

Article

How Danfoss Hansen Universal Quick Disconnect coupling (UQD) can meet the specific needs of thermal management applications?

In this article, Ophélie Pezard of Danfoss Power Solutions, explains the main application challenges in thermal management, and how the Danfoss Universal Quick Disconnect coupling (UQD) meets end-user expectations.



Danfoss has chosen to take part in these applications and deliver products adapted to their needs. The Danfoss UQD is part of the range of thermal management connectors.



System efficiency effects on P.U.E.

In thermal management applications, such as in data centers, we generally talk about P.U.E.: The Power Usage Effectiveness.

This ratio is used to determine the efficiency of the system, with the energy and costs savings. The end-user is looking for efficient components to reduce costs and maximize the efficiency of his cooling system.

Fluid transfer components, such as couplings must have a high-flow and a limited pressure-drop, in order to maximize the efficiency of the liquid cooling system. Indeed, a high pressure drop of the components would be compensated by the system losing more energy to cool, making it less efficient.

Danfoss has designed UQD with optimized flow passages for high flow on smaller hose line (like for in-rack applications in data centers) and low pressure drop. This results in reduced energy consumption and monetary savings.

The Danfoss UQD flow feature is also at least 25% higher than OCP (Open Compute Project) standards for UQD Rev 1.0 that are dedicated to data center liquid cooling applications.

Introduction

Many industrial sectors, such as IT, renewable energies, transport, electric vehicle charging, medical imaging equipment, and energy storage now use thermal management. These diverse applications have one thing in common: they need a high-performance, reliable cooling systems to cool their equipment.

In an application sector, such as data centers, the last few years have seen an impressive increase in data exchanges and, therefore, in the need for high-performance IT equipment and reliable, innovative thermal management system.

Liquid cooling is being used more and more, particularly as heat transfer is much more efficient than air.

This type of thermal management helps to ensure the safety and efficiency of the system and the stability of equipment temperatures.

Liquid cooling is not only more efficient, but also more environmentally sustainable and cost-effective for end-users.

Reliability

In liquid cooling systems, component reliability is central. If a component has poor resistance to corrosion, high temperatures or poor compatibility with the fluid used, it can cause premature damage to the components and require more effort and maintenance costs to replace. Similarly, each time a part is changed, the entire thermal management system fails, resulting in an increase in temperature.

The Danfoss UQD coupling has the advantage of being made of stainless steel. This material provides high corrosion resistance for applications using water glycol or other cooling fluids. This extends its service life and reduces maintenance costs for the end-user. Similarly, the EPDM seal is also highly compatible with fluids used in thermal management applications.

Finally, the design of the Danfoss UQD exceeds the operating temperatures required, which also extends its service life and makes it highly reliable.


Leakage risk

In the event of a component leak, the cooling system fails, and this increases downtime. If a component leaks, time must be spent replacing it, maintenance efforts must be made, and additional costs are incurred.

Above all, in electronic system cooling applications, coolant leaks can be a real safety issue. Danfoss UQD are designed for absolute minimum spillage to allow safe use in a direct electrical environment.

Our UQD couplings offer a flat-face, dry-break design and dual sealing in connected stage that is ideal for cooling IT servers as well as other critical applications requiring leak-free operation and zero downtime.

What's more, the couplings are 100% helium-tested. Lastly, if the connection hasn't been made properly, the couplings are designed to minimize any risk of leakage, to avoid costly damage, downtime, and safety issues.


Configurations

Users of cooling systems come from a wide range of industries and are located in different parts of the world. For data centers in particular, certain regions are seeing their standards increase in this area, requiring adaptations tailored to local needs (e.g. metric vs imperial).

The Danfoss UQD has the advantage of offering a wide variety of thread configurations (ORB, hose barb and BSPP) which are widely used in this market. Additional configurations can be requested as needed.

This allows end-users in all regions of the globe, to get the right fit and avoid customization waiting and development costs.

In terms of user-friendliness, in addition to the end-connection, Danfoss has developed the UQD with a minimum envelop dimension to reduce space need in the application. Also, the UQD comes with color-coding of the sleeves of sockets and O-rings of plug parts. The sleeve is also made of aluminium, which reduces the overall weight of the product.

This has been put in place to help visually identify the connections to the hot and cold circuits, and avoids the risk of cross-connection due to human error.


Operating pressure

In terms of working pressure, thermal management applications do not generally require high pressure, but for smaller and more fragile internal components, the Danfoss UQD has a higher working pressure criteria (exceeds by 66% for UQD02 and 57% for UQD04) than the OCP standard for sizes -02 and -04.

With higher operating pressure, the reliability of the Danfoss UQD is the same as for lower pressure.


Sustainability

The durability of the components used in liquid cooling systems is an important aspect of environmental protection.

At Danfoss, we want to act in this field, by finding solutions for components that enable decarbonization in an intelligent and cost-effective way.

Our Danfoss UQD offers a long service life, thanks to its stainless-steel construction and EPDM seals.

We have also a regionalized production of the UQD series, helping Danfoss to achieve its sustainability goals.

Finally, it is important to note that liquid cooling reduces the carbon footprint and is efficient in terms of water consumption.


Conclusion

In conclusion, we have seen that thermal management applications are very demanding and require reliable, durable, and efficient components. High-flow, low-pressure drop, and fluid compatibility are important selection criteria.

Danfoss offers the UQD series which is fully adapted to these types of liquid cooling applications, with a wide range of sizes (-02, -04, -06, -08), fully compliant and interchangeable with the standards set by OCP for data center applications. Similarly, its design makes it easy push-to-connect and allows disconnection under pressure up to 5 bar. In addition, the various end-connections make this series a practical quick coupling for these applications.

Danfoss also offers a QR code marked on the pieces to improve part identification and traceability, and is expanding its product range with a blind-mate version of the UQD, to be able to connect in applications with limited or no access/visibility.

In all these respects, the Danfoss UQD meets the demands of thermal applications and is, therefore, the perfect solution for end users.