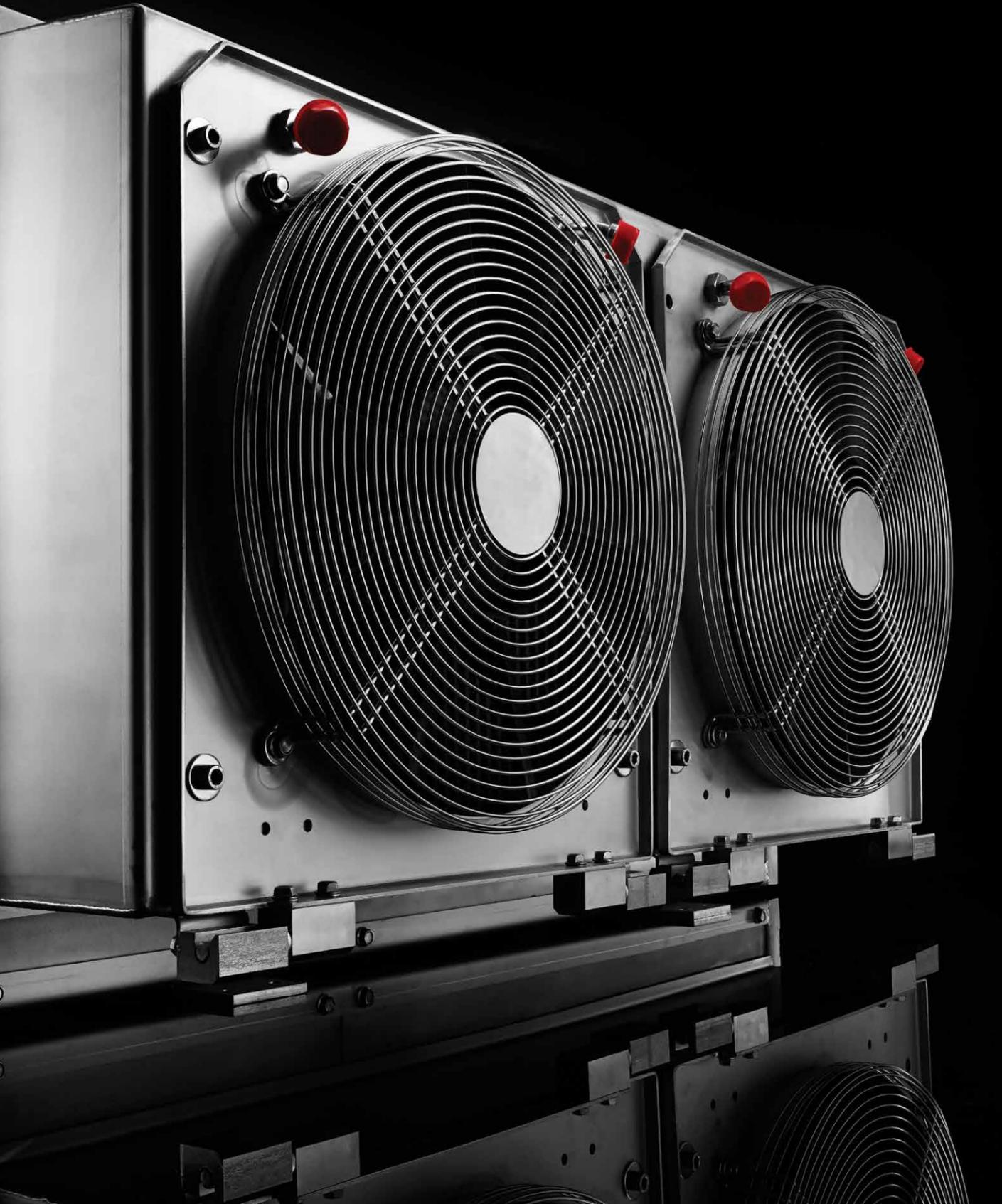
STANDARD THICKNESS OF CORE CONSTRUCTION ELEMENTS

ENLARGED THICKNESS OF CORE CONSTRUCTION ELEMENTS

TRADITIONAL FIN SHAPE

SPECIAL FIN DESIGN FOR MINING CONDITIONS

## Proven Performance – Customized Solutions



## PLATE & BAR COOLERS FROM NISSENS COOLING SOLUTIONS

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 brazed plates and bars, available with a variety of fin performances, is mainly used for high-pressure cooling applications with a working pressure up to 522 psi (36 bar). 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.

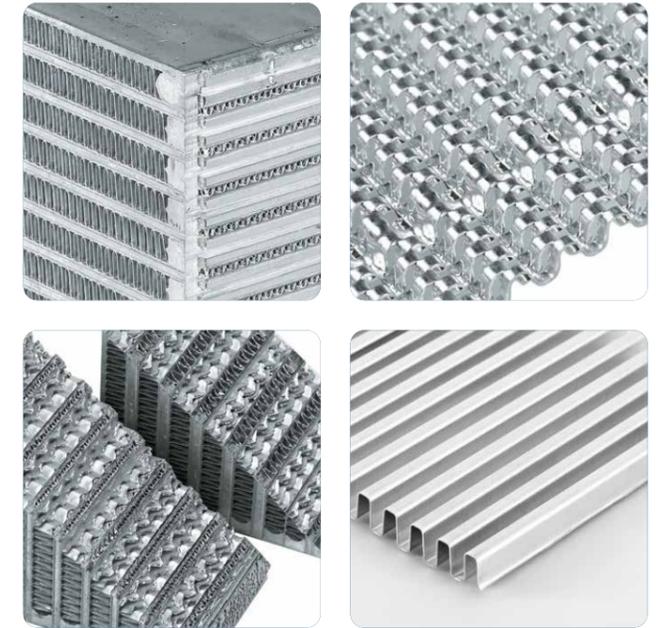
Nissens Cooling Solutions' plate & bar coolers are constructed as a modular system, allowing length and width to vary according to specified application demands and can be equipped with a deep variety of fans, shrouds, mountings, electric/hydraulic motors and connections.

### ADVANTAGES OF PLATE & BAR COOLERS

- 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

|                                   |  |
|-----------------------------------|--|
| <b>Temperature range</b>          | -40° C to 260° C<br>(-40° F to 500° F) |
| <b>Working pressure - dynamic</b> | 16 bar (232 psi)                       |
| <b>Working pressure - static</b>  | 25 bar (362 psi)                       |

For special high pressure applications, a dedicated design can be developed to be applicable at working pressures up to 36 bar (522 psi)

|                    |   |
|--------------------|---|
| <b>Corrosion</b>   | The cooler design is tested for off-shore equivalent to class C5 high                 |
| <b>Cleanliness</b> | The coolers can be flushed to a cleanliness of 15/13/9 or even better acc. to ISO4406 |

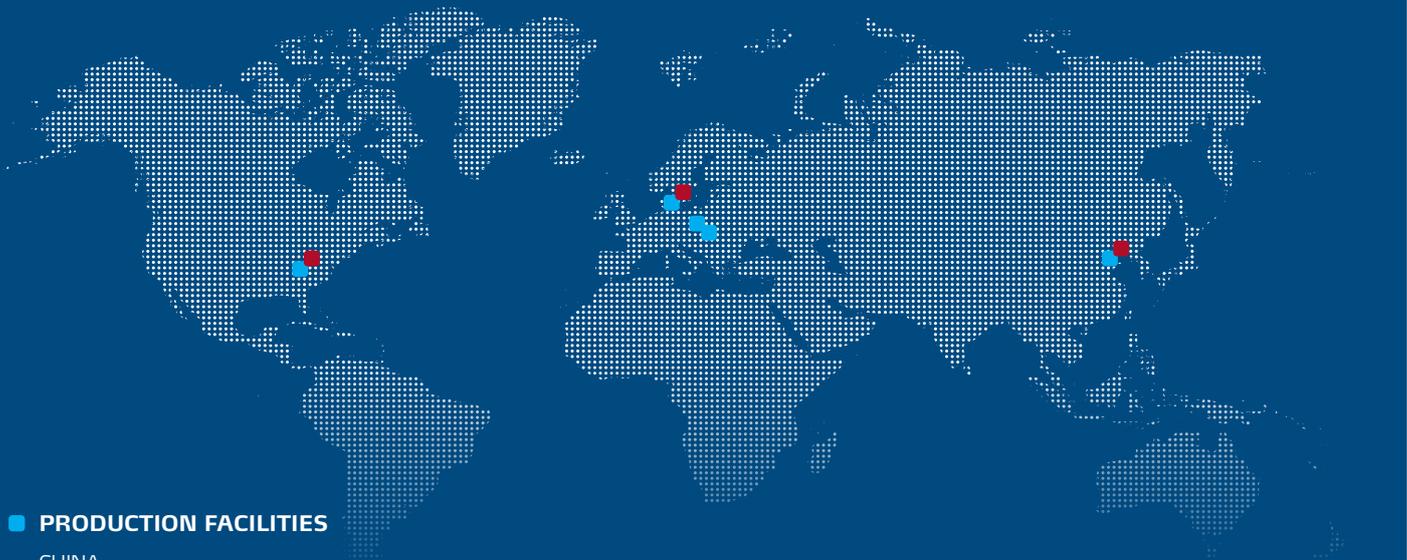
### POSSIBLE SIZES

|                              |  |
|------------------------------|--|
| <b>Available thicknesses</b> | 45 / 63 / 94 / 113 / 140 / 160 mm<br>(1.77 / 2.48 / 3.70 / 4.45 / 5.51 / 6.29 in)            |
| <b>Max. height</b>           | 3000 mm (118.0 in)   |
| <b>Max. width</b>            | 2500 mm (98.4 in)  |
| <b>Tubes</b>                 | 3 mm (0.118 in) oil/water<br>4.4 mm (0.173 in) oil/water/air<br>6 mm (0.236 in) air          |
| <b>Air fins</b>              | Several customized fin types available - specially designed for the tough mining environment |

# 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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