

Trains

Application Needs & Product Solutions



COOLING
SOLUTIONS
TRAINS

Nissens
COOLING SOLUTIONS

Nissens Cooling Solutions: Delivering the Difference in the Train Industry

NO COMPROMISES ON HIGH PERFORMANCE AND SUPERIOR RELIABILITY

The train industry offers an important contribution to supporting the local and global infrastructure to the benefit of the on-going economic growth and business development in almost every country around the world. Millions of passengers and goods are moved from one location to another on a daily basis. For that reason, high performing trains and a superior reliability are key success criteria for the train operation companies, the train manufacturers and their network of suppliers.

TRAIN EVOLUTION OR REVOLUTION: ELECTRICAL TRAINS AND GAS-BURNING TRAINS

With a growing focus on reduction of pollution and green transportation, the train industry pursues its continuous development. With an evolution from steam trains to diesel-driven trains, the train industry has within recent years continued to revolutionize their industry segment by investing in the development of both electrical trains and gas-burning trains with the aim of providing trains that are both cheaper, faster and cleaner. All preferred suppliers to the train industry must be able to support the aims and goals.

NISSENS COOLING SOLUTIONS MEETS THE NEEDS FOR RELIABILITY, PERFORMANCE AND MAINTENANCE

For years, Nissens Cooling Solutions has manufactured and supplied customized cooling solutions for the train industry. In close partnerships with the leading OEMs in the industry, we design unique cooling products that take our global customers' indisputable requirements for absolute reliability, uncompromising performance and uncomplicated maintenance into account in every aspect of the solution that we offer and guarantee.

THE RIGHT COOLING SOLUTION FOR ORIGINAL INSTALLATION AND REPLACEMENT

Our proven performance in the train industry builds upon new product designs for original train installations as well as new or improved product designs for replacements in existing end users applications.



Nissens Cooling Solutions is one of the industry's preferred suppliers of advanced, customized cooling solutions for the demanding train applications. Our customers highly value our application knowledge and in-depth cooling know-how that we provide to the industry as well as decades of experience with cooling and thermal solutions and our strong commitment to constantly develop new and innovative solutions to the benefit of the train industry.

Mikkel Krogslund Andersen
CEO

Handwritten signature of Mikkel Krogslund Andersen.

Advanced Cooling Solutions developed for reliable Train Applications

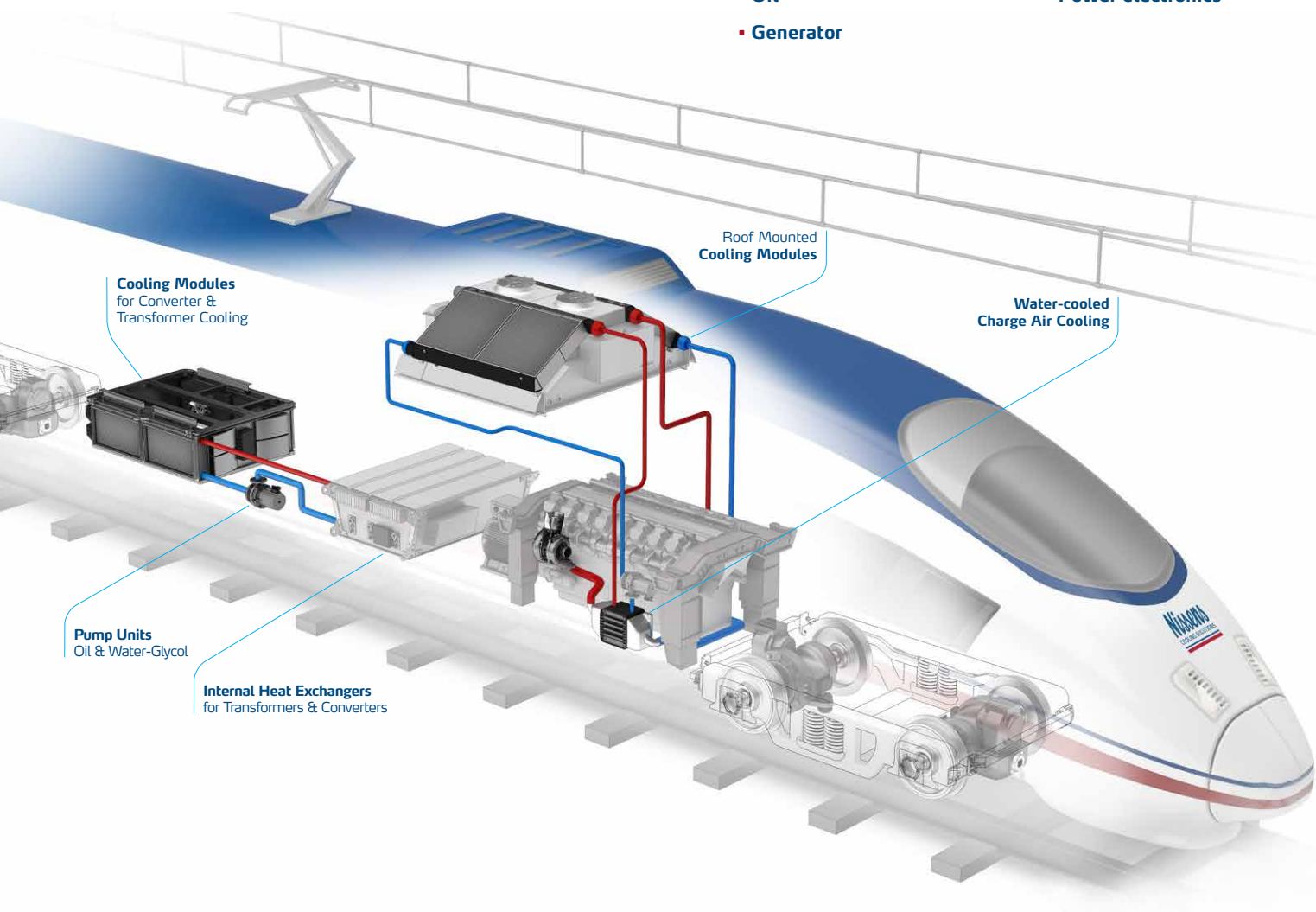
Our customized cooling solutions are suitable for different application areas in the train industry – this is a selection of the most common applications and the cooling options within both direct and indirect cooling:

DIESEL-DRIVEN TRAINS

- Engine
- Charge air
- Oil
- Generator

ELECTRICAL TRAINS

- Transformer
- Electrical converter
- Power electronics



OFFERING SUPERIOR RELIABILITY

The trains in operation often cover long distances, and they are designed to be fully operational 24/7 to ensure that the mobility of passengers and goods takes place without any interruptions or delays. For that reason, Nissens Cooling Solutions designs customized cooling solutions to the train industry with a life time of up to 30 years.

Based on the specific application of any given customer, we design, manufacture and supply a customized cooling solutions that are specifically developed to match our customers' needs for product and operation reliability.

SECURING HIGH PERFORMANCE

Our customers, the global train manufacturers, are obliged to guarantee the performance of their trains. We acknowledge the need for high performance in the train industry, and we thus develop customized cooling solutions to match our customers' individual needs. Special developments could be made-to-order fins, customized turbulators or other unique parts designed for a non-standard cooling solution required by the train manufacturer.

The flows in our customized cooling solutions are also adapted to specific applications, and upon request from our customers, we willingly develop and produce coolers with two-pass designs or back-to-front designs depending on the heat transfer requirements needed for the optimal cooling performance.

Our Product Offer for high-p

Nissens Cooling Solutions' comprehensive range of optimal cooling solutions

PLATE & BAR COOLERS

Plate & Bar coolers from Nissens Cooling Solutions 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 of up to 36 bar (522 psi). Specially formed turbulators improve the cooling performance considerably. CAB brazing technology offers a solid, sturdy and extremely durable construction.

ADVANTAGES - PLATE & BAR COOLERS

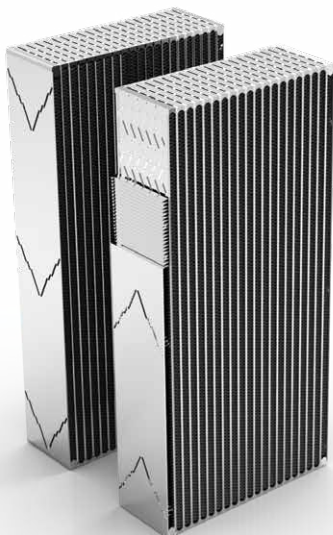
- **Excellent cooling performance**
- **Proven, extended durability and corrosion performance**
- **Compact and flexible design**
- **Deep variety of possible equipment and customizations**

ALUXSTREAM

Nissens Cooling Solutions' AluXstream is an innovative hybrid construction where tube plates have been integrated with bars and a special turbulator pattern. The AluXstream cooler offers the required quality, flexibility and efficiency to comply with any water cooling need.

ADVANTAGES - ALUXSTREAM

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



WCAC

With the WCAC from Nissens Cooling Solutions, the charge air is cooled by a coolant, and not by the passing air. A traditional cooler is designed to provide maximum cooling when needed, but normally only approximately 70-80% of the maximum cooling capacity is required. An optimal solution is thus a combination cooler like Nissens' 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 large diesel engines, gen-sets, and marine engines. It can be integrated into several cooling systems; indirect and direct cooling systems, retarder systems and heating systems. The engine integration flexibility that the WCAC offers makes it an obvious choice in train applications, where fuel savings and high performance are key requirements in a compact installation package with large engines.

Contrary to an air-cooled charge air cooler, the WCAC offers less noise pollution thanks to a limited need for increasing the speed of the fan during operation.

ADVANTAGES - WCAC

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



performing Train Applications

s for demanding train applications

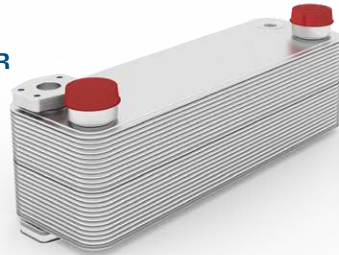
ALUXCHANGER

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, but the AluXchanger is supplied with brazed aluminum as a basis for producing plate heat exchangers.

ADVANTAGES - ALUXCHANGER

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



PRODUCT TECHNICAL INFORMATION

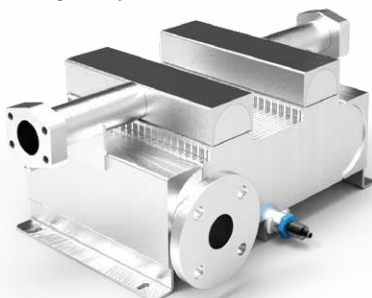
Temperature range	-40 °C to 130 °C (-40° F to 266° F)
Working pressure - dynamic	Up to 16 bar (232 psi)
Working pressure - static	Up to 25 bar (363 psi)
Corrosion	The AluXchanger is made of long-life aluminum alloys suitable for offshore environments.
Cleanliness	Upon request, the AluXchanger can be 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. The AluXsafe consists of a full aluminum design, and the turbulator technology is applied as a central design feature.

ADVANTAGES - ALUXSAFE

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



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. Our pump stations are supplied with a compact manifold and pipe design.

ADVANTAGES - PUMPSTATIONS

- 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

EXAMPLE OF PUMP UNIT

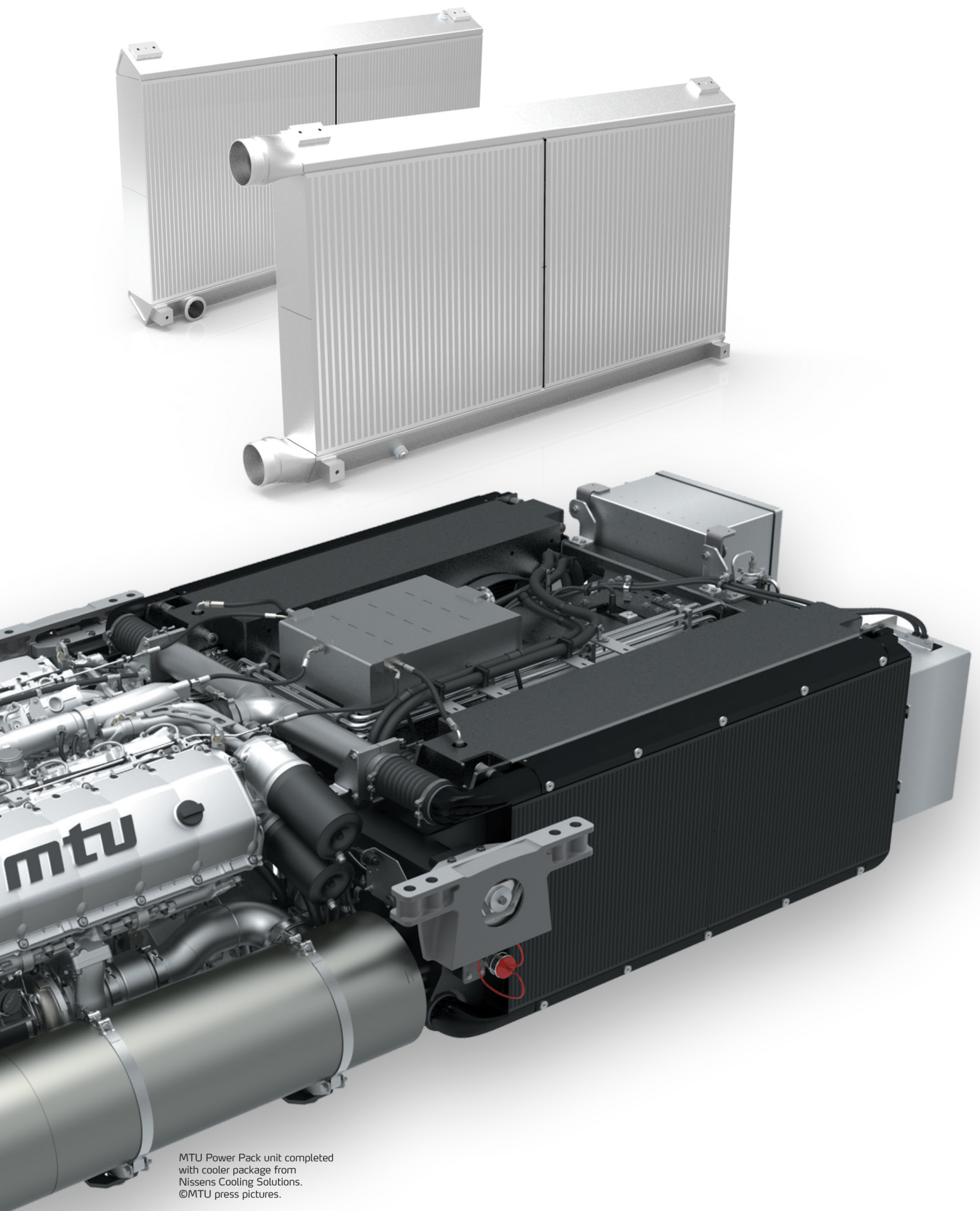
NISSENS COOLING SOLUTIONS' PUMP UNIT: NPU-DN50/H

Pump unit for converter cooling:

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



Proven Performance - Customized Solutions



MTU Power Pack unit completed
with cooler package from
Nissens Cooling Solutions.
©MTU press pictures.

In-House Test Center: Documenting our Proven Performance

Nissens Cooling Solutions has invested in an advanced in-house test center with the purpose of supplying the technical documentation required by our customers to ensure that Nissens Cooling Solutions supplies the optimal cooling solution according to our customers' specifications. Our comprehensive test effort and experience contribute to further developing Nissens Cooling Solutions' technical know-how and strengthens our product innovation for train industry applications.

A FULL PORTFOLIO OF DIFFERENT TEST TYPES

We have the facilities to carry out a large variety of 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 engineering design of a specific, customized cooler. It also comprises a durability test which benchmarks against our customers' requirements as well as against Nissens Cooling Solutions' high 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.

FORMAL TEST PROCEDURES AND SKILLED TEST SPECIALISTS

All of our tests are subject to strict control measures and are carried out in accordance with Nissens Cooling Solutions' test procedure numbers 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 center and perform the tests as well as have the responsibility for the elaboration and analysis of the test results.



TS Quality Management System: High Quality, Continuous Improvements and Zero Defects

Nissens Cooling Solutions' quality system is certified according to the IATF 16949 technical specifications aiming at developing a quality management system that provides for continuous improvements and zero defects. 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.

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 adept 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.

DIN EN 1585-2-CL-2 CERTIFIED

As a renowned supplier to the train industry, Nissens Cooling Solutions is a certified manufacturer according to the strict welding standards applicable for train applications.

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

■ SALES OFFICES

ASIA
Nissens Cooling System
(Tianjin) Co. Ltd., China
Tel.: +86 22 8219 5600
ncs-asia@nissenscoolingsolutions.com

EUROPE
Nissens Cooling Solutions A/S
Denmark
Tel.: +45 7614 8000
ncs-europe@nissenscoolingsolutions.com

USA
Nissens Cooling Solutions Inc.
North Carolina
Tel.: +1 704 987 0088
ncs-northamerica@nissenscoolingsolutions.com

Disclaimer - Nissens Cooling Solutions A/S provides this leaflet as a service and for information purposes only and it cannot be used as a substitute for advice from our engineering team. The material and contents are provided without warranty of any kind, may contain errors or omissions for which we disclaim any liability. Nissens Cooling Solutions A/S shall not be 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 Cooling Solutions 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.