



## Custom-machined liquid Cold Plates

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Cold plates belong to a class of heat exchangers that are typically made out of metal plates with a flow path that moves cold liquid under a heat source. The flow path on the metal plate can be a groove machined on the plate to embed a pipe or machined passages with a cover to force the liquid to flow through the passages. The advantage of using liquids over air is that liquids typically have very high specific heats and can absorb large amounts of heat with small rise in temperature. The hot liquid then dumps the heat into a sink or passes through a chiller if it is a closed looped system. Liquid cold plates also offer high surface area with added benefit of high thermal conductivity of the metal plate for effective heat transfer.

Noren Products helped design a custom cold plate for a customer in high temperature tubing/piping industry. Initial design proposed by the customer was based on CFD analysis and it was sub-optimal for fabrication. During the design review process, instead of embedding copper tubes with tight bends on a single plate, Noren's engineers leveraged their vast experience and suggested using machined flow passages as well as two piece cold plate assembly to increase the surface area as well as to make it easier and cheaper for fabrication. The plate material was also changed from Aluminum to Copper to increase the performance. There was strict requirement of keeping the maximum surface temperature below 90°C under operating conditions and the assembly needed to be leak proof at high temperature while maintaining a 100 psi liquid pressure. Noren's team employed unique fabrication techniques to ensure that all the stringent specifications of the customer are met. Noren's engineers were able to optimize the design and increase the performance by 25% when compared to the customer's original CFD based design.



Figure 1. Custom-machined liquid cold plate

Even though cold plates are outside our realm of expertise, we were able to utilize the thermal know-how as well as over 40 years of experience in the industry to create a unique, high-performance cold plate design. The fabricated prototype cold plates were shipped on time and they performed extremely well as predicted by our engineers.