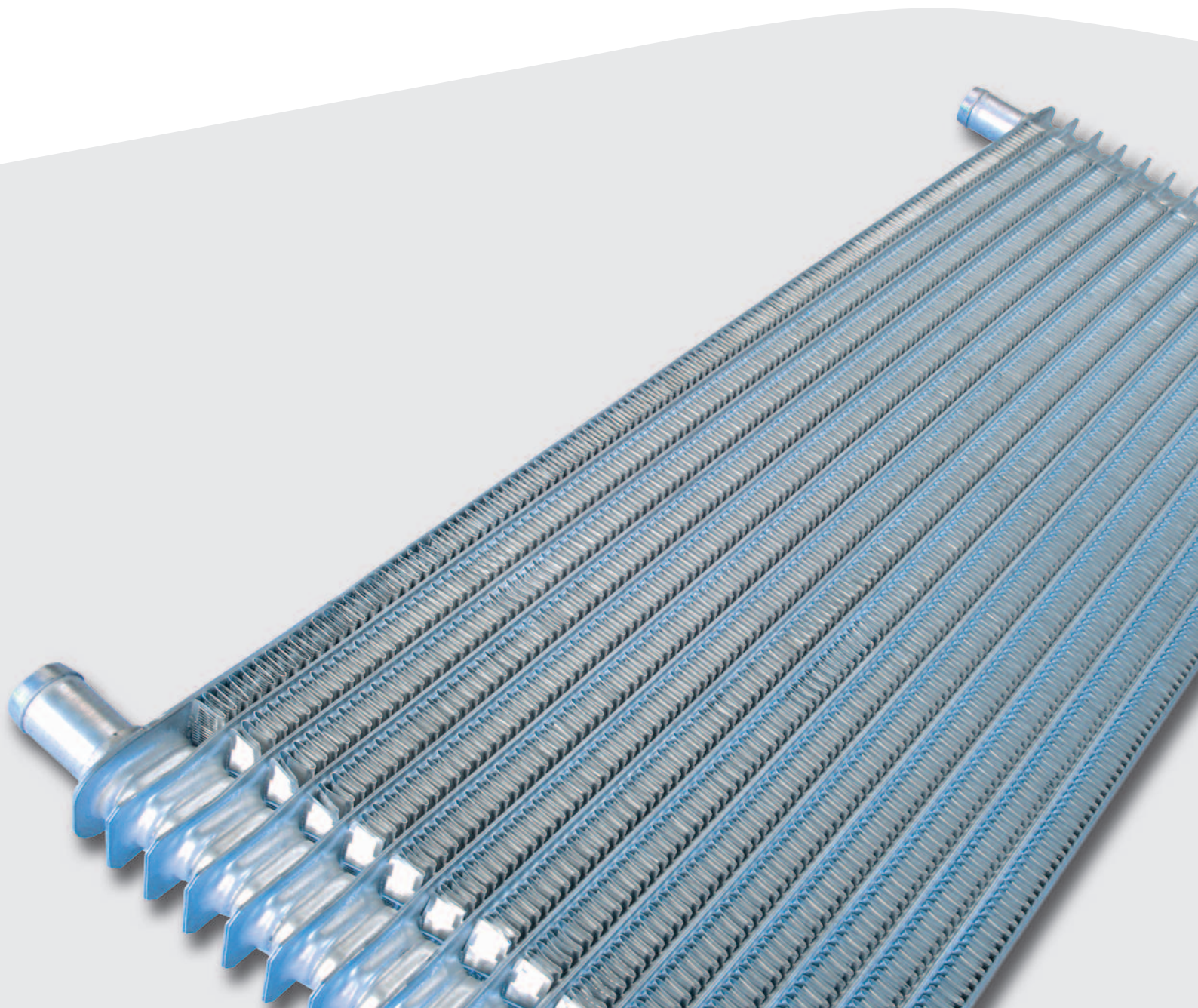


Hybrid and Electric Vehicle Cooling Products

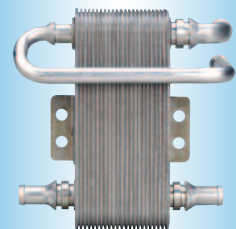


LONG®
Thermal Products



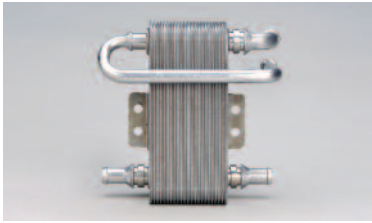
Custom Thermal Products For Hybrid Engines

Dana designs, develops, and manufactures custom heat-transfer solutions for hybrid-vehicle cooling systems. Dana's extensive range of Long® brand hybrid-engine cooling options sets the industry standard for innovation and quality.



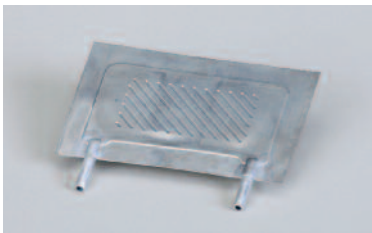
Dana: A Leader in Heat-Transfer Solutions

Dana's hybrid-engine cooling system is highly flexible. Its design consists of a battery cooling chiller; integral battery cooling plate; electronic cooling plate; universal stator cooler; engine control unit (ECU) cooler; and a sub-cooled loop, low-temperature radiator – each of which can be custom-designed to a project's exact specifications.



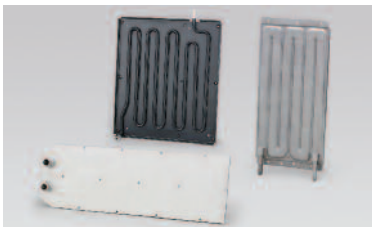
Hybrid and Electric Vehicle Battery Cooling Chiller

- Transfers heat generated in the battery to the vehicle climate control system, extending battery life.
- Employs a patented aluminum brazing process which helps to keep the climate control and battery coolant fluids clean, enabling the use of dielectric coolants.
- Specialized aluminum alloys offer material strength and contribute to weight savings.
- Compact design offers packaging flexibility.



Hybrid and Electric Vehicle Integral Battery Cooling Plate

- Transfers heat from the surface of prismatic cells to a sub-cooled coolant circuit.
- Cooling plate interleaved with prismatic lithium ion cells.
- Coating provides electrical insulation throughout battery pack.
- High precision stamped plates enable <1mm cooler assembly height.
- Flow path designed to minimize temperature variation across plate and throughout pack.
- Match with chiller for complete thermal management system.



Electronic Cooling Plate

- Highly conductive brazed-aluminum construction provides a consistent, uniform temperature across a base plate that is cooled by an integral glycol-coolant circuit.
- Brazed mounting simplifies installation.
- Large base plate area streamlines electronics mounting; holes can be pre-drilled to specification.
- Designed specifically for electronics cooling required in inverters.



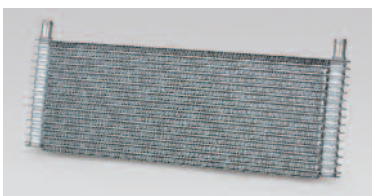
Stator Cooler

- Provides direct cooling to the stator coils and prevents the starter-alternator modules from overheating, even with more frequent engine starts.
- Compact, lightweight, all-aluminum packaging.
- Unique internal surfaces maximize heat transfer at low coolant flow rates.



Engine Control Unit (ECU) Cooler

- Special liquid-cooled base plate attached directly to the ECU to ensure that electronics do not overheat.
- Accommodates diesel fuel, which is used occasionally as coolant for base plate.
- Lightweight, flexible design easily customized for inclusion into any vehicle.
- Cooling can be localized wherever a vehicle's design permits.



Sub-Cooled Loop Radiator

- Provides cooling to a lower temperature than is possible with the main radiator.
- Designed for flow rates typical of electric pumps, but mounting configurations and sizes fit any vehicle.
- Available in both water- and glycol-coolant flow options.
- Aluminum design perfectly suited for hybrid vehicles.
- Faster speed to market and low-cost tooling for standard sizes.

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