Single phase VS two phase and immersion cooling

Data centers are heating up and new cooling systems are crucial for maintaining the optimal temperature for servers and other equipment. Traditional air cooling systems have been the go-to method for many years, but with the rise of high-density computing and AI, new and more efficient cooling methods are necessary. One of these methods is immersion cooling, which involves submerging servers in a non-conductive liquid to dissipate heat. There are two types of immersion cooling: single phase and two phase. In this article, we will explore the differences between these two methods and how data centers use them.

Single phase

Single phase immersion cooling involves submerging servers in a tank filled with a non-conductive liquid, such as mineral oil or synthetic fluid. The liquid absorbs the heat generated by the servers and is then circulated through a heat exchanger to dissipate the heat. This method is known for its simplicity and cost-effectiveness, as it does not require any special equipment or modifications to the servers. It also allows for higher server densities, as the liquid can efficiently cool multiple servers at once.

Data centers that use single phase immersion cooling typically have a large tank or pool filled with the cooling liquid. The servers are then placed horizontally in racks and submerged in the liquid. This method is ideal for data centers that are aiming for high energy efficiency, such as those targeting low PUE (Power Usage Effectiveness) need to maximize their server density.

Two Phase

Two phase immersion cooling is a more advanced method that involves submerging servers in a tank filled with a dielectric fluid, such as Novec or Fluorinert. The fluid is heated by the servers and then vaporizes, carrying the heat away from the servers. The vapor is then condensed and returned to the tank, where it is cooled and recirculated. This method is known for its efficiency, as the vaporization process allows for more heat to be dissipated compared to single phase immersion cooling.

Data centers that use two phase immersion cooling typically have a closed-loop system, where the fluid is continuously circulated and cooled. This method is ideal for data centers that have a high demand for cooling and need to minimize their energy consumption.

Equipment

In both single-phase and two-phase immersion cooling systems, a variety of equipment is used to facilitate the cooling process and maintain optimal operating conditions. Immersion tanks or cooling baths submerge hardware components in dielectric coolant, with pumps circulating the

coolant to absorb heat. Supply lines and hoses are typically made from materials compatible with the coolant being used, such as flexible plastics or rubber compounds to transport the coolant through the system along with manifolds that help distribute an even amount of coolant as well as helps connect components like heat exchangers. Heat exchangers transfer heat from the coolant to another medium for dissipation. Temperature control systems monitor and adjust the temperature using sensors, controllers, and heating or cooling elements. Two-phase cooling systems also utilize vapor management systems, including condensers and vapor collection systems, to convert vaporized coolant back into liquid form. Filtration and purification systems remove impurities and contaminants from the coolant to ensure purity and longevity. These components work together to create an efficient cooling solution, ensuring effective heat dissipation and optimal operating conditions for the immersed hardware components.

Omni Services specializes in fluid transfer components used in immersion cooling to move fluid through the heat transfer process. Liquid cooling hose, tube and connections can be customized for each individual application and be delivered ready for installation. Contact Omni Services to speak with a sales engineers who specializes in liquid cooling components.