LIQUID COOLING

Liquid Cold Plates For High-Performance Components & Systems ................................................ 116-117
Exposed Tube Liquid Cold Plates ........................................ 118-119
Full Buried Tube Liquid Cold Plates ........................................ 120-122

Liquid cooling is a natural evolution beyond air cooling where either due to thermal requirements or footprint requirements, the desired performance can no longer be economically met by air cooling.

There are many ways to accomplish liquid cooling, but the most common method is to have a plate with a flow path that moves liquid under the devices. After the heat is absorbed into the liquid, it is taken out of the plate and into the larger system. While water or water/glycol are the most common fluids used in liquid cooling, gasoline, oil, and refrigerant are other fluids that can be utilized.

There are lots of ways to construct a cold plate and the methods can be driven by the level of performance needed, the materials needed or the environmental requirements.

One construction method is to use a series of cross drilled holes in a plate. The holes intersect in the plate to determine the flow pattern and unneeded patterns are plugged. This construction method can be cost effective, but the pattern is limited to straight lines.

Another method is to embed a tube in a plate by machining a groove in the plate. The tube can either be placed toward the top surface of the plate to provide better cooling to devices mounted on that surface, or it can be embedded further into the plate so that it cools devices mounted on both sides of the plate. This option provides greater flexibility, but the thermal performance is limited because of the surface area of the tube perimeter.

To get more performance, extended surface area in contact with the fluid is required and this leads to machined cold plates. The cold plate is constructed of a plate that has been machined to form some flow passages and then a cover is assembled to capture the flow. The extended surface area can be machined in place or installed by use of a piece of folded fin. The cover can be flat or be another machined plate. The method of assembly of the two parts can be done by gasket/screw, glue/screw, brazing, or welding and is dependent on the required performance and the requirements of the environment.
LIQUID COLD PLATES FOR
HIGH-PERFORMANCE COMPONENTS & SYSTEMS

LIQUID COLD PLATES FOR RECTIFIERS,
DIODES, AND POWER MODULES

LIQUID COLD PLATES FOR RECTIFIERS,
AND POWER DIODES

LIQUID COOLING

LIQUID COLD PLATES FOR
GENERAL PURPOSE

180-10 & 180-11 SERIES

180-12 & 180-20 SERIES

PERFORMANCE CHARACTERISTICS

LOCAL THERMAL RESISTANCE PER DEVICE
PLATE TO INLET WATER (°C/WATT)

Flow - GPM

<table>
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<tr>
<th>GPM</th>
<th>1/2</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<td>0.54</td>
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<td>0.69</td>
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MECHANICAL DIMENSIONS

180-10 SERIES

Dimensions: in. (mm)

180-11 SERIES

Dimensions: in. (mm)

wakefield-vette.com

LOCAL THERMAL RESISTANCE PER DEVICE
PLATE TO INLET WATER (°C/WATT)

Flow - GPM

<table>
<thead>
<tr>
<th>GPM</th>
<th>1/2</th>
<th>1</th>
<th>2</th>
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<th>4</th>
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MECHANICAL DIMENSIONS

180-12 SERIES

Dimensions: in. (mm)

180-20 SERIES

Dimensions: in. (mm)

Contact us: (603) 635-2800

Material: Aluminum, no finish.

Tubing: Copper (stainless steel tubing available on special order).

PERFORMANCE CHARACTERISTICS

Dimensions: in. (mm)

180-10-6C                 6.000 in. (152.4)
180-10-12C             12.000 in. (304.8)
180-10-24C             24.000 in. (609.6)
180-11-6C                 6.000 in. (152.4)
180-11-12C             12.000 in. (304.8)
180-11-24C             24.000 in. (609.6)

Standard P/N       Length "A" in. (mm)

180-12-6C         6.000 (152.4)     7.500 (190.5)     0.688 (17.5)        Double        13.125 (333.4)           0.018°C/W @ 1.0 GPM             1.090 (494.42)
180-12-12C     12.000 (304.8)      7.500 (190.5)     0.688 (17.5)         Single          19.406 (494.7)           0.009°C/W @ 1.0 GPM            2.760 (1250.48)
180-12-24C     24.000 (609.6)      7.500 (190.5)     0.688 (17.5)        Double          31.688 (804.9)          0.004°C/W @ 1.0 GPM           5.680 (2540.48)
180-20-6C         6.000 (152.4)      5.500 (139.7)     0.690 (17.5)        Double        13.125 (333.4)           0.018°C/W @ 1.0 GPM             1.090 (494.42)
180-20-12C     12.000 (304.8)      5.500 (139.7)     0.690 (17.5)         Single          19.406 (494.7)           0.009°C/W @ 1.0 GPM            2.760 (1250.48)
180-20-24C     24.000 (609.6)      5.500 (139.7)     0.690 (17.5)        Double          31.688 (804.9)          0.004°C/W @ 1.0 GPM           5.680 (2540.48)
Wakefield-Vette’s exposed tube liquid cold plates ensure minimum thermal resistance between the power device and the cold plate by placing the coolant tube in direct contact with the power device’s base. Direct contact reduces the number of thermal interfaces between device and fluid thus increasing performance for the application.

### KEY SPECIFICATIONS

<table>
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<tr>
<th>Part Number</th>
<th>Description</th>
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<th>Passes</th>
<th>Figure</th>
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- Base Plate: Extruded Aluminum.
- Copper Tube Material: .0375" OD x .049" wall.
- Thermal Epoxy fill with high thermal conductivity.

**2-PASS THERMAL PERFORMANCE**

**4-PASS THERMAL PERFORMANCE**

**6-PASS THERMAL PERFORMANCE**

Contact Wakefield-Vette for more information or visit www.wakefield-vette.com

Custom Exposed Tube Liquid Cold Plates Available

**MECHANICAL DIMENSIONS**

**PART NUMBER 120455**

**PART NUMBER 120456 & 120457**

**PART NUMBER 120458, 120459, & 120460**
FULL BURIED TUBE LIQUID COLD PLATES

Wakefield-Vette's fully buried tube liquid cold plates have the ability to cool both sides of the cold plate because of its positioning within the base plate. Another key feature of the fully buried tube is that it is not exposed to the outside environment. Some engineers prefer the epoxy layer above the tube to protect the tube from leakage.

**KEY SPECIFICATIONS**
- Base Plate: Extruded Aluminum.
- Copper Tube Material: .0375” OD x .049” wall.
- Thermal Epoxy fill with high thermal conductivity.

**Part Number 120959**

**Part Number 120960 & 120961**

**Part Number 12062**

Custom Full Buried Tube Liquid Cold Plates Available
Contact Wakefield-Vette for more information or visit www.wakefield-vette.com
FULL BURIED TUBE LIQUID COLD PLATES

PART NUMBER 120963

PART NUMBER 120964