Laird™

THERMAL SYSTEMS

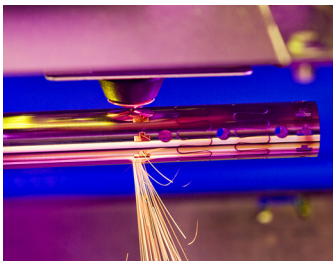
Liquid Cooling Systems

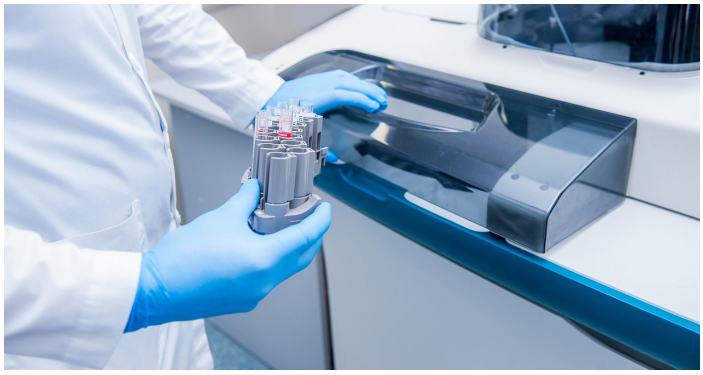
About Laird Thermal Systems

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



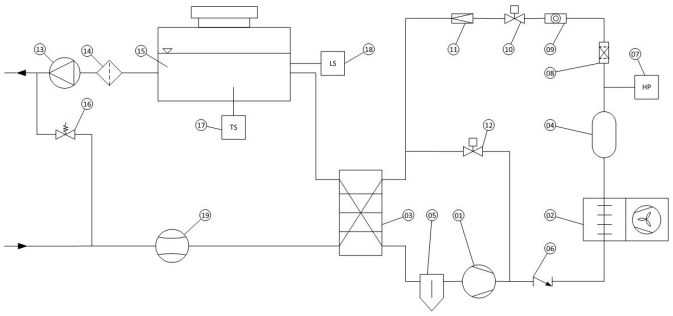


Introduction

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

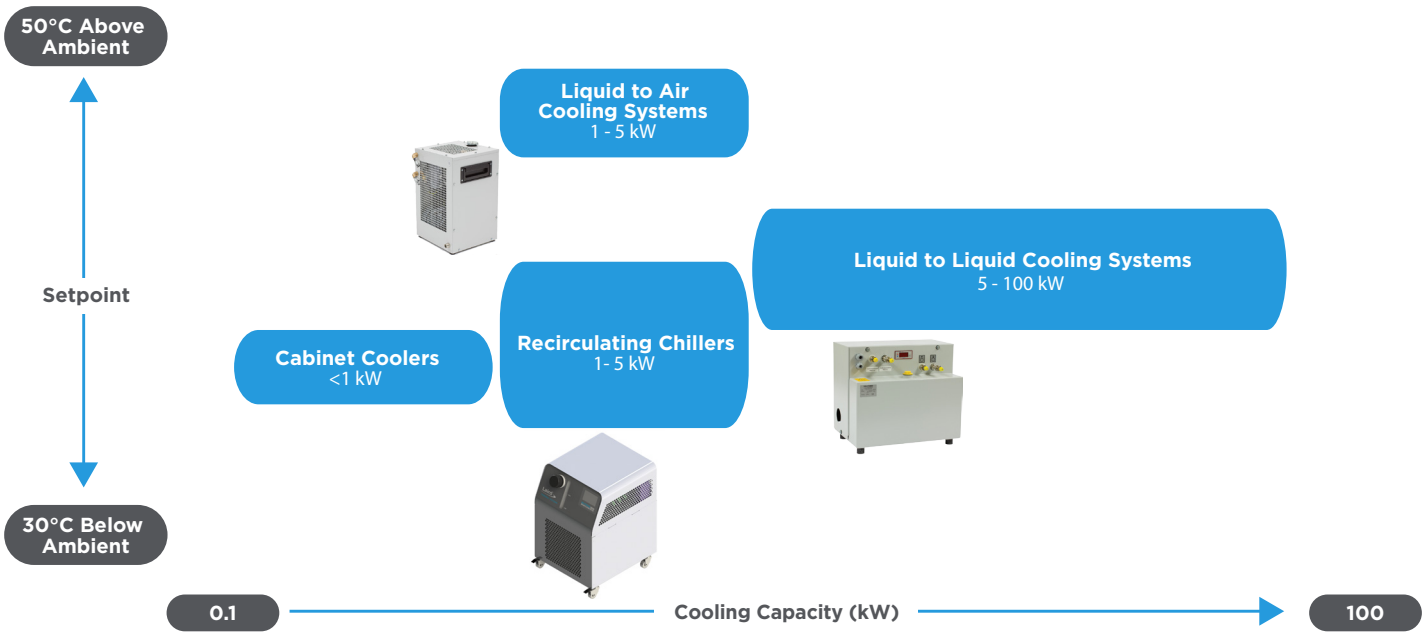
- Medical Imaging
- Medical Lasers
- Medical Diagnostics
- Centrifuges
- Radiation Therapy

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



Recirculating Chillers

Recirculating systems use a compressor to force a refrigeration gas through a condenser in order to change its phase to a liquid. The liquefied refrigerant is then recirculated through an evaporator, where energy is absorbed from the coolant being recirculated to the critical process and it is vaporized again.

Nextreme™ Recirculating Chiller Platform

The Nextreme Recirculating Chiller platform is the next generation of recirculating chillers that feature premium components at a mid-level price. The platform features high-quality components, environmentally friendly R513A refrigerants, low-noise designs and a user-friendly operation for reliable, precise temperature control of analytical, medical and industrial equipment. The chiller line is designed to cool well below ambient temperature and dissipate heat away from thermally sensitive equipment.

- Premium features at a mid-level price
- Environmental friendly refrigerants
- Low noise operation
- Lower ambient heat output
- Reduced energy consumption

MFG PART NUMBER	PART DESCRIPTION	COOLING CAPACITY (W)	CONTROL TEMP RANGE (°C)	MAX AVAILABLE PRESSURE (BARS)	PUMP FLOW RATE (LPM)	INPUT VOLTAGE (VAC)	DIMENSIONS (L x W x H)	WEIGHT (KG)
85910-043	NRC1200	1,600	-10°C to 40°C	5.3	15 @ 1.5 bar / 15 @ 2.6 bar	100 – 120 or 220 - 230	45 X 52 x 67	48
385911-015	NRC2400	2,800	-10°C to 40°C	5.3	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	5.3	15 @ 1.7 bar / 15 @ 2.8 bar	220 - 230	63 x 59 x 91	100

WLK Series, Recirculating Chillers

The WLK Series is a compressor-based recirculating chiller that offers dependable, compact performance by controlling the temperature of water or water with glycol (antifreeze) in a liquid circuit. The coolant is recirculated using a pump with high MTBF. Heat from the coolant is absorbed by a durable, compressor-based system and dissipated to the ambient environment. The unit is regulated with an easy-to-use digital temperature controller with push button interface. The unit is housed inside a rugged sheet metal casing. Standard cooling capacities range are available up to 3 KW. However, custom solutions have been designed to remove up to 200 KW of heat.

- Cooling to below ambient
- High heat pumping capacity
- Variable temperature control
- High temperature stability
- CFC free refrigerants
- Long life operation

MFG PART NUMBER	PART DESCRIPTION	COOLING CAPACITY (W)	CONTROL TEMP RANGE (°C)	MAX PRESSURE DROP (BARS)	PUMP FLOW RATE (LPM)	INPUT VOLTAGE (VAC)	DIMENSIONS (L x W x H)	WEIGHT (KG)
1432.49	WLK 31	3,000	5 – 35°C	6.7	6.0 @ 4 bar	230	59 x 61 x 92	115

MRC Chiller

MRC Chillers are self contained recirculating chillers that offer dependable, compact performance by controlling the temperature of a coolant in a liquid circuit. The coolant is recirculated using a pump with high mean time between failures (MTBF). Heat from the coolant is absorbed by a heat exchanger and dissipated through high density heat sinks equipped with brand name fans. The thermoelectric coolers are custom designed to achieve long life operation. The unit is regulated with an easy-to-use digital temperature controller and is housed inside an aesthetic sheet metal casing.

- Compact design
- Precise temperature Control
- Reliable solid-state operation
- Low noise operation
- RoHS-Compliant

MFG PART NUMBER	MODEL	COOLING CAPACITY, W (dT=12°C)	PUMP FLOW RATE (LPM)	HEATING OPTION	WEIGHT (kg)	DIMENSIONS (L x W x H)
385736-001	MRC 150-DH2-DVA	151	2.9 @ 4 bar	No	10.9	30.4 x 19.5 x 35.1
385755-001	MRC 300-DH2-DVA	299	3.3 @ 4 bar	No	13.6	39.1 x 20.3 x 33.8
385737-001	MRC 150-DH2-HT-DVA	151	2.9@ 4 bar	Yes	10.9	30.4 x 19.5 x 35.1
385760-001	MRC 300-DH2-HT-DVA	299	3.3 @ 4 bar	Yes	13.6	39.1 x 20.3 x 33.8

Liquid Heat Exchangers

Laird Thermal Systems offers three (3) 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.

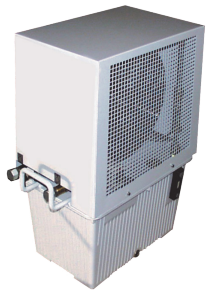
Water Cooled systems, (WL Series)

Water cooled systems are designed to circulate water or a water glycol (antifreeze) mixture and keep the temperature of the coolant at or near ambient. The WL 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 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.

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

MFG PART NUMBER	PART DESCRIPTION	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	500	7.0	2.2 @ 4 bar	230	37 x 30 x 15	11
1510.00	WL1000	1,000	8.0	2.2 @ 4 bar	230	33 x 29 x 30	17
1515.00	WL1500	1,500	6.0	4.0 @ 4 bar	230	48 x 40 x 48	38
1520.00	WL2000	2,000	6.7	5.7 @ 4 bar	230	30 x 30 x 50	26
387002779	WL3004	3,000	6.7	6.5 @ 3 bar	230	48 x 40 x 48	38
1550.00	WL5000	5,000	8.0	6.4 @ 3 bar	230	48 x 40 x 48	38

Oil Cooled systems, (OL Series)



Oil cooled systems (OL Series) 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	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	4,500	9.0	23 @ 3.5 bar	230	75 x 35 x 65	54

Water/Oil-to Water Systems (WW and OW Series)

Liquid-Liquid systems use facility water as a hot side heat dissipation mechanism, which increases the cooling capacity while maintaining form factor. WW series systems are designed to operate using water as coolant, while OW Series systems are designed to operate using oil as coolant.

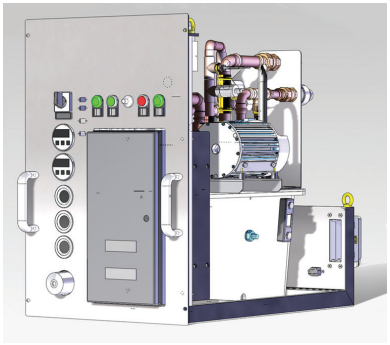
- Cooling to ambient
- Long life operation
- High heat pumping capacity in smallest form factor

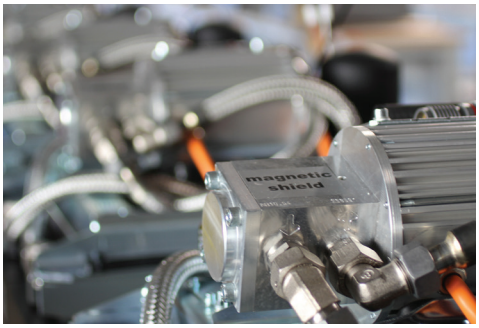
MFG PART NUMBER	PART DESCRIPTION	COOLING CAPACITY (W)	COOLANT TYPE	MAX PRESSURE DROP (BARS)	PUMP FLOW RATE (LPM)	INPUT VOLTAGE (VAC)	DIMENSIONS (L x W x H)	WEIGHT (KG)
1104.00	WW 3001	3,000	Water	6.7	5.4 @ 4 bar	230	45 x 27 x 40	24
1109.00	WW 5001	5,000	Water	6.5	10 @ 4 bar	230	45 x 30 x 37	24
1155.00	OW 4002	4,000	Oil	9.0	17 @ 3.5 bar	230	62 x 35 x 55	45

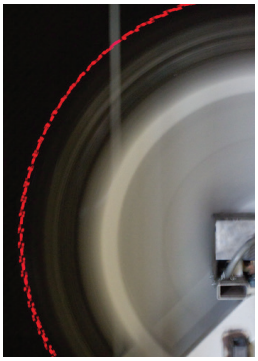
Custom Liquid Cooling Systems

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

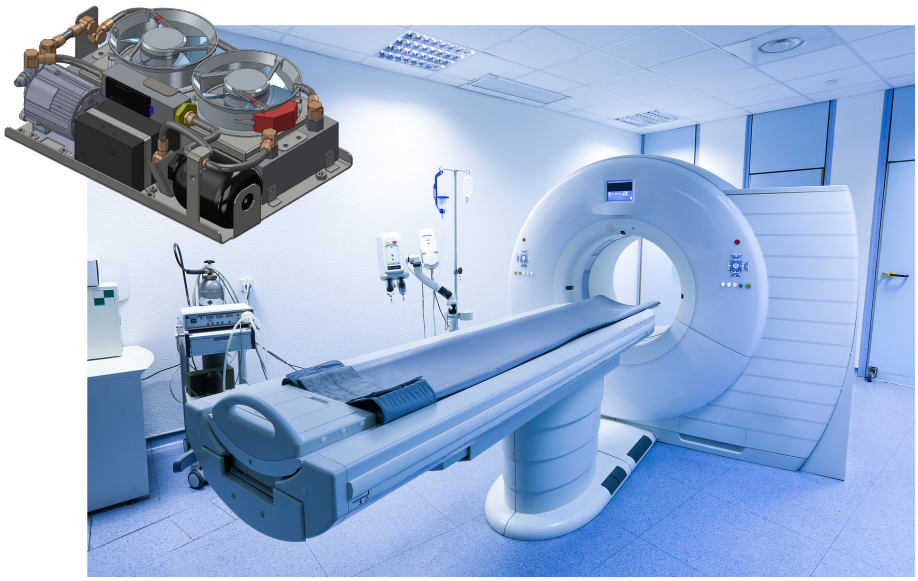
All products are manufactured in an ISO 9001 and ISO 14001 certified facility and are built to meet the needs of strict process control requirements found in many of the medical, industrial and semiconductor industries. All parts are procured from premium suppliers with a proven history of supplying 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

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