

## LIQUID COOLING

**ALUTRONIC**  
SOLUTIONS FOR COOL RESULTS

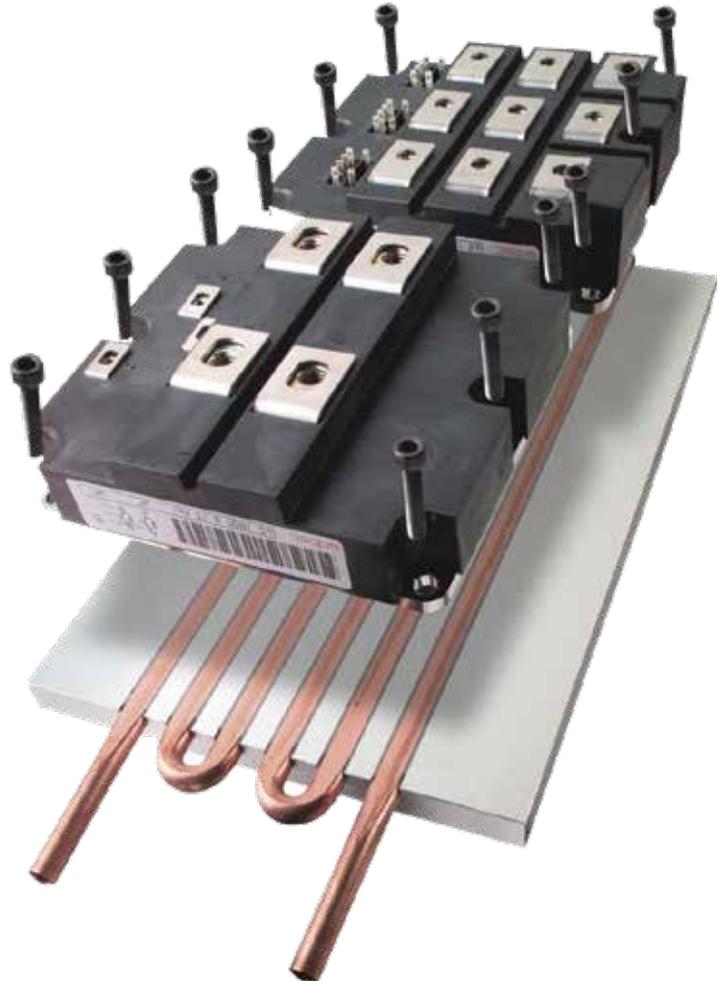
# Liquid Cooling

**Liquid Cold Plates** offer various performance advantages over air-cooled solutions in high watt density designs. It is an effective way of removing high rates of heat with low fluid flow from electronic component's heat loads, while still maintaining design flexibility and reducing costs.

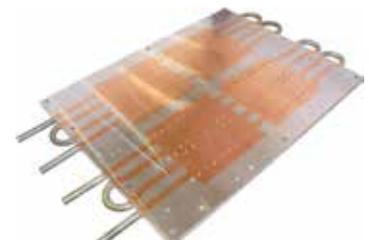
**Our Capabilities And Experience** allow us to develop and produce more efficient and compact cooling for extremely high heat loads while still maintaining design flexibility and reducing costs.

**Electronic Engineers** are continuing to develop demanding applications where heat dissipation becomes more and more challenging. Excessive heat can compromise the reliability of a system, and engineers usually turn to liquid cooling when air-cooling is no longer providing enough heat removal. The rising heat loads of high power electronics and the drive towards more compact packaging has changed the mind-set of designers.

Liquid cooling is no longer regarded as a risk but rather a necessity. When compared with more traditional air cooled solutions, liquid cold plates offer significant performance advantages particularly in high power and high heat flux applications.



**In A World Of Compact Designs** with increasing power densities, liquid cold plates are becoming a critical component of your system. Applications include, energy storage, high-powered electronics, lasers, power drives, medical equip-

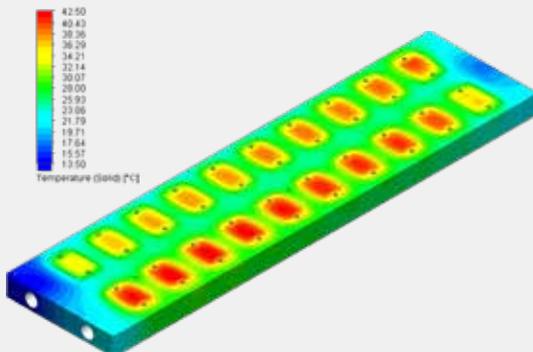


Custom Design Liquid Cooling Solutions  
As Cost Effective As A Standard Product

Each customer has their own unique needs when heat dissipation becomes critical to their designs. With multiple manufacturing methods from Alutronics, you are ensured that the right solution is developed for you.

Manufacturing Methods Include:

- CNC
- Brazing
- Dip Brazing
- Stamped Pillow
- Tube Cold Plates
- Finned Cold Plate
- Friction Stir Welding
- Controlled Atmosphere Brazing
- Forged
- Stamped
- Die Casting
- Vacuum Brazing
- Micro Extrusions
- Deep Hole Drilling
- Extrusions With Welding



We offer many different makes of cold plates, which allows us to ensure we not only meet specific fluid compatibility and performance requirements, but at the best costs for the application.

As simple as a copper tube attached to an aluminum plate or may be as complex as incorporating many technologies to meet demanding heat dissipation needs.

ment, and military and aerospace.

We offer the one of the widest ranges of design and manufacturing in the industry.



**Controlled Atmosphere Brazing** is the next step beyond an open-air environment. It is used in a controlled atmosphere under normal or close-to-normal atmospheric pressure. In this type of environment, a high degree of control over the overall process can be achieved and open-air issues of oxidation, scaling and carbon buildup can be virtually eliminated.

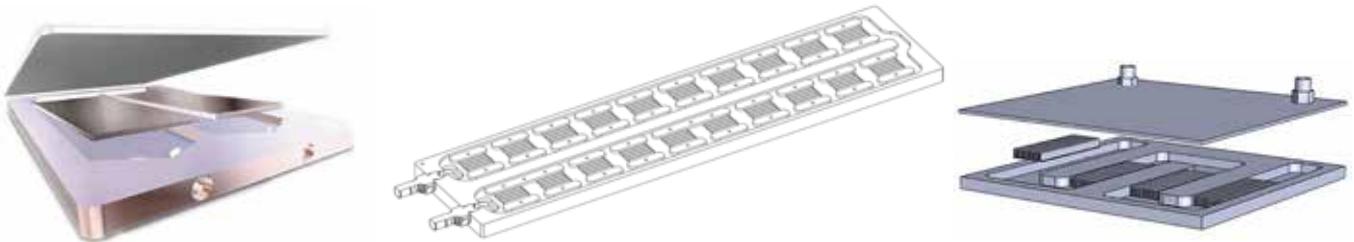


**Die Cast Liquid Cold Plate** is a two piece construction suitable for complex high volume applications. Multiple internal and external features can be incorporated into the two die cast tools. After casting, the two halves can be bonded together by various processes, including welding, brazing or by the use of an epoxy.



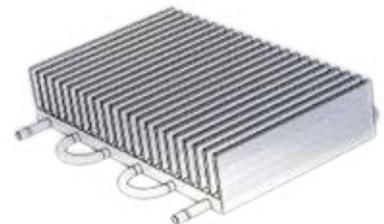
# Liquid Cooling

**Brazed Manufacturing** has the advantage of plates overcoming the “tube bending limitations” that are present with tube liquid cold plates. Our precision design and superior technology eliminate leaks for a cost effective and hassle free solution. Add internal fin structures to enhance heat transfer. Design flexibility to minimize size and pressure drop.



**Vacuum Brazing** is done in a high vacuum environment which provides the best control and produces the cleanest parts, free of any oxidation or scaling. Vacuum brazing is the preferred method for brazing aerospace components, hardening a variety of electronic devices and other applications that require the absolute highest part quality.

**Deep Hole Drilling** is defined by its depth-to-diameter ratio with holes greater than 10:1 which would be considered deep holes. Manufactured by drilling a series of holes through the length of an aluminium plate to form multiple flow paths. The base plate is drilled with orthogonal and parallel channels. The liquid flows in the channel network. Impermeability is achieved by the use of screwed or welded caps.



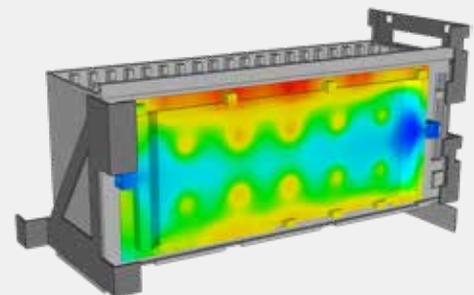
Examples Applications That our cold plates are perfect for:

- GPU
- CPU
- Lasers
- Chillers
- Inverters
- Automotive
- Locomotive
- Data Centres
- RF Amplifiers
- Power Supplies
- Solar Inverters
- Wind Inverters
- MRI Amplifiers
- Traction Drives
- Power Electronics
- DC-DC Converters
- Thermoelectric (TEC)
- Waste Heat Recovery
- Variable Speed Drives
- Agriculture Machinery
- Hybrid & Electric Vehicles

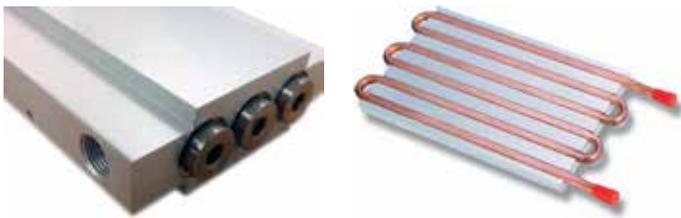
We can also produce universal designs on multiple metal substrates:

- Cu, Al, Cu-Al Clad
- Stainless Steel

Our IGBT base plates also have one of the lowest pressure drop in the industry with out compromising thermal conductivity.



**Friction Stir Welding (FSW)** is a solid state joining process that uses frictional heat. This method creates a high-strength, high-quality weld. The advantages include a process that can be applied to all the major aluminium alloys and avoids problems of hot cracking, porosity, element loss, etc. common to aluminium fusion welding processes.



**Extruded Cold Plates** offer the best thermal performance. They are also cost efficient for medium volume production. The open ends of the extrusion are welded to connector tubes. The micro channel design provides a large internal surface area that minimizes thermal resistance.



The channels create turbulence, which minimizes the fluid boundary layer and reduces thermal resistance. This also yields excellent thermal uniformity because coolant flows below the entire cold plate surface.

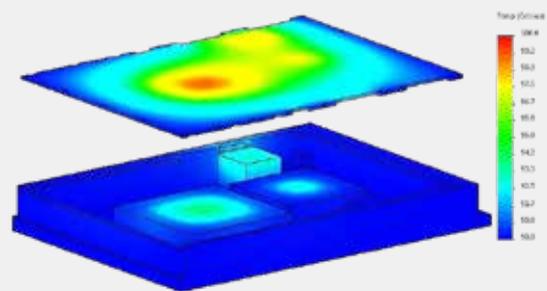


Depending on the direction the headers are mounted, the extruded cold plates may have a “U” or “Z” configuration.

For custom applications, multiple extruded cold plates can be assembled into a single unit or pressed into an aluminum plate.

Thermal assemblies are often part of a solution that includes multiple components in addition to the liquid cold plate. Our team has the experience and best costs for your applications. Simple to complex to very detailed.

Cold plate performance is normally expressed as thermal resistance, in degrees Celsius per watt. The lower the thermal resistance, the better the cold plate will perform and the cooler the surface will be.



A liquid cold plate, which incorporates turbulators, provides the design engineer much less restriction in size, weight and cost.

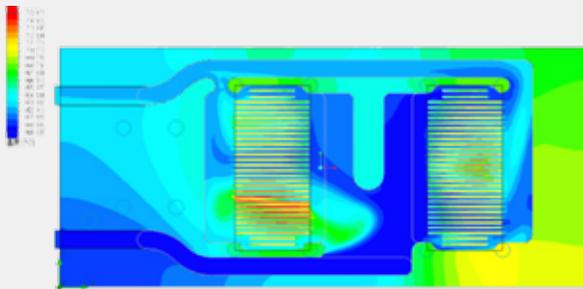
Our Quality Assurance (QA) team is involved at every stage of a project; from raw material inspections and product manufacturing to shipping and fulfillment.

# Liquid Cooling

**Design** - There is no limit to the shape or design of a brazed cold plate. The basic design involves two components that are fused together with a cooling channel or series of folded fins inside.

We use advanced thermal analysis software to model your heat loads, and then we create a design that meets or exceeds your requirements, and is cost-effective and reliable.

**Production and Testing** - Our cold plates are highly reliable and leak free. We manufacture and pressure test your custom cold plates to ensure they meet your working pressure requirements. We also comply with lot traceability and provide an ultrasonic inspection record upon request.



When we develop your cold plates, the design technique for enhancing the heat transfer performance becomes critical. In that regard, consideration is given to manufacturing issues as well as to thermal and fluid flow issues.

Combined engineering and manufacturing expertise allows us to compete on a global scale. Our on-time delivery and quality track record is what brings customers back.

**Tube Cold Plate** is the simplest form of cold plate where a joint free tube is embedded into a copper or aluminium carrier. The tube can be copper or stainless steel and can be a simple mechanical (dry) press fit, press fit with a thermal epoxy boundary to eliminate micro voids or soldered in place for maximum thermal performance.

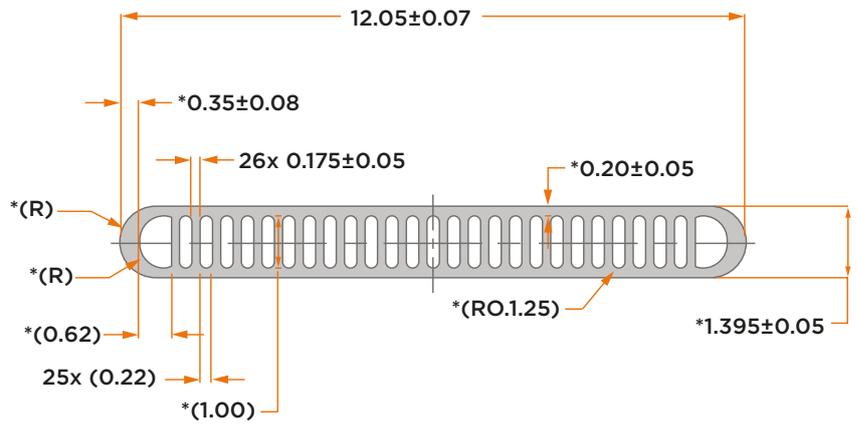


**Ideal for liquid cooling**, Micro Port Extrusion's geometric characteristics are achieved through extrusion. Additional corrosion protection can be provided to the tube through the use coating solutions.

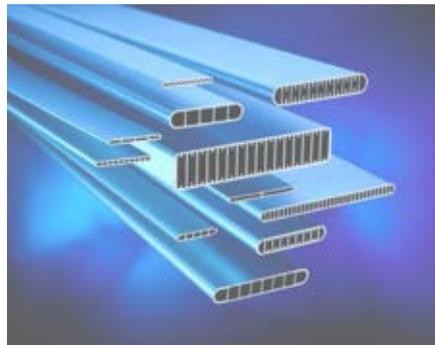


**The Micro Port Extrusion (MPE)**

is an extruded rectangular flat tube with multiple small channels running the length of the tube. MPE's are exceptionally capable of handling high pressure refrigerants and are manufactured to meet the customer's specific requirements with respect to alloy, geometry, wall and web thicknesses.



Tube cooler between cells -Serpentine cooler.



**Aluminum Alloys**

Standard alloys:

3003 -AlMn1Cu

3103 -AlMn1

3004 -AlMn1Mg1

Special alloys:

1197

3026

3333

**Square ports**



**Special ports**



**Internal enhancements**



**ALUTRONIC Kühlkörper GmbH & Co KG**

Auf der Löbke 9-11

D-58553 Halver

Tel. +49 2353 915 5

Fax +49 2353 915 333

info@alutronic.de

**[www.alutronic.com](http://www.alutronic.com)**

Please visit our website for international contacts **[www.alutronic.com/contact/distributors](http://www.alutronic.com/contact/distributors)**