

Understanding the Role of Heat Exchangers in Chilled Water Systems

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Chilled water systems are used to manage temperatures in many commercial, institutional, and industrial buildings. Within some of these systems, heat exchangers perform an important function by transferring thermal energy between separate fluids without requiring the fluids themselves to mix.

[Jennifer Lingo](#), with [LOUMIS Air](#), which services locations in Louisiana and Mississippi, says understanding the role of a heat exchanger begins with understanding how heat moves through a chilled water system.

“A chilled water system is fundamentally moving heat from one location to another,” Lingo said. “Heat exchangers allow that transfer to occur between separate water loops or fluids while keeping those circuits physically isolated from each other.”

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Chilled water systems commonly use a chiller to remove heat from water. The cooled water is then circulated through piping to air-handling units, fan-coil units, process equipment, or other components where it absorbs heat.

The warmer return water eventually travels back toward the chiller, where heat is removed again and the cycle continues.



Depending on the design of the building and mechanical system, heat exchangers may be incorporated at several points within that process.

Heat Exchangers Transfer Heat Without Mixing Fluids

The basic purpose of a heat exchanger is reflected in its name.

Heat moves from a warmer fluid to a cooler fluid through a conductive surface separating the two.

The fluids remain in separate circuits.

In a plate-and-frame heat exchanger, for example, fluids travel through alternating channels separated by thin metal plates. Heat passes through those plates while the fluids remain isolated.

Shell-and-tube heat exchangers use another configuration. One fluid travels through a group of tubes while another fluid moves around those tubes inside an outer shell.

Both designs accomplish the same general objective: transferring thermal energy while maintaining separation between fluids.

“Physical separation can be important for several reasons,” Lingo said. “Different portions of a mechanical system may operate at different pressures, use different fluid mixtures, or serve different areas of a property. A heat exchanger can connect those thermal processes without combining the fluids.”

Separate Water Loops Can Serve Different Purposes

Large buildings may contain multiple chilled water loops.

A central plant, for example, may generate chilled water that serves several buildings or different sections of a large facility. Heat exchangers can separate the primary chilled water system from secondary loops serving individual buildings, floors, or processes.

This separation can simplify pressure management.

A tall building illustrates the issue. Water pressure increases at lower elevations because of the weight of the water column above. Dividing a system into separate loops through heat exchangers can help prevent every component from being exposed to the pressure conditions created by the entire building height.

Separate loops can also allow different areas to operate under different flow or temperature requirements.

Heat Exchangers Can Separate Different Fluids

Not every hydronic cooling circuit contains plain water.

Some systems use water mixed with glycol to reduce the risk of freezing in piping or equipment exposed to low temperatures.

A heat exchanger can allow a glycol loop to transfer heat to or from a water loop without introducing glycol throughout the entire chilled water system.

This approach may be encountered in applications involving outdoor equipment, process cooling, refrigeration-related systems, or other environments where freeze protection is necessary.

Keeping the fluids separate can also simplify treatment requirements when different portions of the system require different chemical conditions.

Building Expansion Can Create Additional Applications

Mechanical systems often change as buildings change.

An addition, renovation, new equipment installation, or change in building use can create different cooling requirements from those considered when the original chilled water system was designed.

Heat exchangers can sometimes provide a method for connecting new cooling loads while maintaining separation from an existing water circuit.

The engineering requirements depend on available system capacity, required temperatures, flow rates, pressure conditions, piping configuration, and the intended use of the new equipment.

"Adding another cooling load is not simply a matter of connecting two pipes," Lingo said. "Flow, temperature difference, pressure, pumping requirements, controls, and existing system capacity all have to be considered together."

Heat Transfer Depends on Clean Surfaces

Heat exchanger performance depends heavily on the ability of heat to move through the surfaces separating the fluids.

Scale, sediment, biological material, corrosion products, and other deposits can accumulate over time.

Those deposits can create an insulating layer that reduces heat transfer.

As a result, the system may require different flow conditions or additional equipment operation

to accomplish the same amount of heat transfer.

Water treatment can therefore play an important role in maintaining chilled water systems.

Different systems may require monitoring of water chemistry, filtration, corrosion control, biological growth, and other conditions depending on the equipment and application.

Flow Rate Affects Heat Exchanger Operation

Heat exchangers are designed around specific flow rates and temperature conditions.

Too little flow can reduce heat transfer. Excessive flow can create other concerns involving pressure drop, pumping requirements, erosion, or equipment operation.

Control valves, pumps, sensors, and building automation systems may be used to regulate flow according to changing cooling demands.

Temperature measurements taken before and after the heat exchanger can also provide information about system operation.

Unexpected temperature differences may indicate changing loads, restricted flow, fouling, control problems, or other conditions requiring investigation.

Heat Exchangers Can Protect Equipment

Separation between water circuits can also help isolate equipment from conditions elsewhere in a mechanical system.

Older piping, different water treatment requirements, high-pressure sections, or process fluids can potentially be kept separate from sensitive equipment.

A heat exchanger effectively creates a thermal connection without creating a direct fluid connection.

That distinction can become particularly useful in large facilities containing multiple mechanical systems.

Hospitals, hotels, office buildings, universities, manufacturing facilities, data centers, and other properties may contain chilled water networks serving numerous areas with different operating requirements.

System Design Determines the Application

Not every chilled water system requires the same type or configuration of heat exchanger.

Equipment selection depends on cooling load, water temperatures, allowable pressure drop,

fluid type, available space, maintenance access, operating pressures, and other engineering considerations.

Plate-and-frame designs may be appropriate in some applications because of their compact configuration and heat-transfer characteristics. Shell-and-tube equipment may be selected for other operating conditions.

The surrounding pumps, valves, controls, strainers, piping, and sensors are also part of how the heat exchanger functions within the complete system.

"Heat exchangers should be considered as part of the entire chilled water system rather than as isolated pieces of equipment," Lingo said. "Performance depends on what is happening on both sides of the exchanger and how the rest of the mechanical system responds."

Heat exchangers ultimately support chilled water systems by allowing thermal energy to move between separate circuits.

The fluids may never touch, but heat still moves from one side to the other.

That ability to transfer heat while maintaining physical separation can support pressure management, fluid isolation, different operating conditions, equipment protection, and cooling distribution throughout residential, commercial, institutional, and industrial applications.

About LOUMIS Air

LOUMIS Air has multiple locations in Louisiana and Mississippi and works with heating, cooling, plumbing, chilled water, and related mechanical systems for commercial and residential properties.

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