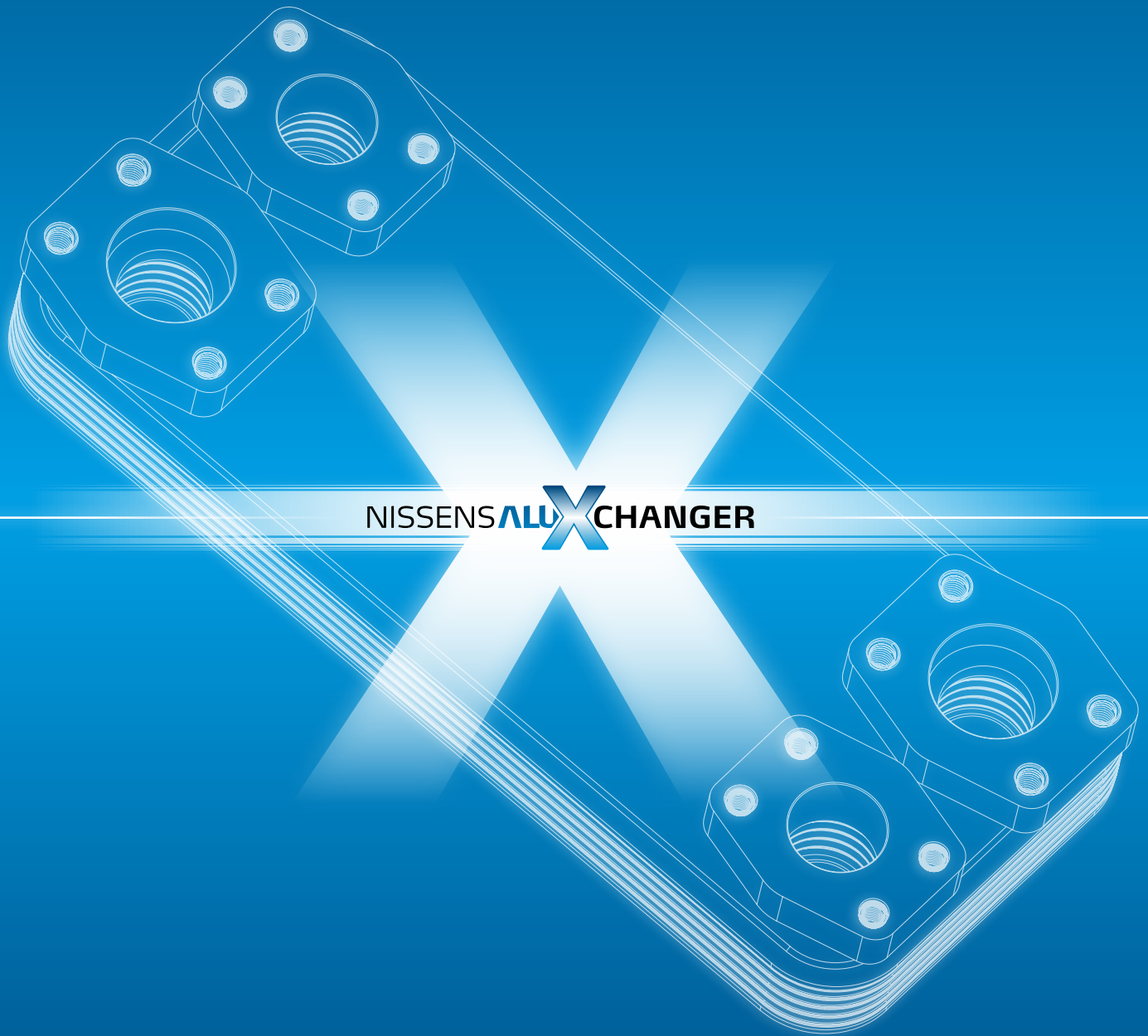


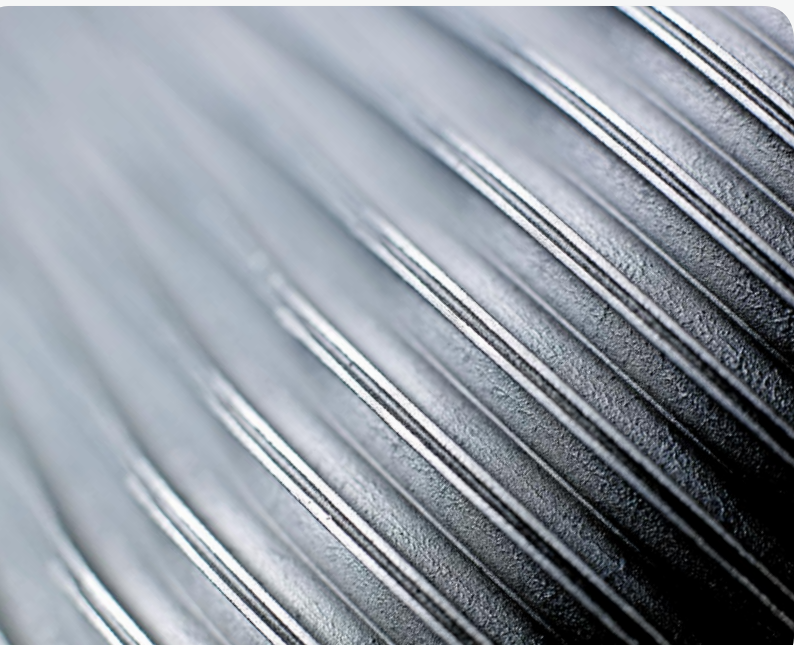


NISSENS **ALU XCHANGER**

Nissens[®]

THE X-SERIES FROM NISSENS

The X-series from Nissens is a range of unique cooling solutions which are designed and manufactured on the basis of proven technologies and Nissens' excellence in handling aluminum processes. Our products are developed with customized features individually matching every customer's need and they are renowned for their high quality and proven performance. The X-series from Nissens aims at taking the market to the next level.



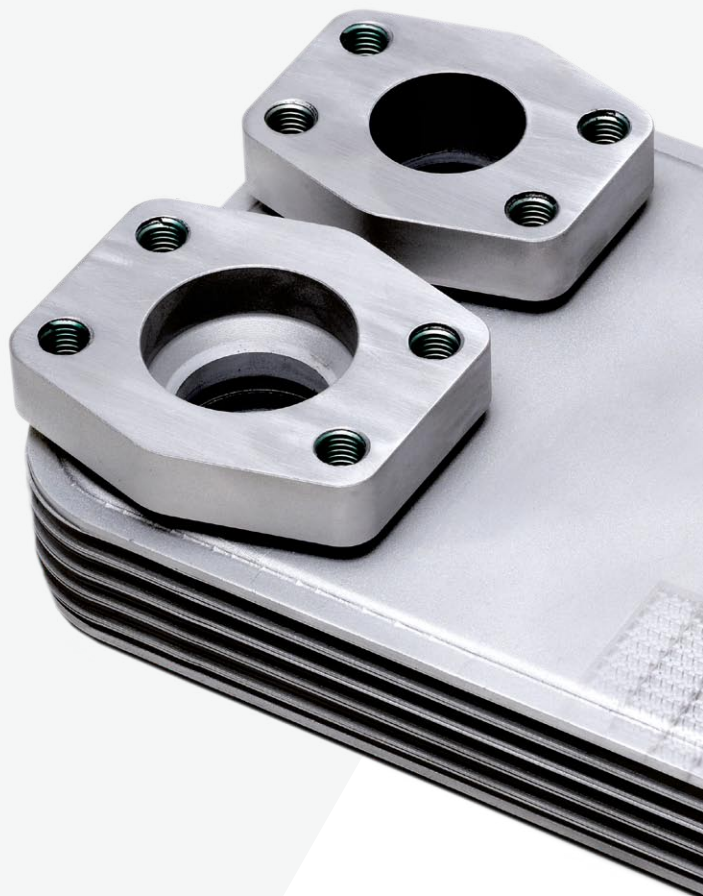
NISSENS **ALUXCHANGER**

Based on 90 years of presence in the international cooling industry, Nissens has applied our significant know-how in innovative cooling solutions and developed a product revolution for a classic application: The plate heat exchanger.

Heat exchangers are traditionally manufactured in stainless steel with copper-based brazing technology. With the AluXChanger series, Nissens offers a unique product solutions with a variety of benefits.

For years, Nissens has been committed to developing and refining the NOCOLOK-based brazing technology for aluminum coolers. Our continuous utilization of this unique production technology in our in-house production facilities has built our expert knowledge and enabled us to create the AluXChanger which is an aluminum-based plate heat exchanger for liquid-to-liquid heat exchange applications.

This unique product is our answer to our customer requests for applying Nissens' renowned aluminum technology in new areas of heat transfer.

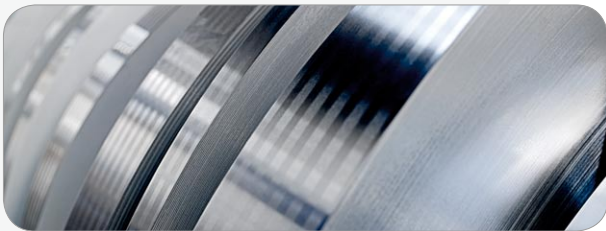


Why choose Nissens' AluXChanger?

The use of NOCOLOK-brazed aluminum as a basis for producing plate heat exchangers gives a number of crucial advantages that form the core of the requirements from a large variety of our customers. The AluXChanger is a testimony of Nissens' commitment to supporting our customers' quest for cost optimization in terms of efficiency gains and cost reductions. The AluXChanger offers:

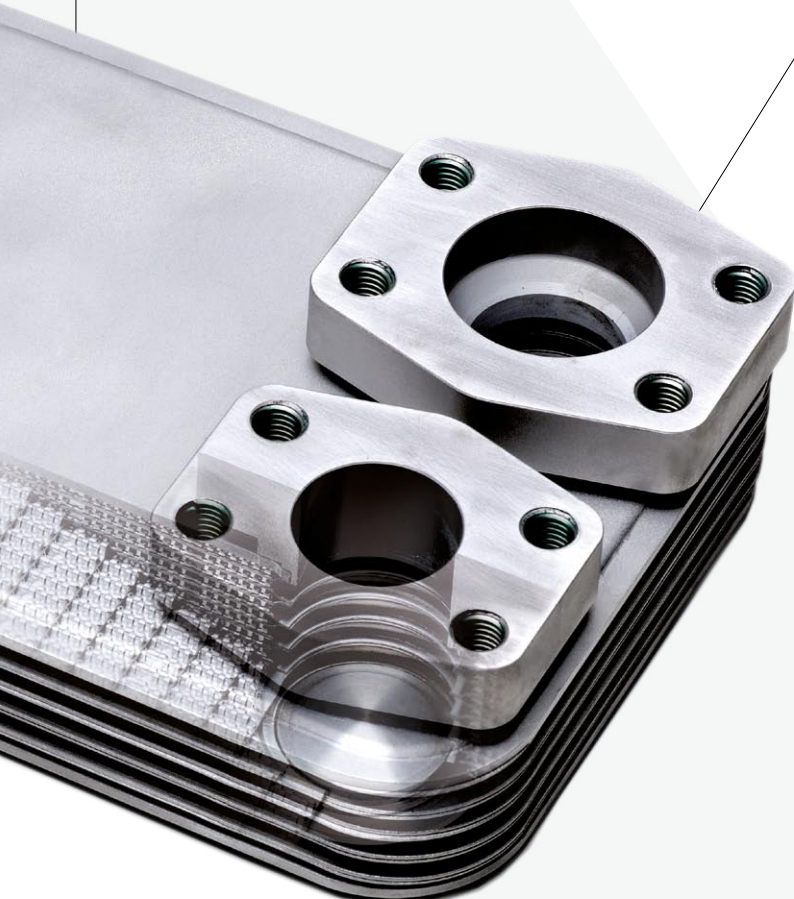
LOWER WEIGHT

An AluXChanger application only weighs half of the equivalent stainless steel heat exchanger. This gives significant cost-saving benefits when the AluXChanger is installed in e.g. wind turbines and diesel engines. Moreover, it facilitates the installation process and makes the maintenance task much easier to undertake.



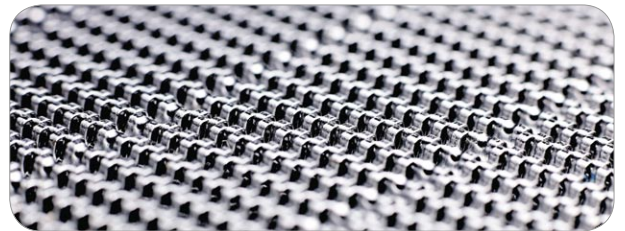
CUSTOMIZED SOLUTIONS

We offer our customers full freedom of design by manufacturing the AluXChanger according to our customers' specifications. This provides a unique flexibility that leaves it to our customers to decide upon length and stack-height dimensions, connection options and circuit diversities. The customized AluXChanger is produced without charging any tool cost to our customers.



HIGHER EFFICIENCY

Our AluXChanger solution has a significantly higher efficiency based alone on the fact that aluminum is a much better thermal conductor than stainless steel. The application of Nissens' well-known turbulator technology also strongly contributes to an improved heat transfer.



MORE VALUE FOR MONEY WHILST RESPECTING THE ENVIRONMENT

The AluXChanger is free from copper and nickel which are potentially harmful materials that are also becoming more and more scarce and thus a more costly resource to apply in manufacturing processes. The aluminum material makes the AluXChanger perfect for recycling with no waste and zero need for material disposal.

IMPROVED CORROSION PROPERTIES

The technological development has had a positive effect on aluminum alloys. The strength of the new alloys is considerably higher, and the lifetime of aluminum products is prolonged thanks to significantly improved corrosion properties. SWAAT tests confirm that the number of "days to failure" of aluminum products has increased and thus made them a very interesting alternative to products in other materials traditionally perceived as being more resistant to corrosion.

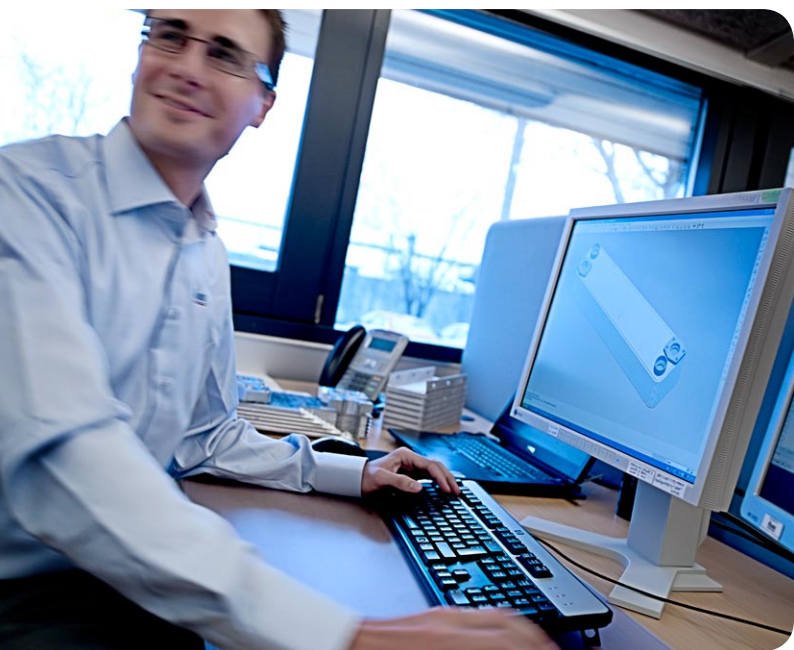


EXPERIENCED MANUFACTURER SUPPLYING WORLD-CLASS CUSTOMIZED COOLING & CLIMATE SOLUTIONS

Nissens is an experienced manufacturer of cooling systems and thermal climate solutions. Throughout 90 years, we have built considerable knowledge of the growing needs of our customers in a number of industries and applications. Having been an esteemed component specialist, we are today steadily heading towards the role as the leading cooling solution provider in all major markets around the world. Our reference list within e.g. the wind industry covers all cooling applications in a wind turbine onshore as well as offshore, and we are supplying to the world's leading wind turbine manufacturers. Furthermore, when it comes to the segment of diesel engine cooling, Nissens has in-depth knowledge of the requirements from applications varying from heavy forest machinery over specialized train cooling applications to small-reach stacker applications.

GLOBAL FOOTPRINT: IN-HOUSE PRODUCTION, LOCAL SUPPORT & GLOBAL SUPPLY

Our focus on cooling and climate solutions has been a strong driver in our dedicated transformation from a local Danish company building upon solid craftsmanship skills to an international industrial group offering local support and global supply of technically advanced product solutions. Today, we have dedicated and experienced employees who are located around the world to serve our customers in the best possible way. We have in-house production in Denmark, Slovakia and China to ensure high quality and short lead times, and our excellent logistics services are second-to-none in the market. Our comprehensive network of Nissens sales facilities situated in central spots of the continents of Europe, America and Asia enables us to grow strong partnerships with our customers and to follow the development of every market segment very closely.



QUALITY AND TECHNOLOGY ARE OUR KEYS TO YOUR SUCCESS

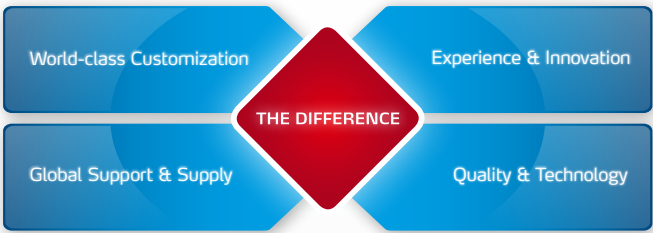
The trust of our customers is built upon our proven performance. We value the importance of applying and respecting the most strict international quality standards for industrial companies. We are certified according to ISO 9001/TS 16949 regulations. As a European manufacturer working closely with leading OEMs in the market, we know that your success is our success, and that implies supply of high-quality products with excellent performance and reliability features, manufactured on the basis of highly advanced technologies. Our in-house R&D department comprises a tooling factory which provides us with a unique flexibility enabling faster development of new products. Of course, we also carry out a full variety of product tests to make sure that product life, performance



and durability are meeting the expectations of our customers. All of our standards, processes and procedures are regularly subject to a number of customer audits throughout the year, so we are continuously tested on our ability to remain the preferred supplier of our valuable customers.

EXPERIENCE & INNOVATION COMBINED TO THE BENEFIT OF 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 our dedicated employees have acquired is directly reflected in our renowned ability to develop, design and manufacture innovative product solutions that bring technical and financial benefits to our customers. We wish to add value to every part of the process starting with a conceptual idea and ending up in an advanced product solution.



DELIVERING THE DIFFERENCE

Our passion for cooling and climate solutions, developed and manufactured in-house, is fundamental to promote our customers’ growth and success. Our respected brand obliges us to continuously exceed the market’s expectations for high quality and technically advanced product solutions. Our customer focus is reflected in local sales support setups and partnerships, global supply and excellent logistics services. The full package is what makes Nissens unique. That is why we are delivering the difference.

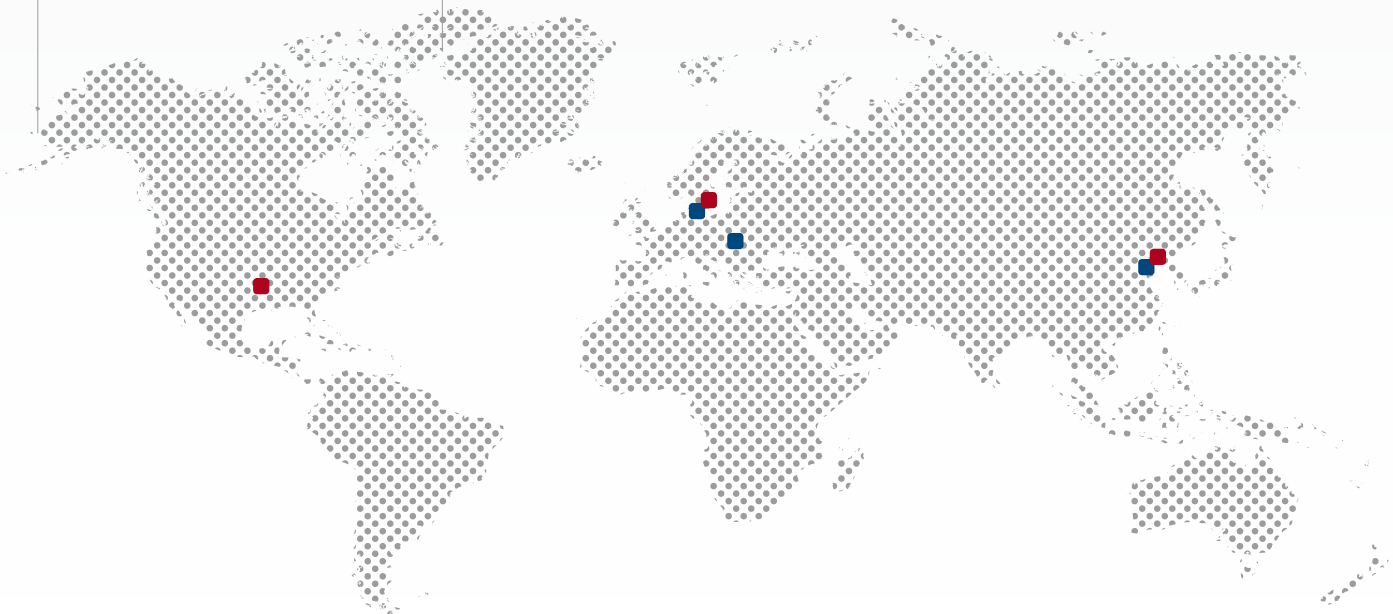
Global Support & Supply

- PRODUCTION
- DENMARK
- CHINA
- SLOVAKIA

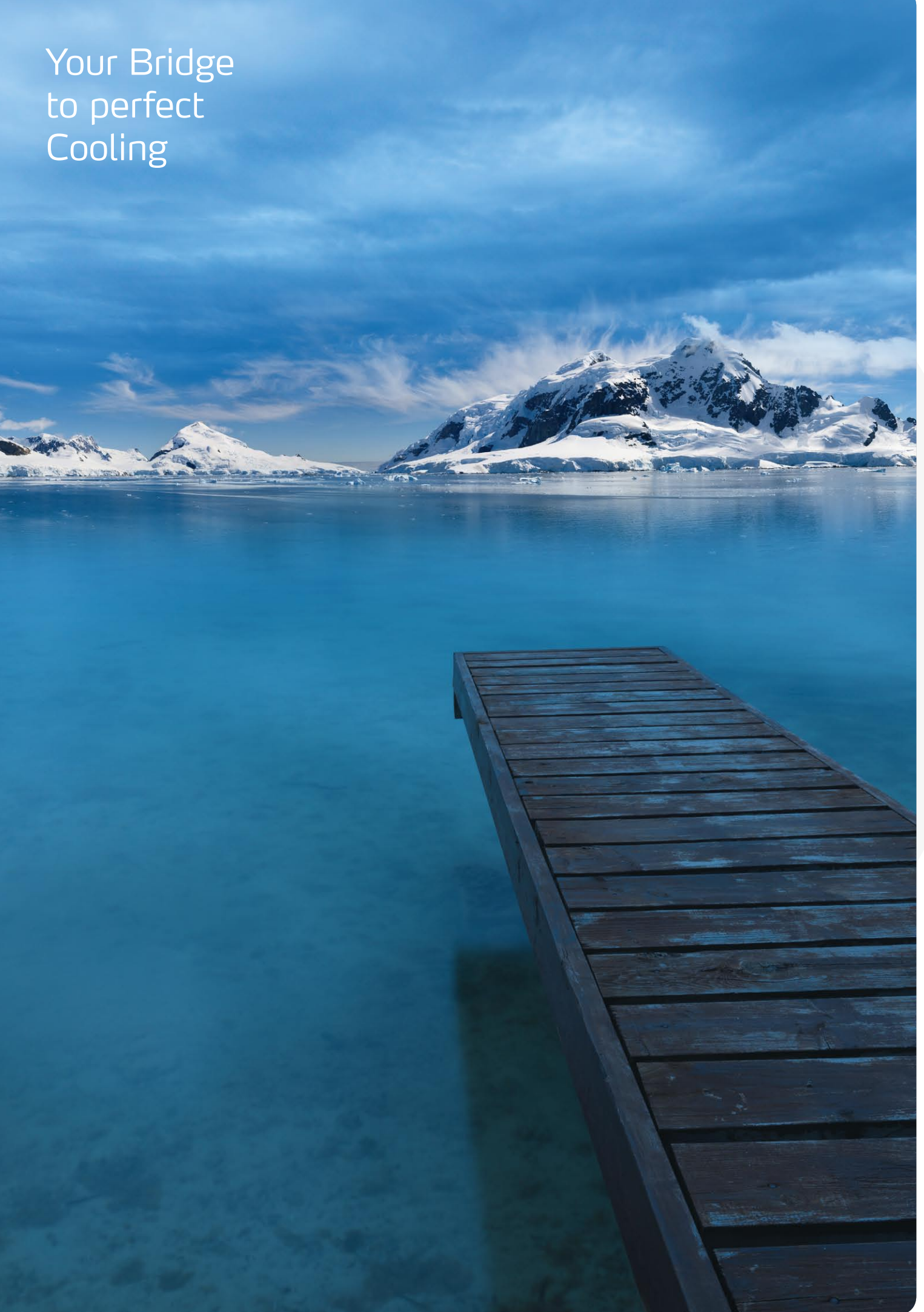
- SALES OFFICES
- ASIA
- Nissens Cooling System (Tianjin) Co. Ltd.
- Tel.: +86 138 118 02701
- cje@nissens.com

- AMERICA
- Nissens North America Inc.
- Tel.: +1 (817) 329 5114
- northamerica@nissens.com

- EUROPE
- Nissens A/S
- Tel.: +45 7626 2626
- nissens@nissens.com



Your Bridge
to perfect
Cooling



THE BENEFITS OF ALUMINUM PROCESSES

Since the early 1990s, Nissens has used Controlled Atmosphere Brazing (CAB) with non-corrosive fluxes as the preferred brazing process. CAB is the leading technology for manufacturing aluminum heat exchangers in the automotive industry. Today, more than 400 CAB furnaces are in operation throughout the world using the NOCOLOK process.

This technology offers the benefits of a flux for successful oxide removal, working at atmospheric pressure while avoiding the disadvantages of post-braze treatments and corrosion susceptibility.

SUCCESSFUL CAB PRODUCTION

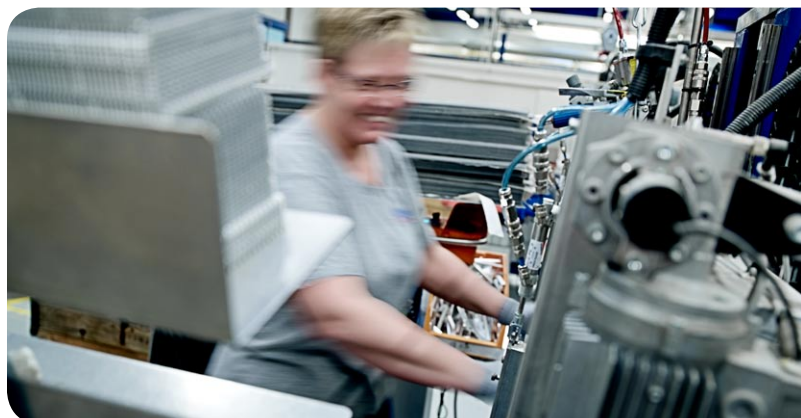
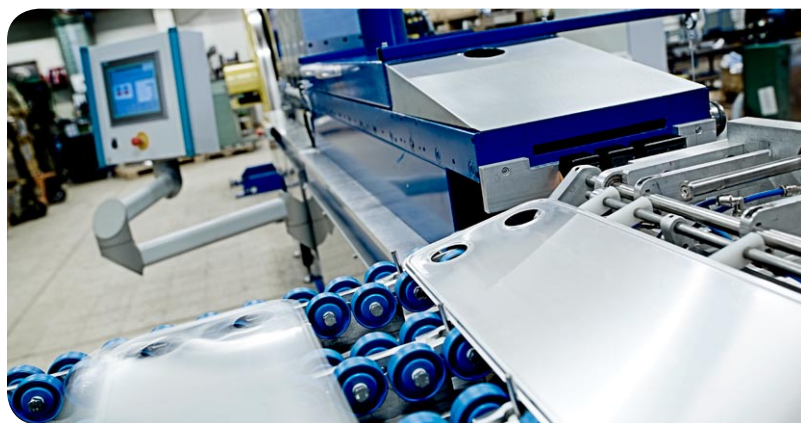
Success or failure in CAB production relies on several factors. The starting point is a good product fit-up. Parts to be metallurgically joined must have intimate contact at some point along the joint. An adequate quantity of filler metal must be available to fill the joints. Capillary forces pull the filler into the joints. By using our well-known turbulator, Nissens successfully ensures to get the optimum between an excellent brazing quality (leading to an adequate strength) and the heat transfer capabilities.

RELIABLE BRAZING RESULTS

Another essential for reliable brazing results is a uniform flux coating on all surfaces involved in the joint formation. The main focus to achieve this result is on the cleaning and fluxing procedures. Equally important are the furnace conditions, i.e. temperature profile, temperature uniformity and atmospheric conditions.

TESTED TECHNOLOGY – INNOVATIVE INVENTION

For almost 20 years, Nissens has proven our excellence in mastering the CAB processes. As a result, it has been a natural step forward to develop the AluXChanger by using and further building upon the same reliable processes and technologies that we are successfully controlling today. That means that Nissens is able to offer new and innovative cooling solutions that are created on the basis of in-depth knowledge of technologies that have been solidly tested and have proven their performance by leading to zero default operations and high-quality cooling components and cooling systems.



PRODUCT-TECHNICAL FEATURES OF NISSENS' ALUXCHANGER

Nissens' AluXChanger offers a number of product-technical features that distinguish this product from the traditional heat exchangers available in the market today. We have developed the AluXChanger in order to meet the growing demands of our customers in a number of areas where the existing heat exchangers have reached their limitations and thus impede the technological development that is necessary for our customers to grow and evolve. Of course, there is full compatibility between the advantages of the AluXChanger and the requirements linked to the respect of international standards and directives.

ACCORDANCE WITH INTERNATIONAL STANDARDS

The AluXChanger is 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
Working pressure - dynamic	up to 16 bar
Working pressure - static	up to 25 bar

COOLING MEDIUM

Mineral or synthetic oil

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

CLEANLINESS

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

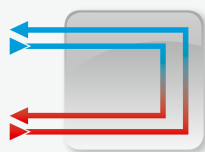
CORROSION

Upon request, the AluXChanger can be supplied flushed with mineral oil to cleanliness level -/13/10 according to ISO 4406

STANDARDIZED RANGE OF CONNECTION TYPES

The AluXChanger is available with a standardized range of connection types:	SAE Flange; size 1" to 2" according to SAE J 518 C and ISO 6162-1/2
	Socket; size G1" to G2", according to DS EN/ISO 228-1 and ISO 1179
	Hose connection; size Ø25-Ø65 with bead according to DIN 71550

CONNECTION CONFIGURATIONS



CONFIGURATION C

Counter flow.
All connections on one side.



CONFIGURATION Z

Counter flow.
Primary inlet and secondary outlet top one side. Primary outlet and secondary inlet bottom opposite side.



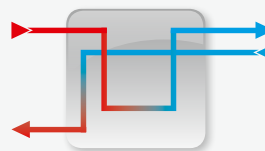
CONFIGURATION X

Counter flow.
Primary inlet and outlet one side.
Secondary inlet and outlet opposite side.



CONFIGURATION W

Counter flow, 2 pass.
Primary inlet and secondary outlet top one side. Primary outlet and secondary inlet top opposite side.



CONFIGURATION P

1/2 counter flow, 1/2 parallel flow.
(primary side 1 pass, secondary side 2 pass). Primary inlet and secondary outlet top and bottom one side. Primary outlet and secondary inlet top opposite side.

Other configurations are available upon request.

STANDARD RANGE

One of the unique features of Nissens' AluXChanger is our offer to customize the product according to customer needs. However, we also offer a standard range of AluXChangers providing you with the opportunity to select the market's most commonly used heat exchanger dimensions:

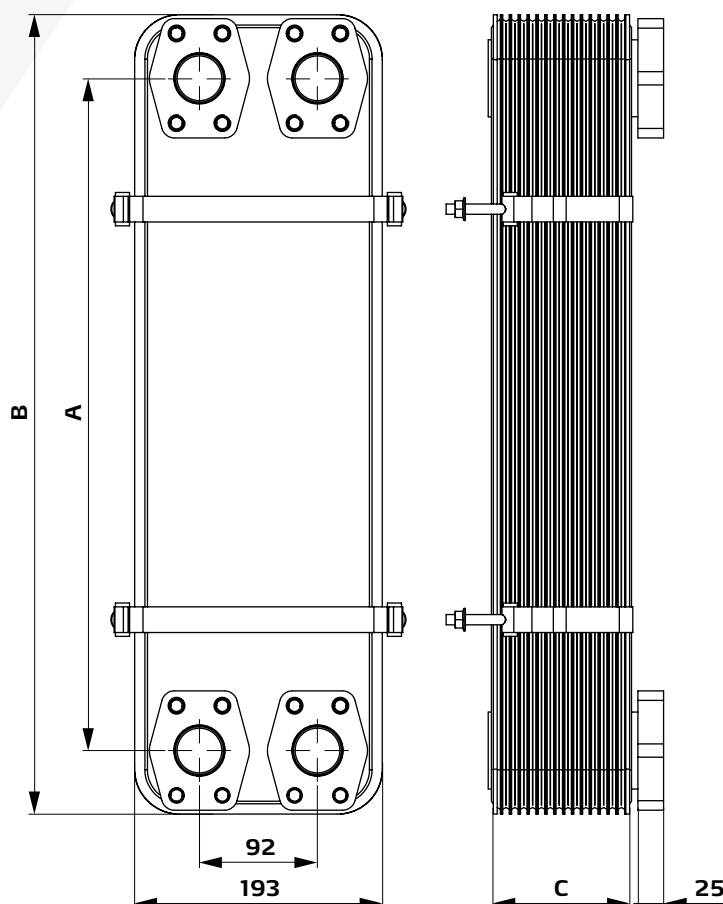
DIMENSIONS

Millimeter (mm)

A	B	C
224	323	$N \times 3,46 + 7,89$
374	473	$N \times 3,46 + 7,89$
524	623	$N \times 3,46 + 7,89$
674	773	$N \times 3,46 + 7,89$
824	923	$N \times 3,46 + 7,89$
974	1073	$N \times 3,46 + 7,89$
1124	1223	$N \times 3,46 + 7,89$

N = number of plates

Connections: SAE flange, Female socket and Hose connections with bead



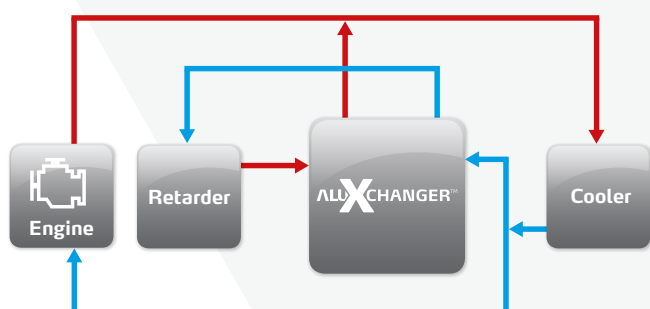
APPLICATIONS

Nissens' AluXChanger can be used in a variety of different industries and applications



EXAMPLE 1

In the wind turbine industry you want to keep your gear oil at a certain working temperature in order to have an optimum lubrication.



EXAMPLE 2

Cooling of retarder oil in construction equipment using the engine cooler to cool both the engine (directly) and the retarder (indirectly via the AluXChanger).

PERFORMANCE

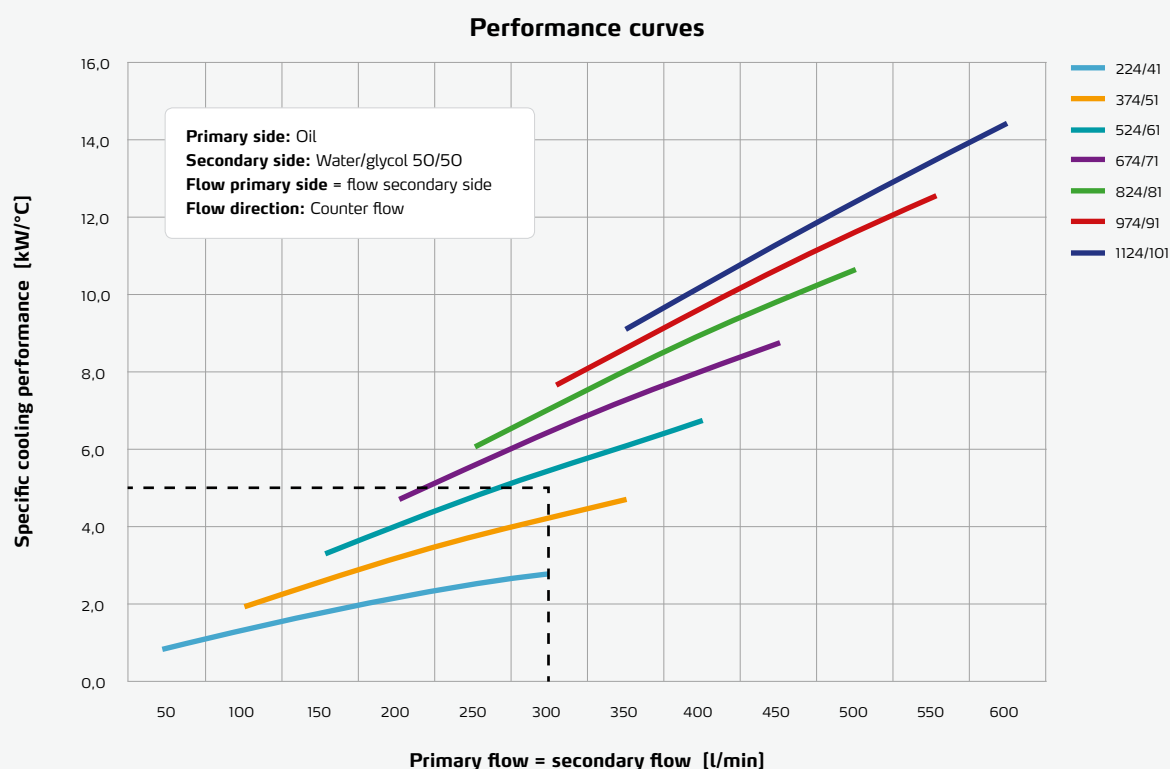
During the process of designing and developing the AluXChanger, we have used our comprehensive knowledge from the cooling industry in general to ensure that proven performance in tested technologies forms the basis of the innovation offered by the AluXChanger.

Designing the AluXChanger with shell plates using a turbulator between each plate, we offer a solution with high strength and excellent heat-transfer properties. At the same time, we have designed in- and outlets to ensure a low pressure drop and an even distribution of the coolants in order to achieve a homogeneous and optimum heat transfer.

PERFORMANCE CURVES

All performance tests are carried out in accordance with DS/EN 306.

Below you will find the performance curves for three standard size AluXChangers.



EXAMPLE

To find the right size of AluXChanger, you need to know: oil and water flow, temperatures and need for cooling performance.

DATA

Flow oil = flow water	300 l/min
Needed performance	125 kW
T oil inlet	80°C
T water inlet	55°C
Specific cooling performance	$125 / (80 - 55) = 5.0 \text{ kW/°C}$

RECOMMENDATION

The performance curves clearly indicate that Nissens' AluXChanger 524/61 will be the best choice to meet the requirements presented in the above table.

Disclaimer - Nissens A/S provides this leaflet as a service and for information purposes only. The material and contents are provided without warranty of any kind and are not intended to be used as a substitute for advice from our engineering team.

While we attempt to maintain the information in this leaflet as accurately as possible, it may contain errors or omissions for which we disclaim any liability. Nissens A/S is not responsible for any property damage or personal injury, direct or indirect damage from failure or down time in production caused by improper equipment construction, incorrect application, operation and/or abuse of our products.

Nissens A/S does not guarantee that the design and/or operational function of any equipment that incorporates our products conform to local, state, and/or federal regulations.

Patents - Nissens A/S develops and manufactures products under a dynamic intellectual property portfolio. Products may be protected by one or more patents, utility models, designs or trademarks. A regularly updated list of all publicly available rights is published on our website www.nissens.com. At the time of print, the products featured in this leaflet have patents pending.

QUALITY – A NISSENS QUALIFIER

As an international manufacturer, Nissens perceives high quality not only as a value-adding feature for our customers, but also as a necessary qualifier for us to remain the preferred supplier to numerous market-leading customers in demanding industry segments around the world.

TS QUALITY MANAGEMENT SYSTEM

Nissens' quality system is certified according to the ISO/TS 16949 technical specifications aiming at developing a quality management system that provides continuous improvement and emphasizes defect prevention as well as reduction of variation and waste in our supply chain. It is a key element in our quality approach that the quest for system and process quality improvements is directly related to increasing customer satisfaction. A strong customer focus is thus a driver for our quality performance.

VALUABLE CUSTOMER AUDITS

A close interaction with our customers on quality performance is reflected in the considerable number of customer audits that are carried out in our global production facilities throughout the year. We are successfully meeting the requirements of our customers by quickly identifying possible risks, eliminating their causes and examining the effectiveness of both corrective actions and preventive measures. We value the co-operation with our customers on quality issues since it serves as a beneficial opportunity for us to keep in line with the trends of the market in terms of higher and more complex quality demands. Understanding the needs makes it easier for us to provide the answers.

ADVANCED TEST CENTRE PROVIDING VALID DOCUMENTATION

Nissens' Test Centre is an offline test laboratory that serves the purpose of supplying the technical documentation required to ensure that our customers will always receive the optimal cooling solution. We offer and carry out a variety of different tests, e.g. material, mechanical, dimensional, thermal and customized tests according to the needs of our customers. Our renowned documentation package offers the basic data for the design engineering of a specific cooler. It also comprises a durability test which benchmarks against our customers' requirements as well as against Nissens' in-house quality standards. Finally, we also offer to carry out specific or customized tests either at the customer's premises or in our in-house test facilities.

All of our tests are subject to strict control measures and carried out in accordance with Nissens' test procedures 10.04 / 10.05 / 10.401 and 11.01. If other standards are used, this will clearly appear from the description of each individual test. Only experienced and specially trained employees are allowed to work in our test centre, to perform the tests and to have the responsibility for the elaboration and analysis of the test results.



Nissens A/S

Ormhøjgårdvej 9-13
8700 Horsens, Denmark

Tel. +45 7626 2626
Fax +45 7626 2604
nissens@nissens.com

www.nissens.com