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TARK THERMAL SOLUTIONS

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

Introduction

- X-ray scanning is used in various industrial applications ranging from non-destructive evaluation on manufacturing sites to luggage scanning at airports.

- Only a small amount of the energy generated by these systems is emitted as X-rays; the balance is released as heat. Industrial X-ray equipment can generate several kilowatts of heat during operation, which needs to be dissipated to ensure maximum performance and long-life operation.

- With the ability to transfer large amounts of heat within confined spaces, liquid cooling is the preferred thermal management solution for X-ray equipment.

Application Overview

Industrial X-ray equipment is commonly used within:

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

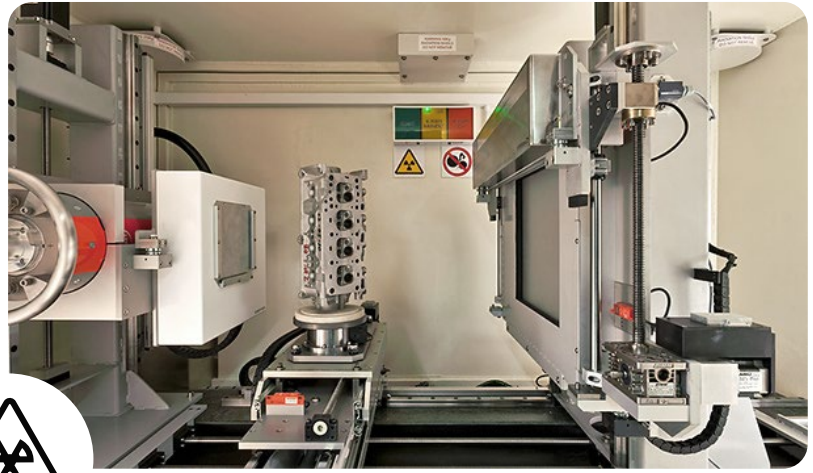
- Non-destructive tests are frequently used in the manufacturing process to improve efficiency and ensure high quality.

- In the automotive industry, x-rays scanners are used to inspect motor blocks and tires to detect defects.

- The food and beverage industry uses this type of scanners for quality control in the packaging process. X-ray technology is also used in luggage scanners at airports and inspection stations for pipelines.

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**

Industrial X-ray scanners are similar to equipment used for medical imaging but typically demand less power, are often stationary and require lower resolution.

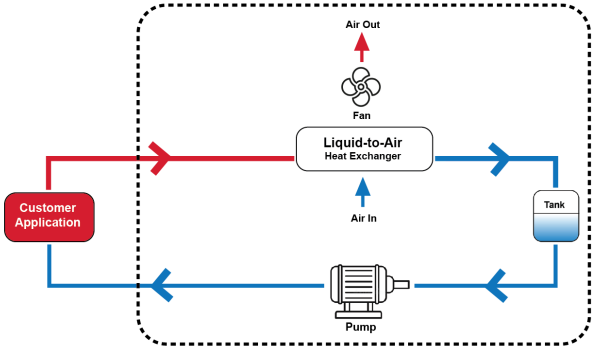
Cooling systems for these types of X-ray system do not typically have space constrains as they often are standalone units, located near the equipment.

More important, cooling systems used for industrial x-ray must be cost-effective, easy to manage and maintain while delivering high performance and reliable operation.

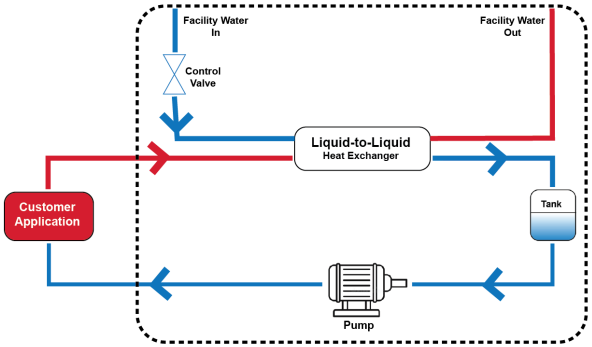
Comparing Technologies

Liquid Cooling offer many advantages over air-based cooling systems

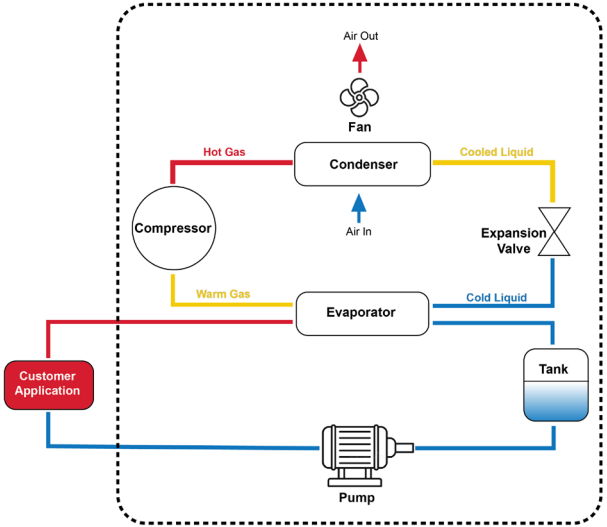
Thermoelectric coolers offer high reliability and a more cost-effective solution



Liquid-to-Air



Liquid-to-Liquid



Recirculating Chiller

Compared to conventional air-based systems, liquid cooling systems offer a higher heat pumping capacity, a more rapid cool down time and quieter operation.

Depending on the X-ray application, three different types of liquid cooling systems can be used:

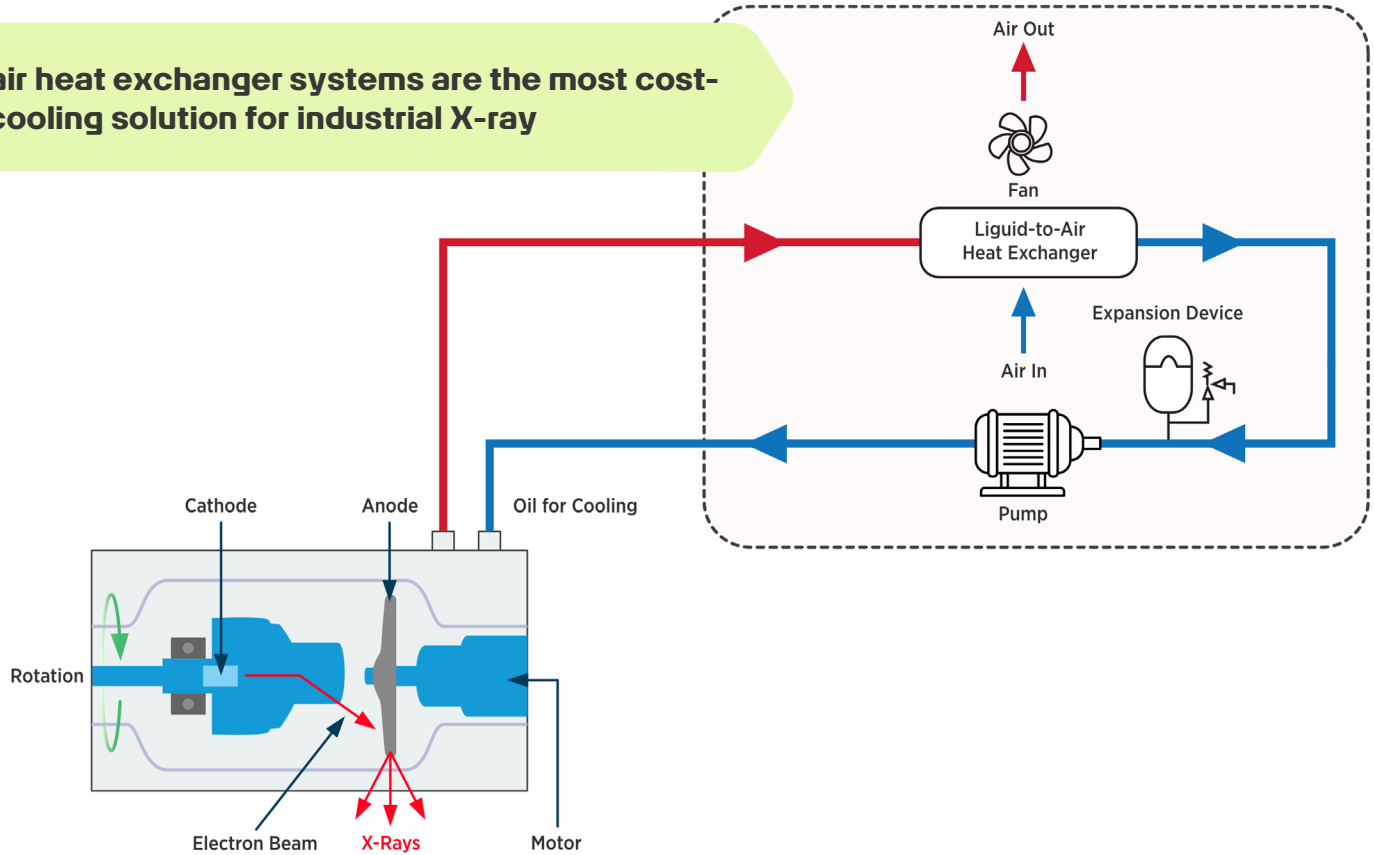
- The first option is a liquid-to-air heat transfer configuration, where a high-pressure pump recirculates the liquid coolant and an air heat exchanger removes the heat from the liquid circuit and dissipates it to the ambient environment by using a fan.

- Another option is a system with a liquid heat exchanger configuration where a liquid-to-liquid heat exchanger dissipates heat to a central facility system and ultimately outside the building.

- A third option is a compressor-based system or recirculating chiller, which uses a refrigerant instead of a liquid heat exchanger to cool the liquid.

Liquid Cooling of X-ray Systems

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



The ability to quickly dissipate a large amount of heat makes liquid cooling systems the optimum thermal solution for industrial X-ray inspection. Because industrial X-ray components often operate above ambient temperatures, a liquid-to-air heat exchanger system is the most cost-effective solution for dissipating waste heat.

A pump recirculates the coolant in a liquid circuit to transfer heat from the application to the liquid cooling system. By using an expansion device, the cooling circuit can be completely sealed from the outside environment which compensates for the thermal expansion of the fluid over the wide operating temperature range.

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

RoHS COMPLIANT

CE

5000

Global Warming Potential

To meet demands of high reliability in industrial X-ray applications, Tark Thermal Solutions has developed the LA5000 liquid- to-air heat exchanger. As a water heat exchanger, the 5000-watt unit offers dependable compact performance while removing large amounts of heat from a liquid circuit.

By offering design simplicity and robust components that have been proven for decades, the LA5000 provides low maintenance requirements, ensuring maximum system uptime.

Featuring the latest heat exchanger technology and a more efficient fan, the LA5000 reduces the operating noise and the temperature difference between the liquid and the air by a factor of 2.

Compared to standard liquid chillers that operate below ambient temperatures, the LA5000 liquid cooling system operates above ambient temperatures, at a significant lower cost.

The unit does not only meet CE, REACH, and RoHS requirements, but also UL61010-1 and IEC 61010-1 lab safety standards.

Conclusion

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

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

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

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

Industrial X-ray equipment generate a large amount of heat that needs to be quickly dissipated to ensure maximum performance and system uptime.

Liquid cooling systems have the ability to dissipate a large amount of heat and offers several advantages over air-based systems.

Because these components often operate above ambient temperatures, a liquid-to-air heat exchanger often is the most economical solution.

With the ability to cool to near ambient temperatures, even at high heat loads, the LA5000 is ideal for cooling industrial x-ray applications. Offering a cooling capacity of up to 5000 Watts, improved fan and heat exchanger technology, this system provides low maintenance requirements and long-life operation which translates into lower costs.

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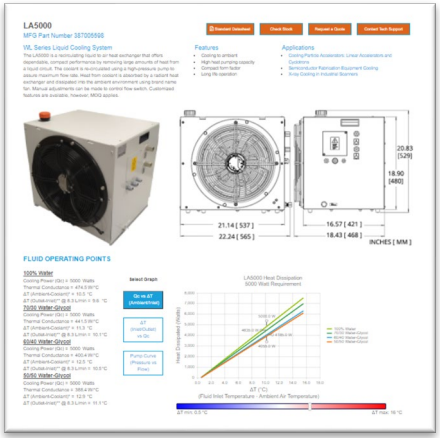
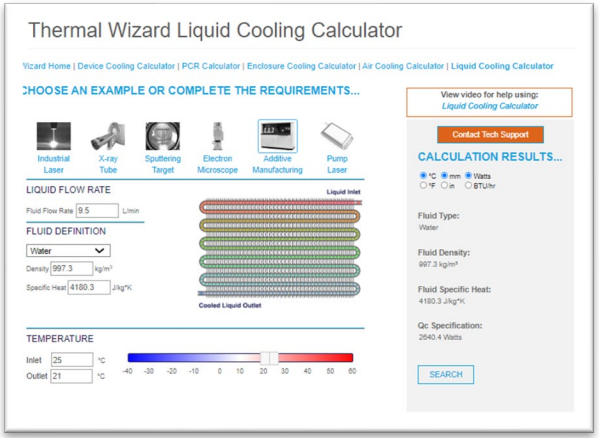
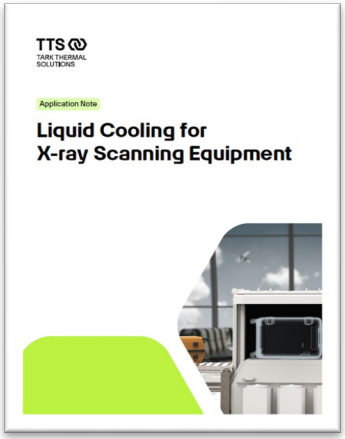


Datasheet



Liquid Cooling Calculator



Application Note

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Contact us for a personal consultation at:
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Tark Thermal Solutions is the optimum choice for standard or custom thermal systems