

COOLING OF POWER ELECTRONICS

SOLUTIONS GUIDE

Offering a safe & reliable way to cool semiconductor equipment & applications



FERRAZ SHAWMUT IS NOW MERSEN

MERSEN

Bring us your toughest thermal application challenge

MERSEN WILL HELP YOU MAXIMIZE PERFORMANCE, SAFETY & RELIABILITY WITH CUSTOMIZED COOLING SOLUTIONS, SERVICES & SUPPORT



Mersen integrates its extensive cooling expertise and patented heatsink technology into semiconductor applications to make them more efficient, reliable and profitable.

Mersen's engineering team will help you find innovative solutions and can also simulate your application. Our unique knowledge of air, phase change and liquid cooled heatsinks enables Mersen to help you find the right thermal protection solution for your application.

Participation in thermal research groups and design work on several demanding thermal applications all over the globe, means we can offer the widest variety of adapted competitive designs.

We work close to our customer to solve their global functional needs.

- By equipping processes with drives and cooling them...
we can decrease the power electric motors need to run.
- By cooling power electronics in wind or solar power systems...
we can increase the efficiency of renewable power.
- By cooling power electronics on HVDC power lines...
we can cut losses from those lines.
- By cooling IGBT components on industrial-use UPSs...
we can improve power quality.
- By cooling the power electronics on high speed train engines...
we facilitate energy savings in transportation.

Electricity runs the world. Mersen keeps it safe & reliable.



A global company

WITH LOCAL TECHNICAL SUPPORT OFFERING CLOSE-TO-THE-CUSTOMER ASSISTANCE



With industrial operations in all three major economic regions of the globe, Mersen offers global service with close-to-the-customer support. Each location brings a specific product expertise and is ISO 9001-2000 registered and RoHS compliant. The facilities operate on a continuous improvement philosophy and a “pull” manufacturing strategy.

- In **Europe**, our historic plant in La Mure is a center of excellence for liquid cooled solutions
- In **North America**, our plant in Toronto, Canada is a center of excellence for air cooled solutions
- In **Asia**, a brand-new facility in Shanghai, China manufactures both air and liquid cooled solutions

Helping customers improve their global competitiveness

Mersen has a keen understanding of the unique challenges customers face in each of the markets we serve. We deliver extensive product expertise and unbeatable applications support, enabling its customers to optimize their market performance. We cater to the unique needs of these markets & applications:

- Aerospace
- Industrial controls
- Medical
- Motor drives
- Power controls
- Renewable energy (wind & solar)
- Signal processing (RF amplifiers)
- Telecommunications
- Transportation



La Mure
France



Toronto
Canada



Shanghai
China



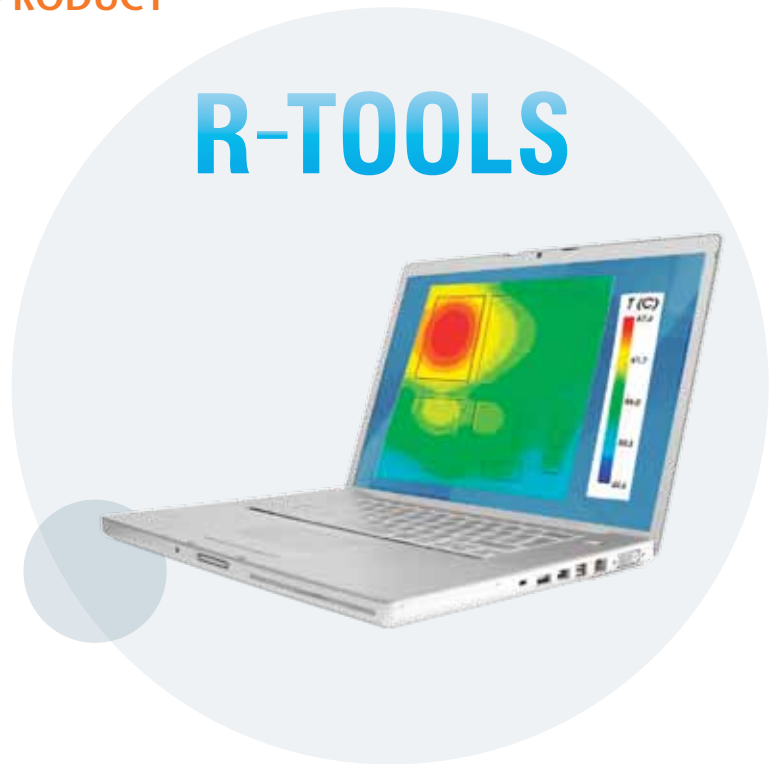
R-Tools 3D thermal heatsink modeling

REDUCE YOUR DESIGN TIME WHILE INCREASING THE RELIABILITY OF YOUR FINAL PRODUCT

Mersen's innovative R-Tools makes it easy to quickly and accurately model various heatsink configurations. It is completely interactive and available online 24/7. It uses analytically based design tools, allowing you to create the thermal design of the heatsink concurrent with the optimization of the electrical and manufacturing elements prior to any prototype builds and testing. This invaluable resource reduces your design time and increases the reliability in your finished product.

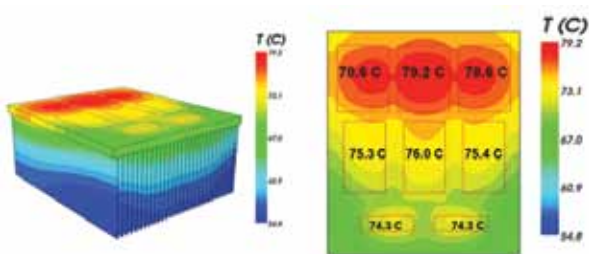
Discover the benefits of R-Tools:

- Understand and communicate the thermal behavior of your designs with the aid of visualization tools
- Quickly & accurately model various heatsink configurations
- Convenient 24/7 online access
- Easy to use
- Test various designs before committing valuable resources

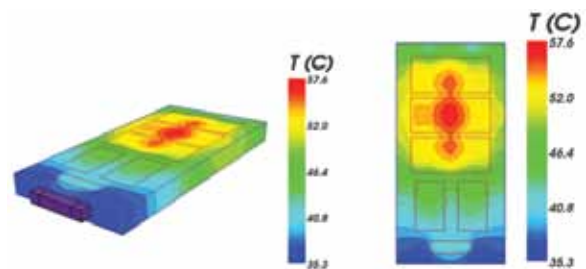


Visit R-Tools online at:

us-ferrazshawmut.mersen.com/cooling



Air Cooled Thermal Data

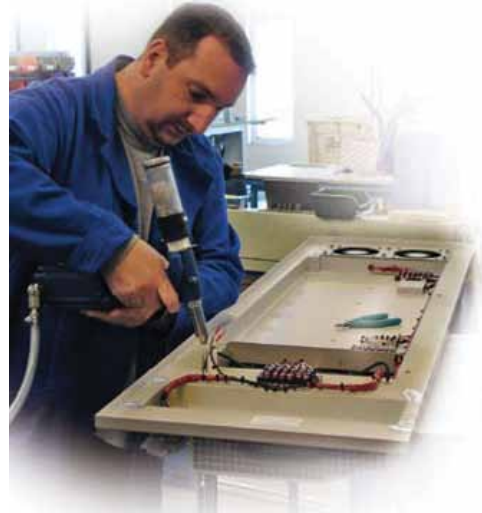


Liquid Cooled Thermal Data

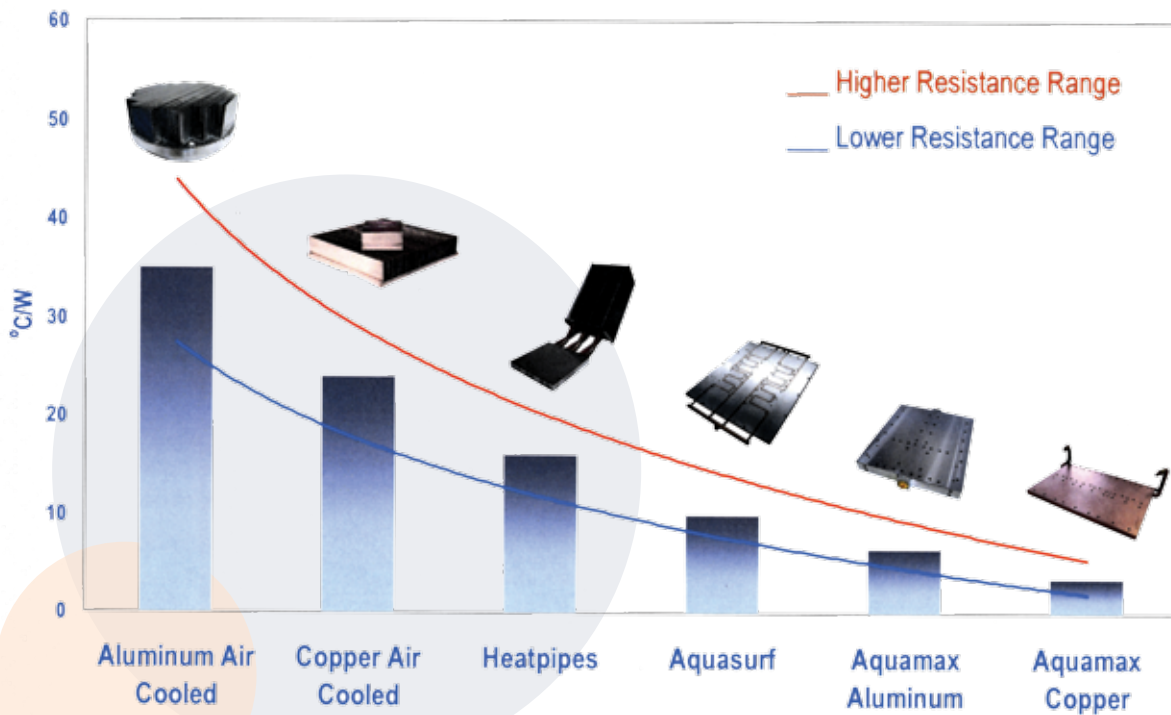
Turn to one source for an extensive line of cooling technologies

AIR, PHASE CHANGE & LIQUID COOLING

Mersen uses a number of cooling technologies (air, phase change, liquid), and **therefore can meet every need from 40°C/kW to 1°C/kW**. This range is complemented by a cooling offering that covers the entire thermal loop.



Thermal Management Road Map



Air cooling solutions

THE HIGHEST PERFORMANCE HEATSINK TECHNOLOGY IN THE WORLD

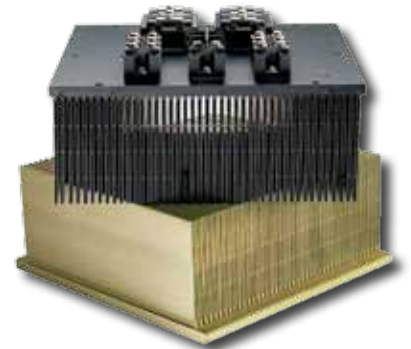


Our Swaging Process – for maximum thermal conductivity

Developed and patented by our Mississauga plant, our swaging process boosts the efficiency of air cooled heatsinks with thinner, longer fins on denser or mixed metals to get maximum thermal conductivity while keeping weight down.

Fabfin® - uses patented swaging technology

- The Fabfin heatsink stands out from ordinary extruded heatsinks because of its higher fins, giving it excellent performances. Using a swaging process means a variety of its higher fins and increased height-to-space ratio types of fins can be used.
- The Hollowfin heatsink uses the same technology but the fins are processed further to increase their density on the baseplate.



Extensive air cooling solutions to meet unique challenges

Also available in mixed metal, dual baseplate, integrated and extrusion* models.



Extrusion*



Dual baseplate



Integrated Module



Mixed metals



Copper

* only available in the North America.

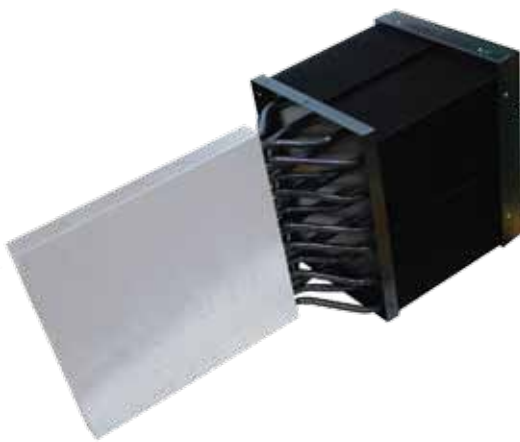
Phase change solutions: Heat Pipe Assemblies

FOR FAST-ACTING COOLING PERFORMANCE



Our Stand-Alone Unit - Optimize performance with the heat pipe range

Our heat pipe solutions significantly reduce the footprint of power conversion systems thanks to performances that approach those of liquid cooling technology. That means the unit is a stand-alone and offers vital benefits to the user: less space required, lighter weight, maintenance-free, and optimized power dissipation.



Heat pipe - instantaneous cooling action

The high heat losses from press-pack or IGBT power devices can easily be conveyed outward via heat pipe cooling units. A unit consists of aluminum evaporator and condenser sections with copper heat pipes. Working fluids are chosen to suit the application (methanol, water). This heatsink offers high thermal performance, homogeneity of temperature under components, and easy maintenance.

A range of phase change cooling solutions to meet your needs:



Liquid cooling solutions

WORLD LEADER IN LIQUID COOLING SOLUTIONS

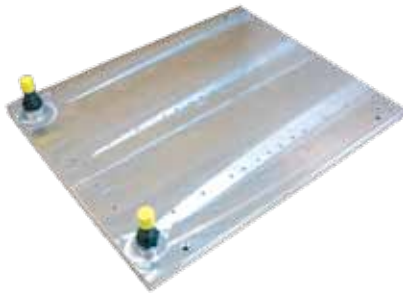
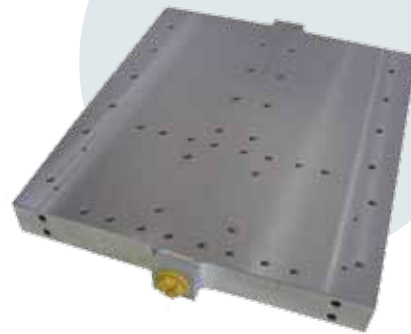


Our vacuum brazing offers reliability and lasting performance

Power electronics components (IGBTs, thyristors) need a cooling solution that is both effective and reliable, especially when installed in a confined space. Liquid cooling systems work perfectly. To ensure maximum reliability, Mersen has mastered vacuum brazing technology to achieve: guaranteed water tightness with no seams, robustness, no corrosion, and excellent thermal performance. Result: a product sure to last 20 years!

Aquamax® - Aluminum

Provides maximum thermal performance in aluminum by employing proprietary channeling techniques to optimize coolant velocity at low head loss while providing uniform temperature across the mounting surface. Precision machining techniques used at the vacuum braze, flux free, interface ensure leak and corrosion free construction.



Numerous liquid cooling options designed for tight spaces while providing lasting performance:



For screw mounted components

For press packed components

Liquid cooling solutions

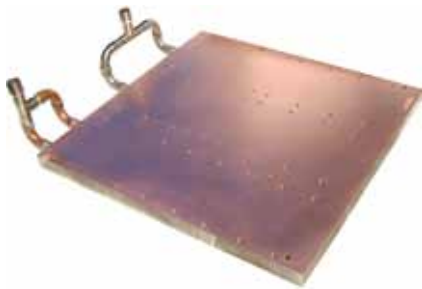
MAXIMUM THERMAL PERFORMANCE FOR DEMANDING ENVIRONMENTS



Over **15 years of experience** in manufacturing large copper cold plates, Mersen has gained a lot of knowledge in the machining of copper. Our capabilities in the handling of such soft material after vacuum brazing while maintaining very tight flatness specs and tolerance for power electronic components, make Mersen the experts in providing complete and fully machined plates.

Aquamax® - Copper

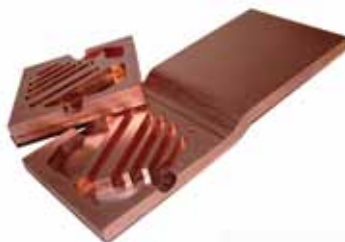
Aquamax copper provides additional performance over aluminum using the same proprietary channeling techniques as aluminum. The vacuum brazed, flux free joint ensures leak and corrosion free construction. Typical external finish is RoHS compliant electroless nickel.



Numerous liquid cooling options designed for tight spaces while providing lasting performance:



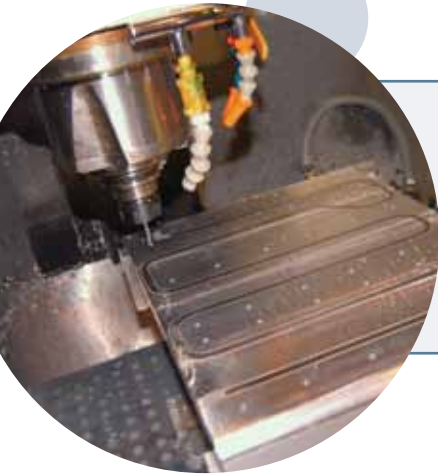
For screw mounted components



For press packed components



Liquid cooling solutions

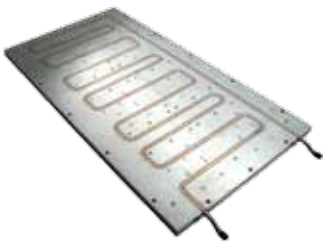
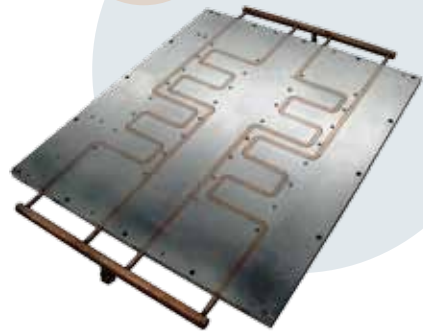


Aquasurf® offers a cost-effective solution with design flexibility

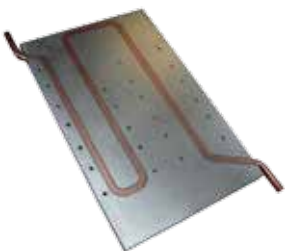
Aquasurf technology offers low to medium performance requirements at cost effective solutions. Flexibility in design, customized tube patterns, two-sided cooling options on tube material (copper, aluminum and stainless steel) are all part of the many advantages of the Aquasurf.

Aquasurf - Tubed Cold Plates

Copper, aluminum or stainless steel tubes are embedded in the surface of an aluminum plate to provide the lowest thermal resistance between the semiconductor mounting surface and the cooling liquid. Tubes can be bent into complex arrays to ensure the copper surface is directly under the semiconductor chips. Tubes can be of any diameter and baseplate of any thickness providing it provides rigidity.



More options for achieving the lowest thermal resistance...



Copper tubes



Aluminum tubes



Stainless steel tubes

Engineering services

CUSTOM UNITS TO ADDRESS THE NEEDS OF THE ENTIRE THERMAL LOOP



Complete cooling systems – for the whole thermal loop

In addition to its custom cold plates, Mersen also offers systems covering the whole thermal loop, including the necessary pumps, hydraulic and electrical elements. Cooling the hot fluid exiting a heatsink before re-circulating it requires a heat exchanger.

FROM DESIGN, TO PRODUCTION, AND AFTER THE SALE

Mersen is ready to assist customers throughout the development of the solution they need: from the earliest stages of identifying needs right through production and logistics at the end of the process.

Participation in thermal research groups and design work on several demanding thermal applications all over the globe, means we can offer the widest variety of adapted competitive designs.

Find out how we can help you, contact us today at:

North America

Email: sales.mis@mersen.com

Manufacturing: 905-795-0077

Applications Support: 905-795-0077 x258 or x340

Europe

Email: cooling.lmr@mersen.com

Tel: +33 (0) 4 76 81 45 04

Asia

Tel: +8621 67602388

Visit us on the web

us-ferrazshawmut.mersen.com/cooling



Visit R-Tools online at:
us-ferrazshawmut.mersen.com/cooling



MERSEN
Expertise, our source of energy

**A WORLD LEADER
 in safety & reliability
 for electrical power**

A GLOBAL PLAYER

Global expert in materials and equipment for extreme environments and in the safety and reliability of electrical equipment.

Mersen designs innovative solutions to address its clients' specific needs to enable them to optimize their manufacturing process in sectors such as Energy, Transportation, Electronics, Chemical, Pharmaceutical and Process Industries.

MERSEN France SB
 S.A.S.
 Rue Jacques de Vaucanson
 F-69720 Saint-Bonnet-de-Mure
 Tel: + 33 4 72 22 66 11

MERSEN Shanghai Co.
 Ltd.
 No.55-A6. Shu Shan Road,
 Songjiang 201611 Shanghai
 Tel: +8621 67602388

MERSEN USA
 Newburyport-MA L.L.C.
 374 Merrimac Street
 Newburyport, MA 01950
 Tel: +1 978-462-6662