

Revolution™ Cold Plate Technology

Features :

- Custom Designed for Application
- Wolverine's MicroCool® Surface Technology
- Selective Locations of Heat Transfer Surface
- Multiple Joining Technologies
- Two Sided Cooling
- Connections as Specified
- Aluminum Alloys
- Other Materials Upon Request

Benefits:

- Up to 150 % Improvement in Thermal Performance
- Low Pressure Drop
- Lightweight
- Compact
- Reliability
- Robustness
- Affordability

Markets:

- Defense and Aerospace
- Renewable Energy
- Medical Equipment
- Automotive
- Industrial

“Heat Transfer Specialists willing to take on the toughest problems”

Niagara Thermal Products, LLC

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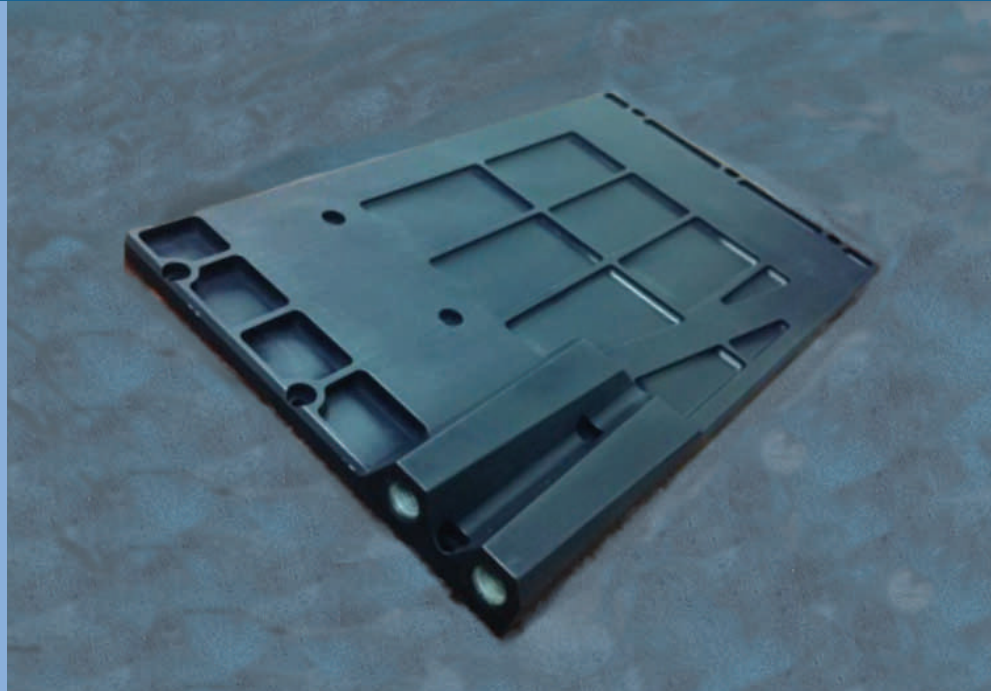
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Niagara Thermal Products is bringing cold plate technology into the 21st century. Utilizing the benefits of Wolverine Tube's MicroCool® surface technology, NTP is designing another level of performance into cold plate cooling, while offering the benefits of reduced package space and lighter weight. Customers can expect up to 150% improvement in their thermal performance. In addition, the technologies can be delivered affordably at any volume.

Niagara Thermal has an outstanding track record of providing their customers with cost effective solutions to the toughest thermal challenges. We have been designing and manufacturing heat exchangers for the demanding defense and aerospace industries, as well as telecom, automotive, medical and industrial for over 20 years.

The custom designed Revolution™ Cold Plate products have application across an extremely wide market base including the Defense, Aerospace, Medical, Power, Industrial and Automotive markets.

(see back page for technical information)

* MicroCool is a Registered Trademark of Wolverine Tube, Inc.

Technical Specifications :

- Aluminum 1000, 3000 and 6000 series
- Microchannel continuous fin or pin fin
- Patterns in either in-line or staggered formations.
- Fins per inch : 8-650 (3-255 fins/cm.)
- Fin thickness to fin gap ratio : ~1:1
- Fin height to fin thickness ratio : up to 15:1
- Maximum gap between fins : 1.2mm +
- Pin fin height to diameter ratio : up to 8:1
- Fins can be formed in specific geometric areas or across the entire surface
- Leak and proof tested to customer requirements
- Thermal performance designed at system operating points



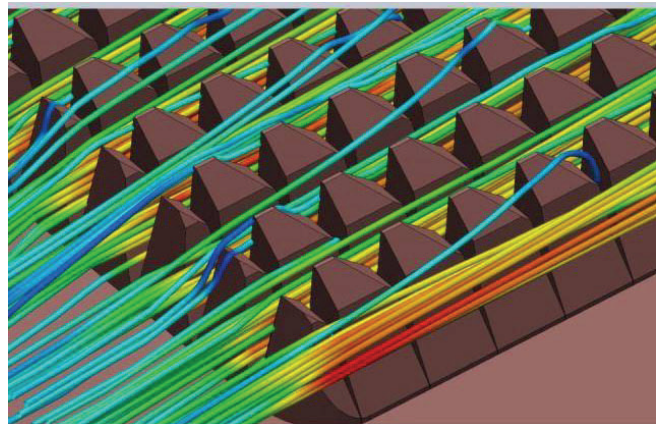
Straight Fin— 150 fins/inch



In-Line Pin Fin

Design Capability

- ⇒ Proprietary Cold Plate Simulation
- ⇒ Computation Fluid Dynamics
- ⇒ Stress Analysis
- ⇒ Fluid Compatibility
- ⇒ Liquid Loop Component Design
- ⇒ System Designs Available



Maximum heat transfer coefficient