



MATERIEL THERMIQUE & ELECTRONIQUE

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Heat Pipe Assemblies: A Wide Range of Efficient Cooling Solutions

Heat pipe assemblies from Thermacore mean that thermal engineers can count on innovative, best-in-class thermal management solutions that offer industry-leading thermal performance, help control energy costs and maximise system life and reliability even under harsh conditions.

Efficient, cost-effective cooling from compact-size thermal solutions — even where space is limited — can be realised through a range of proven Thermacore heat pipe assembly systems. These thermal technologies give you effective means to move heat for remote heat dissipation, low thermal resistance heat spreading from concentrated heat sources or isolated cooling to protect sensitive [computer components](#), [consumer electronics devices](#), [transportation control systems](#) and [military systems](#), among many other applications.



[Remote Dissipation](#)



Remote dissipation thermal management can be the answer whenever system design features make it difficult to place heat transfer devices directly adjacent to key components for essential cooling.

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Vapour Towers



To protect sensitive telecommunications and electronic equipment, Therma-Towers® offer enhanced heat flux resistance and long service life.

Applications with the following constraints would consider using a heat pipe assembly thermal solution:

Space Constrained — Limited by height or footprint: In some applications, the height over the electronic module may not provide sufficient space to provide direct cooling at this location. In these cases Thermacore's [remote heat pipe assemblies](#) can be an effective solution. If there is no room to increase the height or footprint of the existing heat sink, Thermacore's embedded or [vapour chamber assemblies](#) can be the answer. Where the height above the heat sink is not restricted, Thermacore's [Therma-Tower or Vapour Tower](#) technology is appropriate.

Limited or Zero Electrical Power Consumption: Cooling with a fan requires either electricity or, in some applications, drawing down battery power, which limits useful operating time. For these applications, a heat pipe allows the developer to acquire additional surface area for heat rejection by natural convection, thus eliminating the need for a fan. If volume constraints limit the use of a natural convection cooling solution, a heat pipe to a miniature fan/sink might be more economical than a large system fan solution.

Zero Noise or Noise Reduction: Cooling by natural convection eliminates fan noise and improves reliability. If volume constraints limit the use of a natural convection cooling solution, a heat pipe to a fan/sink will result in less noise than a large system fan solution.

Low Maintenance: All electro-mechanical devices such as fans have finite life and require maintenance. A heat pipe thermal solution has no moving parts to fail, eliminating or reducing product maintenance requirements.

Sealed Enclosure Cooling: In some applications, the electronics are in a sealed enclosure to protect them from the environment (for example, an industrial PC located on a dirty shop floor). In these applications, heat needs to be rejected to the outside of the sealed enclosure. A heat pipe provides a thermal path to the enclosure wall.

Combination of Constraints: Any combination of the above constraints would warrant the consideration of using a heat pipe assembly thermal solution.

Remote Dissipation - Limited Height/Budget:



Remote dissipation thermal management can be the answer whenever system design features make it difficult to place heat transfer devices directly adjacent to key components for essential cooling. In some applications, the height over the electronic module may not provide sufficient space to provide direct cooling at this location. A heat pipe in this situation is used to move the heat to locations where it can be effectively dissipated by natural or forced convection. A natural convection cooling solution uses a heat pipe to transport heat to a heat sink where it is rejected to the ambient environment.

There are many configurations for this solution. The heat pipe can transport the heat to thin plate fins attached to the heat pipe. This option can be made smaller if it is installed in a forced convection environment.

The configuration of the fin stack is variable. This solution works by natural convection or by forced convection from a system fan. Efficient, cost-effective cooling from compact-size thermal solutions — even where space is limited — can be realised through a range of proven Thermacore heat pipe assembly systems. These thermal technologies give you effective heat spreading, and the power of two-phase cooling to protect sensitive computer components, consumer electronics devices, transportation control systems and military systems, among many other applications.

Embedded Heat Pipes



Thermacore [embedded heat pipes](#) are a cost-effective solution, proven in rugged environments like computer components, computer electronics devices, transportation control systems and [military](#) and [aerospace](#) systems, among many other applications.

Embedded heat pipes provide efficient thermal management for applications that are space-constrained (and redesigning a product to accommodate more volume for the heat sink would be

impractical) and the need is to increase performance or upgrade their existing product with advanced electronics that generate more heat.

Embedding heat pipes into the existing heat sink, or applying a Vapour Chamber Therma-Base[®] to the heat sink to increase its heat spreading and rejection efficiency, can do the job without a costly product redesign. Our pliable sintered powder metal wick structure allows Thermacore heat pipes to be bent, shaped, flattened and configured to fit into the tightest of applications. For example, our heat pipes can be bent to go around mounting holes. For the best thermal contact, heat pipes are soldered or adhesively bonded into the metallic heat sinks. With over 40 years of experience and product field experience exceeding 20 years, Thermacore's procedures for making these solder or adhesive bonds and the material used have been proven over and over again to withstand and survive the toughest temperature extremes and vibration environments.

Vapor Chamber Assembly



Thermacore [Vapour Chamber Assemblies](#), such as Therma-Base deliver higher thermal performance than traditional heat sinks by alleviating spreading resistance.

Therma-Base is a two-phase heat transfer device that allows spreading of heat in three dimensions. Vapour chambers are typically referred to as planar or flat heat pipes. Thermacore's vapour chambers incorporate various wick structures, including a sintered powder option that provides high-heat flux heat dissipation capability ($>300 \text{ W/cm}^2$). Therma-Base can offer thermal performance improvement of up to 30% when compared to a typical aluminium or copper base spreaders. This improvement is more evident in applications where the heat source is small relative to the allowable area for fins. Thermal architects can utilise this technology with a minimum design effort since it is possible to change a metallic base to a vapour chamber without changing the geometry of the heat sink.

- Patented Thru-Hole Technology allows both straight and threaded holes through the highly conductive vapour space region for ease in design of attachment hardware
- Thermacore vapour chambers have been successfully thermally cycled from -40°C to $+85^\circ\text{C}$
- Thermacore has over 24,000 hours of vapour chamber life testing
- Can be engineered to withstand increase internal pressure (working temperatures $+150^\circ\text{C}$)
- Thermacore vapour chambers are used in severe vibration environments to cool mission critical electronics on military applications



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Therma-Tower and Vapour Tower Assemblies — Height is Available Above



To protect sensitive telecommunications and electronic equipment, Therma-Tower and [Vapour Tower](#) offer enhanced heat flux resistance, high heat load and long service life.

When there is height available above the item to be cooled but not surrounding it, the best thermal solution might be a Therma-Tower or vapor tower. These efficient devices mount to the heat source directly and send the absorbed heat to fins above the device being cooled. There is practically no limit to how far above the device cooling can go. If there is more room above the item to be cooled than there is in the surrounding area, Thermacore's vapor tower can be a heat pipe configuration to transport heat vertically away from the component being cooled.