Metal or plastic quick disconnects? Key considerations

Long-term, leak-free performance in fluid management systems requires robust connectors. As liquid cooling is increasingly deployed in high performance computing and data center applications, these industries demand quick disconnects (QDs) purpose-built for their needs. Gone are the days of making do with metal ball-and-sleeve connectors designed for heavy industrial use. Also, advanced materials are expanding the range of available QD options.

Historically, metal was the material of choice for strength and durability. Metal's weight, cost and corrosion susceptibility, though, have prompted thermal engineers and liquid cooling system designers to look for alternative materials. As materials evolve, QDs built from high-performance thermoplastics now offer performance that rivals, and in some cases, surpasses their metal counterparts. For example, for the first time the highly impact- and heat-resistant material polyphenylsulfone (PPSU) has been utilized in a QD. PPSU delivers the benefits of plastics—lightweight, cost-effective and non-corroding—with robustness comparable to metal.

Pressure, temperature, flow rate, environmental exposure and chemical compatibility are all important factors in selecting the right QD. Additional real-world considerations include ease of use, weight, cost, the ability to hot swap without risking leaks, and robustness for long periods of connection. The chart below outlines key performance factors of new PPSU QDs compared to traditional all-metal QDs.

PERFORMANCE FACTOR	CPC PLQ SERIES (PPSU)	TRADITIONAL ALL-METAL QDS
Fluid loss	Non-spill, dripless; disconnect under pressure with no spills	Potential fluid loss due to mechanical wear of metal parts and/or degradation due to corrosion
Spillage	.015cc	.02cc
Corrosion risk	No corrosion risk for all-plastic components	All metals—copper, brass and even stainless steel—are susceptible to oxidation or corrosion over time, though metal/poly combos exhibit lower corrosion risk
Ease of use	Simple, lightweight, compact, contoured thumb latch for convenient one-handed connection; weighs >4x less than brass equivalent	Ball-and-sleeve connectors require two-handed connection and are bulky, heavy
Durability	Stable, durable, high-performance thermoplastic; impact resistant; withstands heat and humidity without losing structural integrity	Appropriate for extreme rough-use conditions (construction, mining), but typically not required to achieve desired technical performance in liquid cooling

PERFORMANCE FACTOR	CPC PLQ SERIES (PPSU)	TRADITIONAL ALL-METAL QDS
Heat transfer	Thermal insulator	Thermally conductive
Thermal conductivity	.24 W/mK	~110 W/mK
Thermal expansion	45 µm/mK	~15-25 µm/mK
Operating temperature	-17 to 115°C	-17 to 115°C
Valve cycling	Plastic valves experience lower friction than all-metal valves; compatible with many chemicals	After repeated use, metal valves can wear away the protective coating within metal housing, exposing raw metal to coolant and leading to corrosion
Operating pressure	Vacuum – 120psi (8.3bar)	>2900psi (200bar)
Cv – Flow coefficient (1/8")	Cv>.25	Cv.15
Reliability	CPC product tested to 10,000 cycles	Non-CPC QDs claim up to 5,000 connection cycles
Value	Delivers durability and performance at a lower cost than metals	Expensive and unnecessary when the same specifications can be met with a high-performance thermoplastic option

CPC's PLQ Series QDs allow fast, simple service while protecting essential and expensive computing equipment. For more information on liquid cooling solutions, call 800-444-2474 or visit www.cpcworldwide.com. Validation reports, technical videos, selection guides and more are available online.

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