BESPOKE, CLEAN PROTECTION

Danfoss is a leading Danish engineering company that creates technologies focused on driving energy efficiency, performance, decarbonization, and sustainability. They provide components and software for heating, cooling, refrigeration, variable-frequency drives, and hydraulic power solutions.

CUSTOMER:
Danfoss Fluid

INDUSTRY:
Data Center Cooling

PROJECT:
Protection for Connectors

SOLUTION:
Protection Caps

THE CHALLENGE

In 2024, Danfoss became an approved components partner for NVIDIA's UQD (Universal Quick Disconnect) and UQDB (Universal Quick Disconnect Blind-mate) connectors. These high-performance, flat-face liquid cooling couplings are designed for AI-driven data centers and servers, delivering safe, leak-free, and self-aligning connections in tight spaces, typically for direct-to-chip cooling.

Data center cooling systems are highly sensitive. Safeguarding connections from damage or contamination during manufacturing processes, shipping, or maintenance is essential. Danfoss required bespoke protection caps that could meet an exceptionally demanding set of performance and cleanliness requirements.

Beyond impact resistance and physical protection, any chosen materials must not shear on connection threads or edges, as even small particles can contaminate and compromise cooling systems. For the same reason, every cap had to be manufactured and supplied to an extremely high standard of cleanliness. Fire safety and emissions requirements also meant that materials had to be halogen-free. Furthermore, fluctuating customer demand required a production process capable of scaling rapidly when needed.

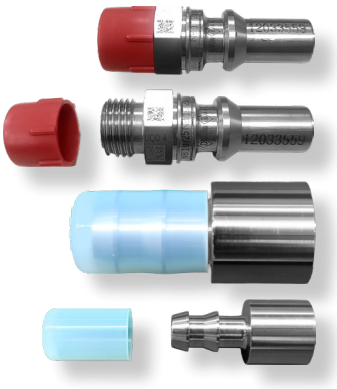
"We are very satisfied with Essentra's product design capability and new product development progress. The team was able to meet our specific design requirements to the letter."

– Hao Zheng, R&D Engineer, Danfoss

THE SOLUTION

Danfoss commissioned Essentra to develop a new range of specialist protection caps for its UQD and UQDB connectors. Essentra created a portfolio of 2D technical drawings covering more than 30 design variations.

Comprehensive material analysis identified ultra-low-density polyethene (ULDPE) as the ideal, halogen-free choice. Compared to LDPE, it demonstrated markedly superior resistance to shearing, cutting, and damage. Additional silicone options were also



provided, with all variants delivered within a fully customized color masterbatch.

To meet scale demands, Essentra created a series of custom hot-runner injection molds, delivering faster cycle times and significant material savings to align with Danfoss' sustainability goals. All caps were processed through a purpose-built cleanroom operating to a 150µm cleanliness standard, including electrostatic dust removal ahead of packing.

RESULTS

With the custom protection cap solution in place, Danfoss can supply its specialist components with confidence that they remain protected and free from contamination.

Lower costs: Development of a shared tooling frame design with quick-change capabilities meant a single frame could accommodate several hot-runner molds, driving significant cost efficiencies.

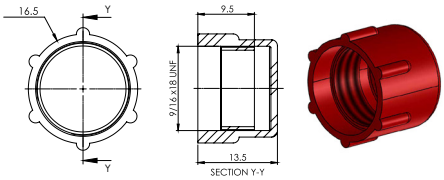
Rapid fulfilment: Specialized hot-runner tooling was developed to support a portfolio of more than 30 product sizes, each requiring its own custom mold. Each mold supported 12 cavities, increasing production capacity to 80,000 units per day.

Clean, enhanced protection: The new ULDPE material caps provide much-needed resistance to cutting and damage, all supplied to the required cleanliness specifications through Essentra's purpose-built clean room.

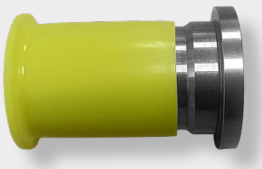
ONGOING SUPPORT

Essentra continues to supply Danfoss with bespoke protection caps for its UQD and UQDB connector ranges. Our production facility and fulfilment centers stand ready to provide rapid, clean, end-to-end delivery at scale.

To find out how the experts at Essentra can help your business, call **0345 528 0474** or email **sales@essentracomponents.co.uk**









"As well as providing excellent solutions, Essentra was able to deliver within tight timelines and at scale. We know we can rely on them for agile fulfilment."

- Gavin (Chengang) Zhang, Sourcing Engineer, Danfoss