

## **Liquid Cooling** for X-ray Scanning Equipment

# Introduction



Industrial X-ray scanners generate a large amount of heat that must be quickly dissipated away



**Liquid Cooling Systems ensure high performance and long-life operation**

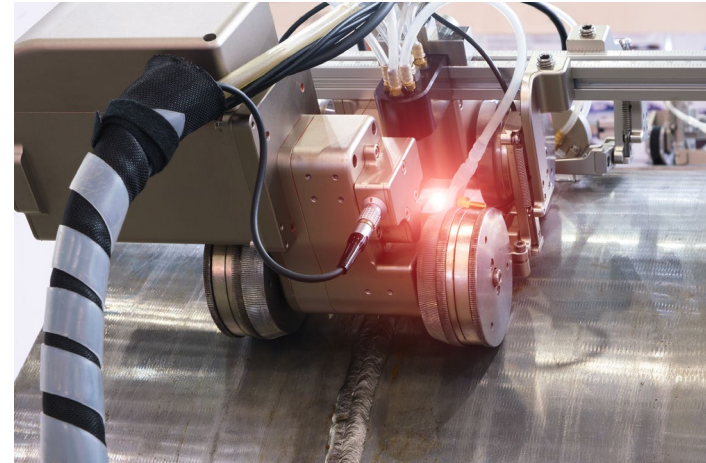


# Application Overview



Industrial X-ray equipment is commonly used within:

- Manufacturing processes
- Automotive
- Food and beverage processing
- Luggage scanners
- Pipeline inspection stations



# Design Objectives



Industrial X-ray require less power and lower image resolution than medical X-ray



Cooling System Design Requirements:

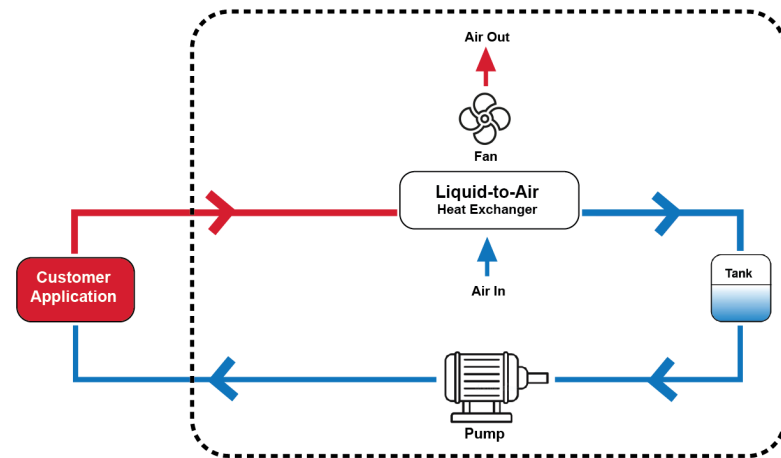
**Cost-Effective**

**Easy To Maintain**

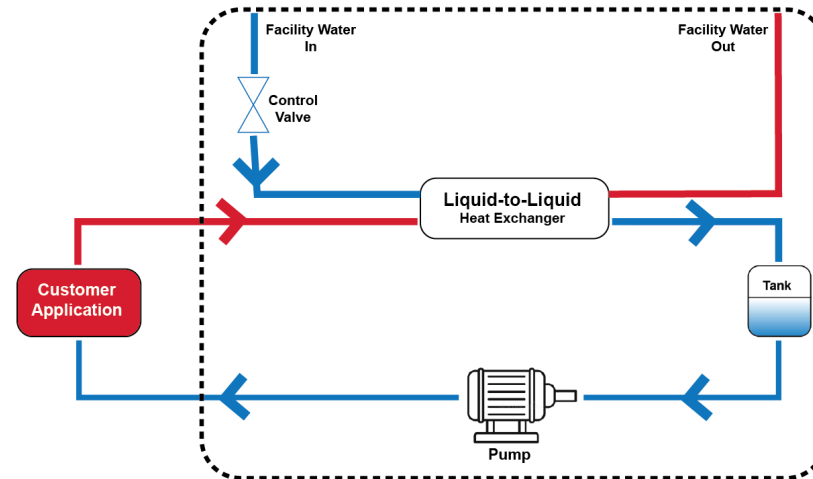
**High Reliability**

# Comparing Technologies

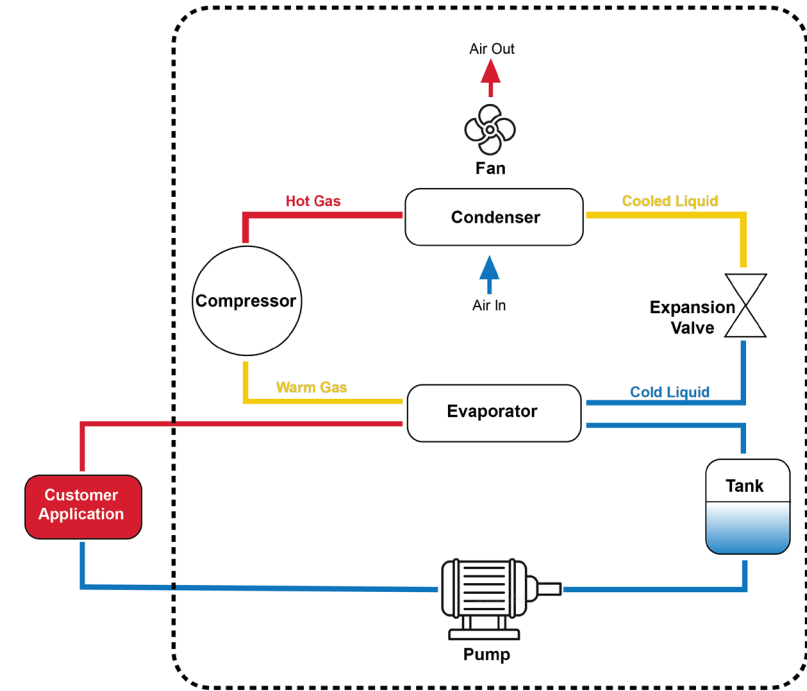
Liquid Cooling offer many advantages over air-based cooling systems



Liquid-to-Air



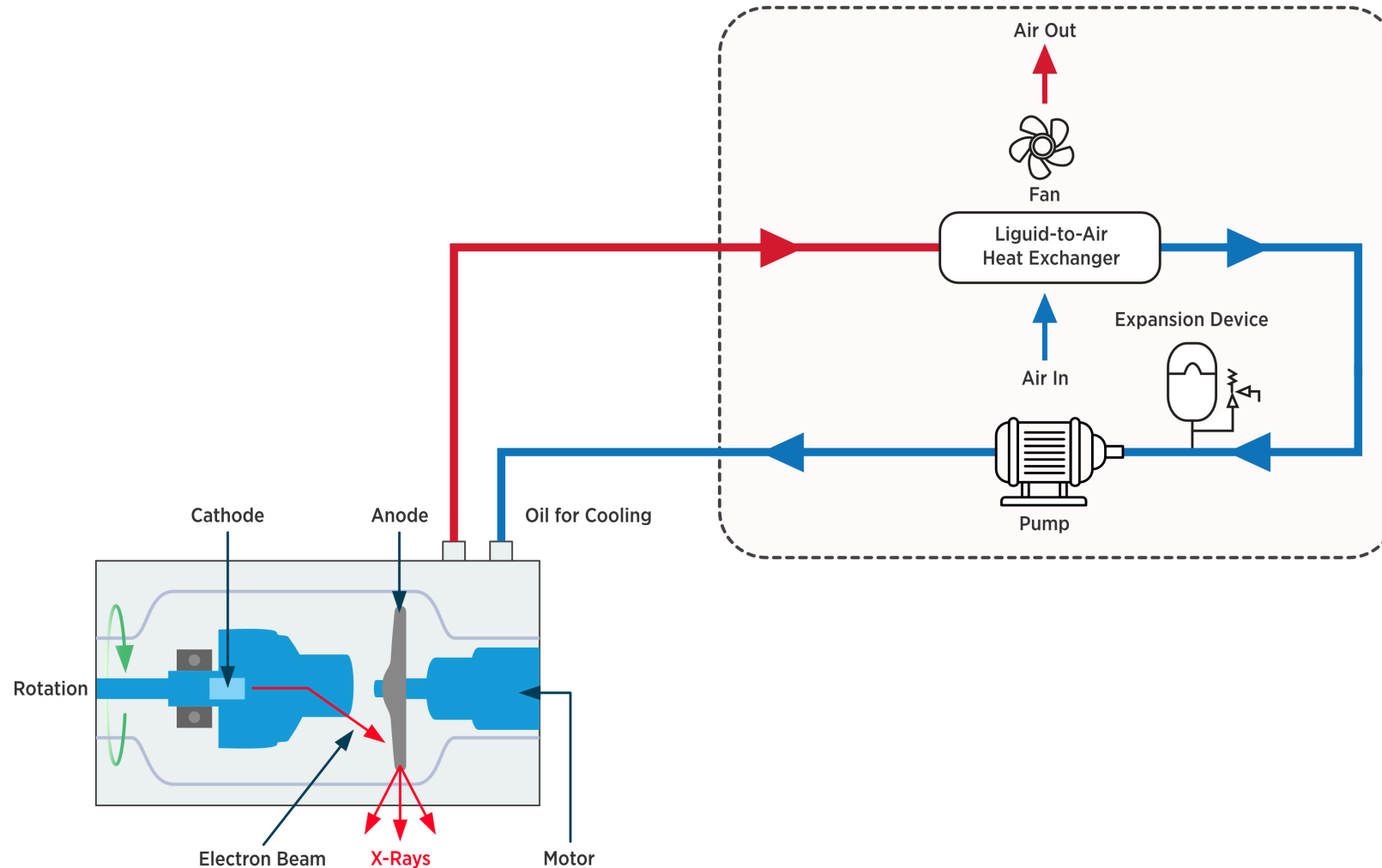
Liquid-to-Liquid



Recirculating Chiller

# Liquid Cooling of X-ray Systems

Liquid-to-air heat exchanger systems are the most cost-effective cooling solution for industrial X-ray





# LA5000 Liquid-to-Air Heat Exchanger



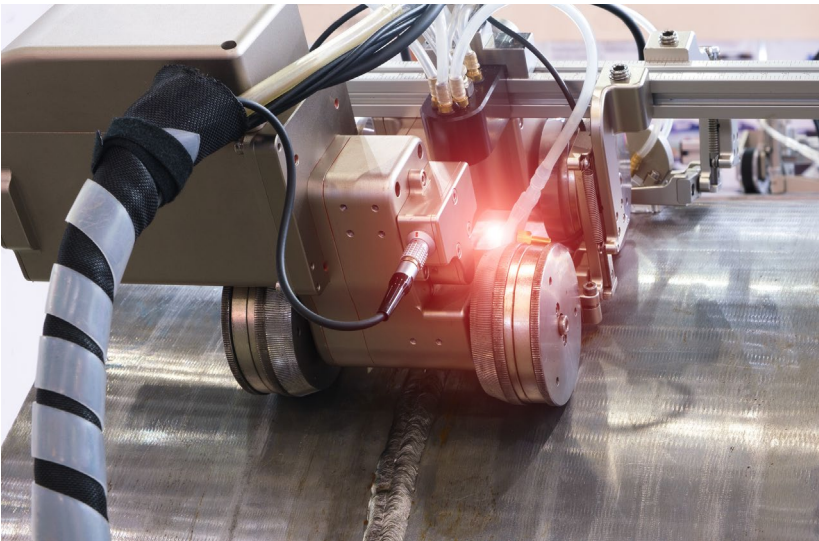
- **High Reliability**
- **Low Maintenance Features**
- **Low noise operation**
- **Operates above ambient temperatures**
- **Cost-effective cooling solution**
- **Meets laboratory standards**



**5000**

Watts of  
Cooling Capacity

# Conclusion



Industrial X-ray Equipment **requires a cooling solution to dissipate a large amount of heat** to the surrounding environment

Liquid-to-Air Heat exchangers are the most economical option for **operation above ambient temperatures**

**Liquid cooling systems offer several advantages** over air-based heat transfer mechanisms

The LA5000 features improved fan and heat exchanger technology **providing high reliability and long-life** operation with **low maintenance**



**LA5000**  
MFG Part Number 387005696

**WL Series Liquid Cooling System**

The LA5000 is a re-circulating liquid to air heat exchanger that offers dependable, compact performance by removing large amounts of heat from a liquid circuit. The coolant is re-circulated using a high-pressure pump to ensure maximum flow rate. Heat from coolant is absorbed by a radiant heat exchanger and dissipated into the ambient environment using brand name fan. Manual adjustments can be made to control flow switch. Customized features are available, however, MOQ applies.

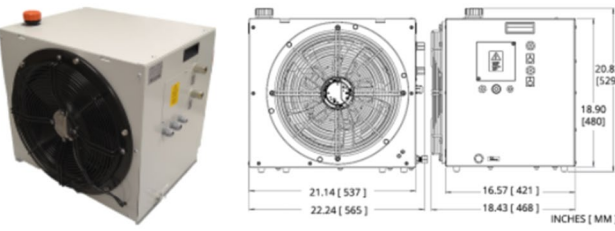
[Standard Datasheet](#) [Check Stock](#) [Request a Quote](#) [Contact Tech Support](#)

**Features**

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

**Applications**

- Cooling Particle Accelerators, Linear Accelerators and Cyclotrons
- Semiconductor Fabrication Equipment Cooling
- X-ray Cooling in Industrial Settings



**FLUID OPERATING POINTS**

**100% Water**  
Cooling Power (Qc) = 5000 Watts  
Thermal Conductance = 474.5 W/°C  
 $\Delta T$  (Ambient/Coolant) = 10.5 °C  
 $\Delta T$  (Coolant/Inlet) @ 8.3 L/min = 8.6 °C

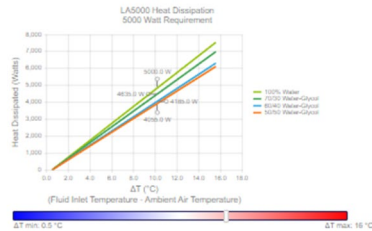
**70% Water-Glycol**  
Cooling Power (Qc) = 5000 Watts  
Thermal Conductance = 441.5 W/°C  
 $\Delta T$  (Ambient/Coolant) = 11.3 °C  
 $\Delta T$  (Coolant/Inlet) @ 8.3 L/min = 10.1 °C

**50/50 Water-Glycol**  
Cooling Power (Qc) = 5000 Watts  
Thermal Conductance = 400.4 W/°C  
 $\Delta T$  (Ambient/Coolant) = 12.5 °C  
 $\Delta T$  (Coolant/Inlet) @ 8.3 L/min = 10.5 °C

**30% Water-Glycol**  
Cooling Power (Qc) = 5000 Watts  
Thermal Conductance = 388.4 W/°C  
 $\Delta T$  (Ambient/Coolant) = 13.2 °C  
 $\Delta T$  (Coolant/Inlet) @ 8.3 L/min = 11.1 °C

**Select Graph**

☒ Qc vs  $\Delta T$  (Ambient/Inlet)  
☐  $\Delta T$  (Inlet/Outlet) vs Qc  
☐ Pump Curve (Pressure vs Flow)



LA5000 Heat Dissipation  
5000 Watt Requirement

AT min 0.5 °C AT max 16 °C

## Thermal Wizard Liquid Cooling Calculator

[Wizard Home](#) | [Device Cooling Calculator](#) | [PCR Calculator](#) | [Enclosure Cooling Calculator](#) | [Air Cooling Calculator](#) | [Liquid Cooling Calculator](#)

**CHOOSE AN EXAMPLE OR COMPLETE THE REQUIREMENTS...**

[Industrial Laser](#) [X-ray Tube](#) [Sputtering Target](#) [Electron Microscope](#) [Additive Manufacturing](#) [Pump Laser](#)

[View video for help using: Liquid Cooling Calculator](#)

[Contact Tech Support](#)

**CALCULATION RESULTS...**

☒ °C ☐ °F ☐ mm ☐ in ☐ Watts ☐ BTU/hr

**LIQUID FLOW RATE**  
Fluid Flow Rate: 9.5 L/min

**FLUID DEFINITION**  
Fluid: Water  
Density: 997.3 kg/m³  
Specific Heat: 4180.3 J/kg·K

**TEMPERATURE**  
Inlet: 25 °C  
Outlet: 21 °C

**Liquid Inlet**  
**Cooled Liquid Outlet**



**Liquid Cooling for X-Ray Scanning Equipment**

Laird Thermal Systems Application Note

**Laird**  
THERMAL SYSTEMS

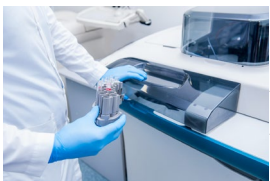
[Datasheet](#)

[Liquid Cooling Calculator](#)

[Application Note](#)

# About Laird Thermal Systems

Laird Thermal Systems develops thermal management solutions for demanding applications



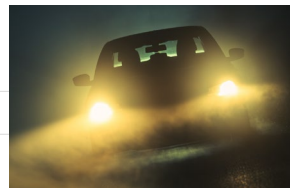
Medical



Analytical



Industrial



Transportation



Telecom

- **DIVERSE PRODUCT PORTFOLIO**  
Thermoelectric Coolers, Thermoelectric Cooler Assemblies, Temperature controllers and Liquid Cooling Systems

- **SOLVING COMPLEX ISSUES**  
Our engineers use advanced thermal modeling and management techniques to solve complex heat and temperature control problems

- **ACCELERATING TIME-TO-MARKET**  
We partner closely with our customers across the entire product development lifecycle.

- **MAXIMIZING PERFORMANCE**  
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

Learn more by visiting  
[www.lairdthermal.com](http://www.lairdthermal.com)





Have a question or need more information about  
Laird Thermal Systems? Please contact us via the website at [www.lairdthermal.com](http://www.lairdthermal.com)



Liquid-Cooling-for-X-Ray Scanning-Equipment-Presentation-041922

**Trademarks**

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