

Liquid Cooling Systems



About Laird Thermal Systems

Laird Thermal Systems develops thermal management solutions for demanding applications across global medical, industrial, transportation and telecommunications markets. We manufacture one of the most diverse product portfolios in the industry ranging from active thermoelectric coolers and assemblies to temperature controllers and liquid cooling systems. Our engineers use advanced thermal modeling and management techniques to solve complex heat and temperature control problems. By offering a broad range of design, prototyping and in-house testing capabilities, we partner closely with our customers across the entire product development lifecycle to reduce risk and accelerate their time-to-market. Our global manufacturing and support resources help customers maximize productivity, uptime, performance and product quality. Laird Thermal Systems is the optimum choice for standard or custom thermal solutions.

Laird Thermal Systems partners with its customers to design custom thermal solutions for applications in many industries including:

- Medical Diagnostics
- Medical Imaging
- Battery Cooling
- Industrial Laser Systems
- Optoelectronics
- Analytical Instrumentation
- Semiconductor Fabrication
- Aerospace Defense
- Food & Beverage
- Automotive

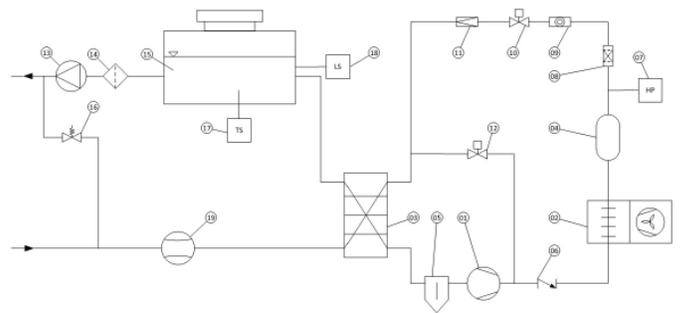


Introduction

Thermal management of electronic components and systems is more challenging than ever. Power densities continue to increase, while product form factors continue to shrink. Engineers must now consider thermal management early in the product development cycle to make sure sufficient space and power is available to remove heat from their system. Simple thermal management solutions, such as a heat sink fan mechanism, are no longer viable to keep critical systems operating at peak performance.

In today's complex operating environment, liquid cooling systems are required to dissipate a large amount of heat in a densely packed electronic environment. Maximum operational life is required to keep system maintenance and repair down time to a minimum. Temperature stabilization has especially become critical, as next generation systems require more precise temperature control.

Liquid cooling systems are self-contained units that recirculate a coolant to a predefined temperature set point. There are two types of liquid cooling solutions. The first is a liquid heat exchanger system that cools the coolant in a liquid circuit to ambient temperature. This system consists of a pump to circulate coolant, a liquid heat exchanger to dissipate heat and a liquid circuit to transfer coolant from the heat source to the liquid cooling system. The second type is a compressor-based system, or recirculating chiller, that encompasses a compressor system instead of a liquid heat exchanger assembly. It is used to cool the coolant to well below ambient and dissipate heat to the outside environment. Additional features can be included to add temperature control, variable flow control, bypass control, coolant filtration and electronics in order to meet unique attribute requirements. Compatibility of material selection to coolant is also critical in order to minimize corrosion and keep loose oxidized particles from obstructing flow.



PID Recirculating Chiller

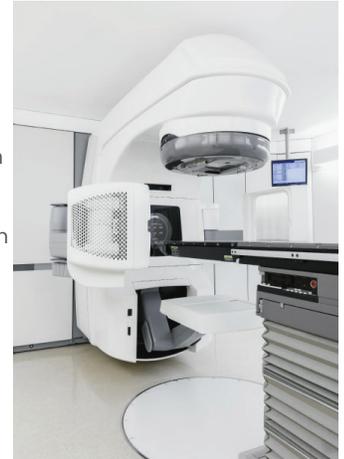
Benefits of Liquid Cooling Systems

Liquid cooling systems are unique to the thermal management market in that they use a coolant to transfer heat. Most engineers are concerned about introducing liquids to their electronics, but if the unit is designed and assembled correctly, it becomes a non-issue. Liquid cooling systems have several advantages over conventional air-cooled systems.

- **High Heat Pumping Capacity.** Liquid heat exchangers can reduce the thermal resistance of conventional heat sink fan dissipation mechanisms by a factor of 10 or more. This is due to the poor thermal properties of air versus coolants such as water.
- **High Heat Flux Density.** Liquid cooling systems can remove up to five times the amount of heat per square area over conventional air cooling systems. This becomes advantageous in densely packed electronics with limited space to accommodate an air cooling mechanism.
- **Heat Routing.** Liquid cooling allows the integration of a small heat exchanger to be located at the heat source, which then routes heat away through a liquid circuit. This is advantageous in densely packed electronics where a conventional air cooling system pushes air all around system and potentially adds heat to the system from other hot electronics in close proximity
- **Rapid Cool Down.** Cool down time is a function of cooling capacity. Liquid cooling systems have larger cooling capacities than conventional heat sink fan mechanisms, which will reduce the time it takes to reach temperature.
- **Lower Noise.** Systems with high heat removal requirements of one kilowatt or higher require much larger fans to generate the air flow needed to dissipate heat. This makes the air cooling system noisier, exposes system to higher vibration and potentially requires a larger system than that of an liquid cooling system.

Liquid Cooling Applications

Laird Thermal Systems provides robust liquid cooling solutions for many of the high-performance applications found in the medical, industrial and semiconductor markets. Systems are designed to maximize temperature stabilization at above, below, or equal to ambient temperature. Service life expectations can exceed more than 20 years in the field.



Healthcare Diagnostics & Treatment

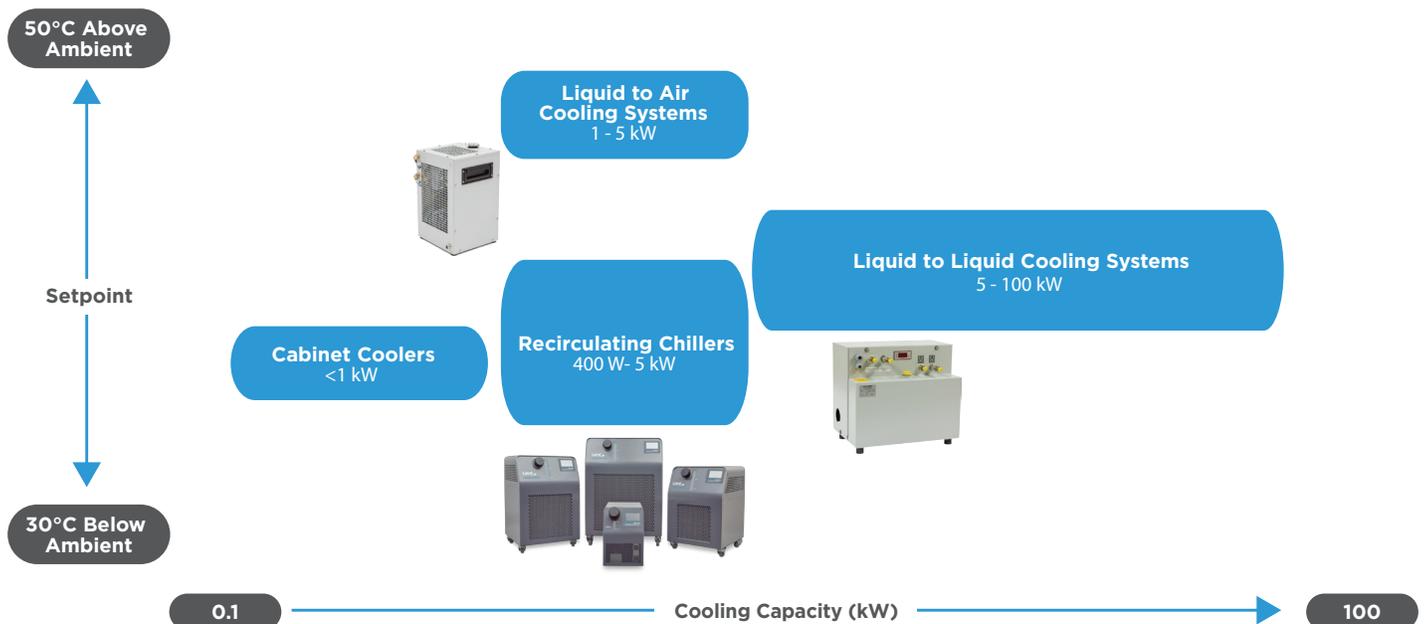
- Medical Imaging
- Medical Lasers
- Medical Diagnostics
- Centrifuges
- Radiation Therapy

Industrial Instrumentation

- Security X-Ray Scanning
- Non-Destructive Test
- Digital Printing
- Electron Microscope
- Industrial Lasers

Semiconductor Fabrication

- Metrology
- Plasma/Wet Etch
- Lithography
- Chemical/Physical Vapor Deposition
- Rapid Thermal Processing



Nextreme™ Recirculating Chillers

The Nextreme Chiller Platform is a next generation recirculating chiller featuring a high coefficient of performance (COP) and environmentally friendly refrigerants in a user-friendly design. The platform uses either compressor- or thermoelectric-based technology to cool well below ambient and dissipate heat away from thermally sensitive components in analytical, medical and industrial equipment.

Nextreme™ Performance Series, Compressor-based Recirculating Chillers

The Nextreme Performance Chiller Series feature premium components at a mid-level price. By utilizing variable speed motors for the compressor and condensing fan, this chiller series offers a high coefficient of performance (COP) and low-noise operation in a smaller and lighter package compared to previous versions.

- Premium features at a mid-level price
- High Reliability
- Environmental friendly refrigerants
- Reduced energy consumption
- Low noise operation
- High coefficient of performance



MFG PART NUMBER	MODEL	COOLING CAPACITY (W)	CONTROL TEMP RANGE (°C)	MAX FORWARD PRESSURE (BARS)	PUMP FLOW RATE (LPM)	INPUT VOLTAGE (VAC)	DIMENSIONS (L x W x H)	WEIGHT (KG)
385910-015	NRC1200	1,600	-10°C to 40°C	4.1	15 @ 1.5 bar / 15 @ 2.6 bar	100 - 120	45 X 52 x 67	48
385910-043	NRC1200	1,600	-10°C to 40°C	4.1	15 @ 1.5 bar / 15 @ 2.6 bar	220 - 230	45 X 52 x 67	48
385911-015	NRC2400	2,800	-10°C to 40°C	4.1	15 @ 1.5 bar / 15 @ 2.6 bar	220 - 230	48 X 52 x 75	54
385912-029	NRC5000	4,900	-10°C to 40°C	4.1	15 @ 1.7 bar / 15 @ 2.8 bar	220 - 230	63 x 59 x 91	100

Nextreme™ Performance Series, Thermoelectric-based Recirculating Chillers

The NRC400 is a benchtop recirculating chiller utilizing solid-state thermoelectric technology to deliver precise temperature control for analytical and industrial equipment. The coolant is recirculated using a high-quality pump with high mean time between failures (MTBF), providing low pulsation to accommodate highly sensitive imaging and test instruments. Thermoelectric chillers do not use any refrigerants, resulting in zero global warming potential.

- Compact design
- High coefficient of performance
- Precise temperature Control
- Low noise operation
- Reliable solid-state operation
- Zero global warming potential



MFG PART NUMBER	MODEL	COOLING CAPACITY (W)	CONTROL TEMP RANGE (°C)	MAX FORWARD PRESSURE (BARS)	INPUT VOLTAGE (VAC)	DIMENSIONS (L x W x H)	WEIGHT (kg)
385901-001	NRC400	400	-5°C to 40°C	1.18	115 - 230	41.3 x 27.4 x 40	24

Nextreme™ Value Series, Compressor-based Recirculating Chillers

The Nextreme™ Value Chiller is designed for OEMs looking to integrate a cost-effective and reliable thermal management solution in industrial, analytical and medical equipment. It offers the same user-friendliness and high coefficient of performance (COP) as the performance chiller but at a lower cost to provide a more competitive pricing of an OEM bundled solution. The Value Chiller can be configured to meet unique application requirements.

- Economical cooling solution
- High reliability
- Environmental friendly refrigerants
- High coefficient of performance
- Low noise operation
- Can be configured to meet specific requirements



MFG PART NUMBER	MODEL	COOLING CAPACITY (W)	CONTROL TEMP RANGE (°C)	MAX FORWARD PRESSURE (BARS)	PUMP FLOW RATE (LPM)	INPUT VOLTAGE (VAC)	DIMENSIONS (L x W x H)	WEIGHT (KG)
387008451	VRC1200	1,250	5 - 40°C	5	15 lpm @ 1.8 bar / 15 lpm @ 2.9 bar	230	56.3 x 48.2 x 69.9	51
387010181	VRC1200	1,250	5 - 40°C	6.5	9 lpm @ 5 bar / 10.5 lpm @ 5 bar	230	56.3 x 48.2 x 69.9	58
387005774	VRC2400	2,700	15 - 40°C	3.5	15 lpm @ 1.8 bar / 15 lpm @ 2.9 bar	230	48.2 x 56.3 x 69.9	56
387009925	VRC2400	2,700	15 - 40°C	6.5	17.4 lpm @ 5.0 bar / 14.4lpm@5.0 bar	230	48.2 x 56.3 x 69.9	63
387010178	VRC4500	4,850	5 - 40°C	5	15 lpm @ 1.8 bar / 15 lpm @ 2.9 bar	230	56.3 x 57.9 x 81.8	67
387010179	VRC4500	4,850	5 - 40°C	6.5	17.4 lpm @ 5.0 bar / 14.4lpm@5.0 bar	230	56.3 x 57.9 x 81.8	74

Liquid Heat Exchangers

Laird Thermal Systems offers three types of liquid heat exchanger systems. Standard cooling capacities range from 500 W to 5000 W. However, custom solutions have been designed to remove up to 40 KW of heat. Standard heat transfer configurations are either Liquid-Air or Liquid-Liquid systems. All systems are designed to operate using either water, water with glycol (antifreeze), or oil as a coolant.

Water-based Heat Exchangers

Water-based heat exchanger systems are designed to circulate water or a water glycol (antifreeze) mixture and keep the temperature of the coolant at or near ambient. Laird Thermal Systems offers recirculating liquid to air heat exchanger systems deliver reliable, compact performance by removing large amounts of heat from a liquid circuit. The coolant is recirculated using a high-pressure pump to assure maximum flow rate. Heat from coolant is absorbed by a heat exchanger and dissipated into the ambient environment using a brand name fan. Liquid-Liquid systems use facility water as a hot side heat dissipation mechanism, which increases the cooling capacity while maintaining form factor.

- Cooling to ambient
- High heat pumping capacity
- Compact form factor
- Long life operation



MFG PART NUMBER	PART DESCRIPTION	HEAT TRANSFER MECHANISM	COOLING CAPACITY (W)	MAX PRESSURE DROP (BARS)	PUMP FLOW RATE (LPM)	INPUT VOLTAGE (VAC)	DIMENSIONS (L x W x H)	WEIGHT (KG)
1505.00	WL500	Liquid to Air	500	7.0	2.2 @ 4 bar	230	37 x 30 x 15	11
1510.00	WL1000	Liquid to Air	1,000	8.0	2.2 @ 4 bar	230	33 x 29 x 30	17
1515.00	WL1500	Liquid to Air	1,500	6.0	4.0 @ 4 bar	230	48 x 40 x 48	38
1520.00	WL2000	Liquid to Air	2,000	6.7	5.7 @ 4 bar	230	30 x 30 x 50	26
387002779	WL3004	Liquid to Air	3,000	6.7	6.5 @ 3 bar	230	48 x 40 x 48	38
387005598	LA5000	Liquid to Air	5,000	7.0	6.0 @ 6 bar	230	47 x 57 x 53	40
1104.00	WW3001	Liquid to Liquid	3,000	6.7	5.4 @ 4 bar	230	45 x 27 x 40	24
1550.00	WW5001	Liquid to Liquid	5,000	8.0	6.4 @ 3 bar	230	48 x 40 x 48	38

Oil-based Heat Exchangers

Oil-based heat exchanger systems are designed to circulate transformer oil and are used in applications where the temperature at the heat source exceeds the operational temperature limit of water based coolants, or when special insulating properties are required within the coolant loop. The OL Series is a recirculating liquid to air heat exchanger that offers dependable, compact performance by removing large amounts of heat from a liquid circuit. The coolant pump to assure maximum flow rate. The coolant is recirculated using a high-pressure pump to assure maximum flow rate. Heat from coolant is absorbed by a heat exchanger and dissipated into the ambient environment using brand name fan.

- High heat pumping capacity
- Compact form factor
- Long life operation
- Cooling to above ambient (where the temperature at the heat source is at or exceeds the limit of conventional coolant operating temperatures)

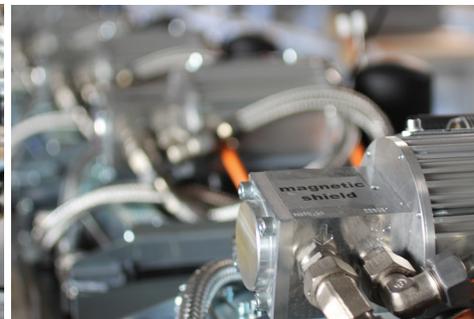


MFG PART NUMBER	PART DESCRIPTION	HEAT TRANSFER MECHANISM	COOLING CAPACITY (W)	MAX PRESSURE DROP (BARS)	PUMP FLOW RATE (LPM)	INPUT VOLTAGE (VAC)	DIMENSIONS (L x W x H)	WEIGHT (KG)
1264.00	OL4503	Oil to Air	4,500	9.0	23 @ 3.5 bar	230	75 x 35 x 65	54
1155.00	OW4002	Oil to Water	4,000	9.0	17 @ 3.5 bar	230	62 x 35 x 55	45

Custom Liquid Cooling Systems

Since there are many unique attributes that need to be ascertained for each application, often the optimal liquid cooling solution ends up requiring a custom configuration. Laird Thermal Systems has over 45 years of experience in the design, manufacture and servicing of custom liquid cooling systems for various high-end markets. Our engineering team has the know-how to design cooling systems that are compatible with water, water-glycol, transformer oil, or various corrosion inhibitors. Liquid cooling systems can also be quite complex and require the temperature control of multiple liquid circuits or multiple pressure drop settings in order to accommodate low and high-pressure conditions. Laird Thermal Systems has experience designing both systems and can integrate many unique attributes into a liquid cooling system such as:

- Cooling capacity (up to 200 KW)
- Variable pump capacity
- Thermal control of multiple liquid circuits
- Coolant filtration
- Variable flow control
- PID temperature control
- High temperature stability
- High Coefficient of Performance
- Durability by hot gas bypass control
- CFC-free refrigerants
- Stainless steel heat exchanger
- High operational temperatures
- Flow monitoring
- Level monitoring
- Pressure limit
- Custom input/output fittings and housing configuration



Strong Engineering Services

Laird Thermal Systems offers strong engineering services with a global presence that supports onsite concept generation, thermal modeling, flow analysis, mechanical design, electrical design and rapid prototyping. Vertical integration is fundamental to meet the needs of today's fast product development cycles. Laird Thermal Systems has invested in sheet metal fabrication, spot welding, tube bending and CNC equipment. Our engineering team also works with world-class suppliers to utilize their expertise in supporting custom designs on pumps, compressor technologies, evaporators and liquid heat exchangers. Validation test services are also available to support compliance standards for each industry, such as UL/CSA and MIL-STDs. In-house test capabilities exist to support:

- Noise measurement
- Cooling capacity
- Pressure and flow rates
- Electronic drive circuit testing
- Reliability testing
- G-force testing
- High temp oven storage testing
- Temperature cycling
- Continuous operation testing

All products are manufactured in an ISO 9001 and ISO 14001 certified facility and are built to meet the needs of strict process control requirements found in many of the medical, industrial and semiconductor industries. All parts are procured from premium suppliers with a proven history of supplying high reliable components. Laird Thermal Systems also offers strong service support to repair or replace parts on units that have been in the field for more than two decades.

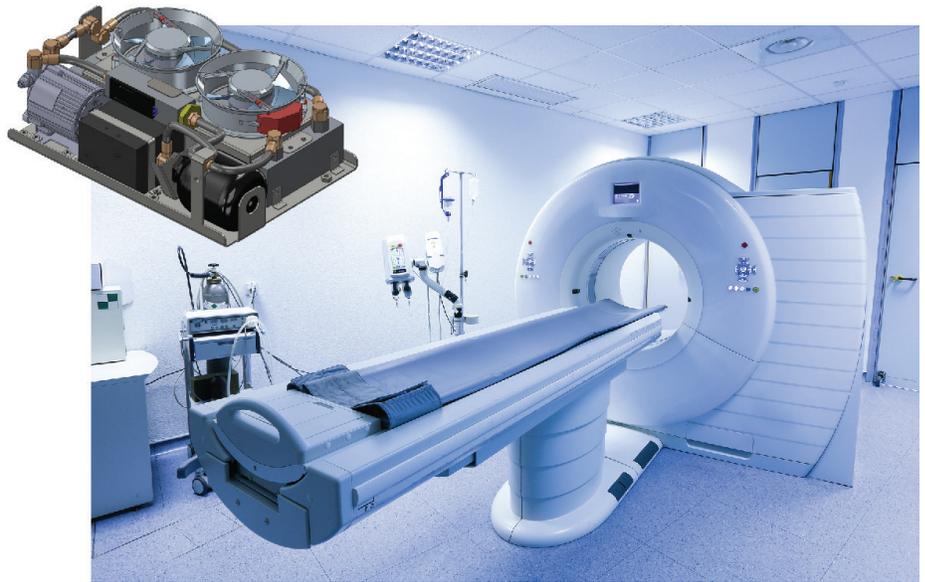
Laird Thermal Systems provides the knowledge, innovation and resources to ensure exceptional thermal performance and customer satisfaction. Contact us today for your complete application solutions.

Featured Application: Medical Imaging

Medical imaging systems provide detailed images on the structure of a body in multiple topographies. Detailed contrasts are visible between the different soft tissues and are useful in neurology, cardiology and oncology. CT and PET Scanners use ion radiation created by X-rays to capture topographical images and MRI's use magnetic and radio frequency fields.

Why Liquid Cooling?

During operation, components such as amplifiers and power supplies generate a large amount of heat that needs to be managed within the system. Thermal management systems that feature liquid cooling offer higher efficiencies than air-based heat transfer mechanisms, which translates into higher reliability, less field maintenance, greater system uptime and lower total cost of ownership.



Worldwide Service & Support

Laird Thermal Systems has an established, world-class service operation dedicated to responding to our customers' service and support needs worldwide. All liquid cooling systems are serviced in an ISO 9001 and ISO 14001 certified facility. Laird Thermal Systems stocks components on continuous running programs with ability to ship out parts to a regional technician within 24 hours.

Laird Thermal Systems offers extended service contracts to support beyond standard warranty periods.

- Repairs, exchanges, or upgrades
- Installation, commissioning and start-up assistance
- Precision tuning and system optimization
- Custom preventative maintenance plans
- Tailored refurbishment management plans
- Extended warranty programs
- Customized training programs



www.lairdthermal.com

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