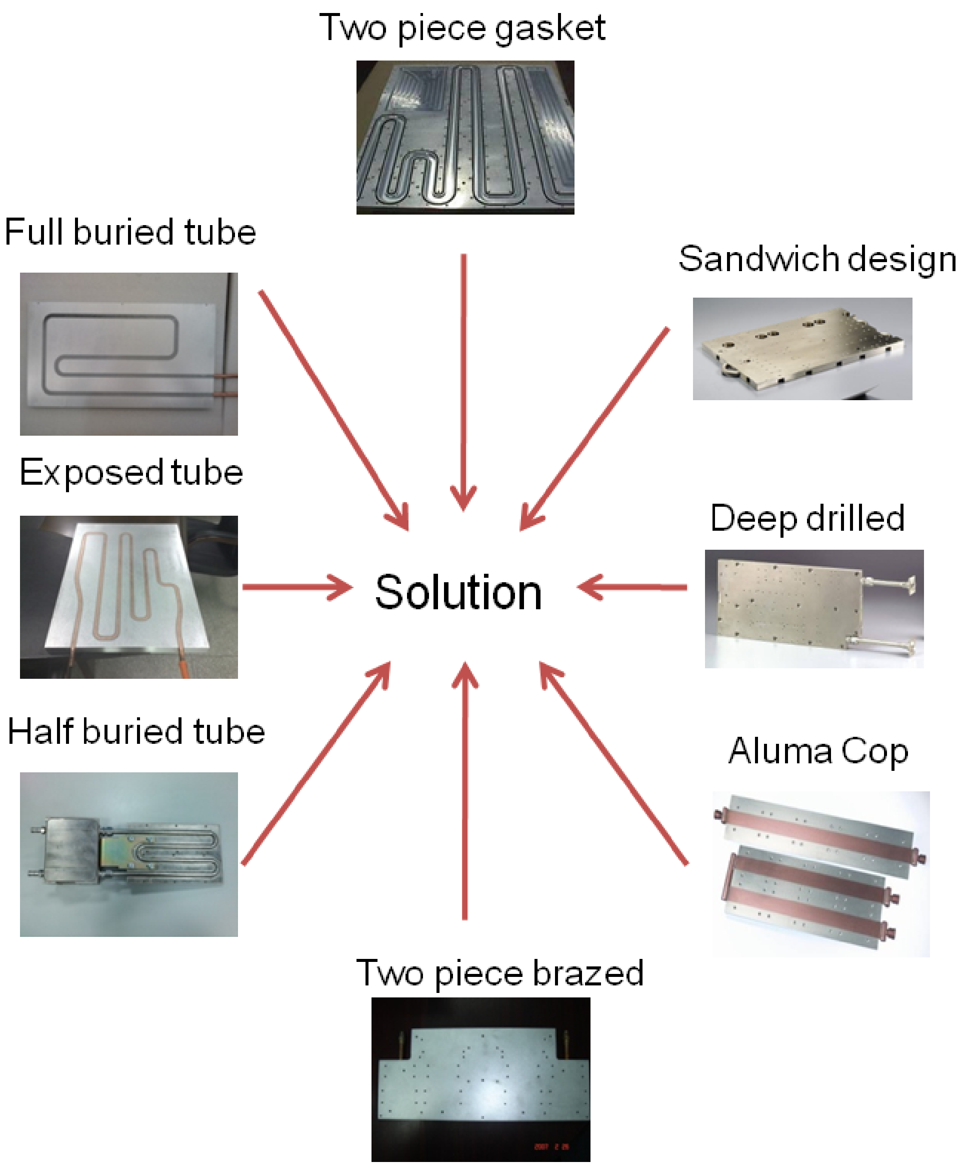
FEBRUARY 2010

Vette Corp. App News

DESIGN ACTIVITY

Cold Plate Construction Questions

In the December edition we showed several types of cold plate construction and received several requests for additional information on each type and why one would be used over another. So here's a simple summary on the basic types with some rules of thumb.



Liquid cold plates can be generally classified into two types, those using a discrete tubing assembly for the liquid pathway and those which have an internal fluid pathway construction.

The use of a discrete tubing assembly offers the advantages of having known physical parameters for the tube, specifically of material, temper, strength, wall thickness and usually a plethora of readily available commercial fittings which can be applied to the in and out ports of the cold plate. Most commonly used is copper tubing which offers low cost, a wide range of fluid compatibility, is easily formed and low cost fittings which can be soldered or crimped to the tubing. Aluminum, stainless steel and nickel tubing are available for specialty applications.

Internal fluid pathway construction is usually a lot more expensive and care must be taken with cooling fluid selection but can offer improved thermals in some applications.

Need more information ? Please contact your local Vette Applications Engineer or Salesperson.

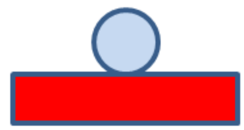
Cold Plate Construction Questions, cont...

COOLING FLUID SELECTION

The fluid selection is often based on what is available. Treated water and/or an antifreeze mixture is common but we have seen jet fuel, hydraulic fluid, gasoline, again whatever is available. Water is the best thermal solution but must be treated to make it completely compatible. Fungicides are needed to prevent bacterial growth, corrosion inhibitors to protect the metals and possibly a glycol type additive to prevent freezing and boiling. A 60/40 glycol solution will reduce waters thermal carrying capacity by approximately 25%., De-ionized water is not recommended with any system that has any copper content, as the DI-water is hungry for ions, copper has lots of them and this will eat the copper away in surprisingly fast time. Likewise, any halides in the cooling liquid will eat the silicates in aluminum tubing or internal fluid paths over time.

DISCRETE TUBING COLD PLATES

Cold pates with tube sub assemblies have the benefit of having the cooling liquid flow through a known strength pipe which eliminates the possibility of any internal leaking which is always a concern on internal fluid cold plates.. Also copper piping can be used in an aluminum cold plate, saving weight and greatly improving corrosion resistance.

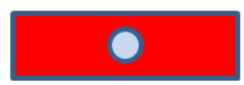


Snake On A Plate: seldom used today, this is where the tube is laid on a flat plate and can be welded or soldered to the plate. Like a Model T Ford, limited thermal performance but the name says it all.

Crimped Extrusion: A plate is extruded with two fins that are crimped around the tubing, low cost but limited thermal and each size/shape must be tooled.

Half Buried: Just like it sounds the tube is buried half way into the cold plate, this is often done where the plate may be of limited thickness and strength. The tube is best soldered to the cold pate, providing some level of mechanical strength.

Buried Tubing

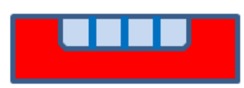


Buried tubing parts offer an economical, outstanding high pressure and high reliability paths for the cooling fluids. Tubes are then set into the cold plate, which are often aluminum for weight and cost savings.

Flat Exposed Buried Tubing

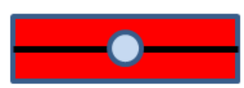
Round tubing is formed into a D– shaped tube and the flat side of the tube is flush with the surface of the cold plate, this gives greater area for thermal transfer directly to the tube.

Flat Exposed Flat Tubing (aka **Aluma-Cop**)



Larger section rectangular tubing in the cold plate for maximum thermal transfer area. Internal fins provide better heat transfer to the fluid, internal ribbing provides added structural strength so that the flat tubing does not oil can or distort when exposed to high pressure.

Sandwich Construction: Bolted, Gasketed, Soldered.



Bolted and gasketed. The two sides of the cold plate are machined and then bolted together with or without a sealing gasket or compound in between. This requires that the cold plate be thick enough for the bolts /screws that will hold it together. If gasketed, that it be acceptable that the two sides be thermally isolated form each other (the gasket is a big insulator) and that the parts have sufficient intrinsic strength to be bolted together.

Soldered: the cold plate sides are held together by solder which typically will have a melting point of 400F , the solder also provides a metallurgical joint to the tubing,

Cold Plate Construction Questions, cont...

INTERNAL FLIUD PATH COLD PLATES

BRAZED: there are three common types of brazed plates, Vacuum, Dip and Controlled Atmosphere.

All internal fluid path cold plates need to be carefully pressure tested to make sure that parts are completely sealed. Internal fluid leakage from one cooling path to another inside the cold plate usually cannot be detected and some level of internal leakage should be allowed on the thermal design.

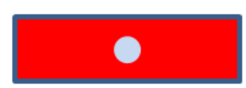
Vacuum Brazed: this is the Rolls Royce of Aluminum cold plates. The cold plate halves are machined, then assembled with braze sheet in between (similar to a solder pre-form sheet). Parts are then heated to near melting point at around 1100 F, the braze melts and the parts are cooled. The vacuum means that no air pockets or contaminants will be trapped and a solid metallurgical joint is made. The metal however is now dead soft and usually distorted in the oven, parts must be straightened and drawn back to hardness. This means that parts really need to be final machined after all these processes, basically double machining. Parts can be very thin-walled and this is good in applications where weight is important, such as aircraft parts. The big drawback is that this is a very expensive process , limited by the number of parts that can be fitted into the oven (which can have up to a 12 hour cycle) and multiple machining steps are required.

Dip Brazed: This is the Yugo of aluminum brazing, parts are assembled with braze sheet and then dipped in molten salt at 1100 F to assemble. Aluminum has a near neutral buoyancy in molten salt, so the parts will not sag at temperature. Once the parts are withdrawn the salt crystallizes and must be washed out of the heat sink, tubing, fine features and fin spacing often cannot be washed out. Parts are dead soft temper and must be drawn back to temper. Similar to vacuum brazing, a solid metallurgical joint is made but pockets of imbedded salt are trapped inside the joints, customers in high moisture environments (like the Navy) do not allow this.

Controlled Atmosphere—the Chevy Impala of brazing, parts are assembled with braze sheet and heated in an inert atmosphere, then cooled. This is how aluminum automobile radiators are made on conveyorized lines, low cost if you have huge volume and thin walled parts. Most cold plates have heavy walls for heat spreading and part mounting and not the needed volumes.

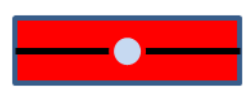
DEEP DRILLED

Deep drilled parts (aka/similar to gun drilling) allow solid parts to have simple cooling channels added. The channels are usually at right angles and will have a higher fluid backpressure due to the 90 degree joints, but in those cases where high performance cooling is not needed, they can be a high strength solution.



SANDWICH CONSTRUCTIONS:

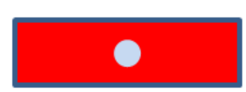
Bolted and gasketed: The two sides of the cold plate are machined and then bolted together with a sealing gasket or compound in between. Think in terms of the cylinder head and engine block in your automobile. This requires that the cold plate be thick enough for the bolts /screws that will hold it together, that it be acceptable that the two sides be thermally isolated form each other (the gasket is a big insulator) and that the parts have the intrinsic strength to be bolted together. Cooling fluid selection must be compatible with the gasket and operating pressures within reason.



Soldered: Similar to brazed in many respects, but the parts are often plated and then held together by silver-solder which typically will have a melting point of 500F vs. 1100F for a brazed part. Excellent lower cost alternative to brazing.

EXTRUDED CHANNELS

The cold plate is extruded with fluid bores in the plate. Simple approach but each size must be carefully tooled, parts will not be as flat as plate stock, all bores must be welded or tapped for fittings and parts are only good for one fluid pass per length.



COOLCENTRIC DRAMATICALLY REDUCES SOARING DATA CENTER COOLING COSTS BY 60 PERCENT

New Vette Corp Division Focuses on Data Center Sustainability with its Patented LiquiCool Solutions

MARLBOROUGH, Mass., Feb. 16, 2010 — Coolcentric™, a new division of Vette Corp.®, announces that its award-winning LiquiCool® systems have been proven to significantly reduce energy consumption by cooling units by up to 90 percent and to lower total data center cooling costs by as much as 60 percent. Coolcentric also announces that Vette Corp. has acquired U.S. patents for cooling IT rack technology.

Coolcentric, formerly named Datacom Facilities Division, focuses on delivering the world's most energy- and space-efficient cooling solutions for reducing data center costs. The creation of Coolcentric is a testament to the growing demand for sustainable data centers, challenged by soaring energy consumption and operating costs.

"A majority of the world's data centers are highly inefficient and utilize legacy air cooling methods that consume vast amounts of energy," said George Dannecker, President and CEO, Vette Corp. "The benefits of data center liquid cooling are clear, evidenced by dramatic reductions in power consumption, space requirements and operating costs. Coolcentric aligns all our knowledge, experience and resources to best serve the needs of owners and operators of sustainable data centers."

Today up to 55 percent of the power consumed in a data center is associated with its cooling infrastructure. To address this problem, Coolcentric offers its patented LiquiCool technology in a variety of turnkey data center cooling solutions. The LiquiCool system includes Rear Door Heat Exchangers (RDHx) that mount to the back of IT racks and cool computer equipment exhaust air before it reenters the data center operating environment. LiquiCool reduces or eliminates unnecessary fan power which reduces cooling unit energy consumption by up to 90 percent. Data center cooling costs are reduced up to 60 percent by lowering capital expense, energy consumption and space requirements. Coolcentric products are currently being used in hundreds of data centers, hosting facilities and enterprises, including DataSite Orlando, IBM, NASA and Syracuse University.

"As conventional architectures for air cooling are overrun by the power densities in data centers, industry participants gradually look at liquid cooling as an effective alternative," states Jorge Moreno, Research Analyst, Frost and Sullivan. "Given the environmental and economic benefits that hundreds of clients have achieved with the LiquiCool solution, Coolcentric has developed a compelling value proposition for the growing problem of data center energy consumption and costs with its efficient water-cooled technology."

"Data center rack densities, and resulting power and cooling densities, have grown drastically, to the point where the energy envelope, not the available floor space, has become the limiting factor in data centers," said Jed Scaramella, Senior Research Analyst for IDC's Enterprise Platforms and Datacenter Trends. "Customers are looking for highly flexible and low-risk solutions, like Coolcentric that address energy inefficiency without any disruption in day-to-day data center operations."

LiquiCool is flexible, scalable and cost-efficient to meet the needs of a variety of data center environments. LiquiCool solutions utilize low-impedance fin and tube heat exchangers that have no fans, moving parts or electrical connections. LiquiCool RDHx is an open cooling architecture that can be deployed without any operational impact to IT racks or equipment and can be deployed in both raised- and nonraised-floor data centers.

DataSite Orlando, a world-class data center hosting facility, engaged Coolcentric to address the cooling needs of a client that has a vast array of blade servers and IBM systems that consume up to 500 watts of power per square foot. By installing seven Coolcentric Rear Door Heat Exchangers, DataSite Orlando's client reduced its data center footprint by 80 percent, from 3,000 to 600 square feet.

"Coolcentric's efficient data center liquid cooling solutions provide a tremendous cost savings to our clients, protecting their critical IT infrastructure while reducing cooling energy consumption and carbon footprint — a win for everyone," said Rob Wilson, Director of Sales and Marketing, DataSite Orlando.

Coolcentric's LiquiCool RDHx solutions are available for deployment on enclosures by leading brands including AFCO Systems, APC, Chatsworth Products, Damac, Data Center Resources, Dell, Electrorack, Great Lakes, HP, IBM, IMS Engineered Products (AMCO), NER, Rittal, SMC and Wright Line. In addition to manufacturing a broad range of Rear Door Heat Exchangers, Coolcentric provides turnkey data center cooling solutions, integration, installation and support services.