Universal Quick Disconnect Blind-Mate (UQDB) Specification
Revision 1.0

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2. Scope & Overview

Scope:
This document defines the technical specifications for the Universal Quick Disconnect Blind (UQDB) used in non-combustible single-phase (water/glycol) systems for liquid cooling of electronics.

Overview:
In liquid cooled systems, fluid is transported under pressure within a Technology Cooling System (TCS) fluid loop [1]. The IT equipment loop is joined to the TCS using a fluid connector.

This specification defines the fluid connector as Universal Quick Disconnect (UQDB) with interface dimensions for universal interchangeability and defines acceptable performance for a hand-mate, drip-free, hot-pluggable, fluid line connector for use in TCS for electronics. The UQDB maintains a leak-tight seal under pressure when coupled and on both sides when decoupled.

2.1 Terms & Definitions

Plug
The male side of the coupling

Socket
The female side of the coupling

Coupled
The state when the plug and socket are fully engaged and locked together

Coupling
The act of connecting the plug and socket together so that they are locked together to join a fluid line.

Cv
Flow coefficient defined as $C_v = \frac{Q}{\sqrt{\Delta P}}$, where $Q$ is flow rate in gallons/min (GPM) and $\Delta P$ is pressure drop in lbs/in² (psi) for water at 60 degrees F

Termination
Both plug and socket have terminations on the ends to connect a tube or pipe to the coupling

UQDB
Universal Quick Disconnect Blind

Break
Act of de-coupling the plug and socket

Make
Act of coupling the plug and socket such that the pair are fully mated and locked

Universal Quick Disconnect
Fully interchangeable with other plug and socket parts meeting the UQD Requirements of the same nominal size

KPI
Key Performance Indicator

UQDB02
Universal Quick Disconnect Blind Dash 02 (1/8”)

UQDB04
Universal Quick Disconnect Blind Dash 04 (1/4”)

UQDB06
Universal Quick Disconnect Blind Dash 06 (3/8”)

UQDB08
Universal Quick Disconnect Blind Dash 08 (1/2”)
2.2 Key Performance Indicators

The following Key Performance Indicators (KPI’s) are measured parameters that are key in defining the appropriate part selection. Suppliers should have data available to address the KPI’s below:

- Flow Rating
- Temperature Rating
- Pressure Rating
- Burst Pressure Rating
- Fluid loss on disconnect
- Cv

2.3 UQDB Engagement

Plug and socket pairs shall meet Cv and Flow rating and performance requirements with insertion tolerance given in the table below.

<table>
<thead>
<tr>
<th>Size</th>
<th>Nominal Engagement Stroke</th>
<th>Min Engagement*</th>
</tr>
</thead>
<tbody>
<tr>
<td>UQD02</td>
<td>7.1</td>
<td>6.1</td>
</tr>
<tr>
<td>UQD04</td>
<td>10.4</td>
<td>9.4</td>
</tr>
<tr>
<td>UQD06</td>
<td>13.2</td>
<td>11.7</td>
</tr>
<tr>
<td>UQD08</td>
<td>16.0</td>
<td>14.5</td>
</tr>
</tbody>
</table>
Only minimum engagement is considered. Assumption is that valve will be maximum area at nominal engagement and will not decrease for any further insertion beyond nominal prior to and including the hard stop position. Therefore, there is no specified tolerance for max engagement.

### 2.4 UQDB Coupling Insertion Panel to Panel Distance

![Figure 2 UQDB Coupling Panel to Panel Distance](image)

#### Table 1 UQDB Panel-Panel Distance

<table>
<thead>
<tr>
<th>Size</th>
<th>E-E Nominal Panel-Panel Distance (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UQDB02</td>
<td>36.4</td>
</tr>
<tr>
<td>UQDB04</td>
<td>44.6</td>
</tr>
<tr>
<td>UQDB06</td>
<td>48.1</td>
</tr>
<tr>
<td>UQDB08</td>
<td>52.1</td>
</tr>
</tbody>
</table>
3. Feature & Dimensional Requirements

Physical features of the socket shall conform to the dimensions shown in Figure 3 UQDB Socket Dimensions and given in Table 3 UQDB Socket Dimensional Specification. Physical features of the plug shall conform to the dimensions shown in Figure 4 UQD Plug Dimensions and given by Table 4 UQDB Plug Dimensional Specification. Where no dimension is given the geometry is left to the discretion of the manufacturer and should consider end user (datacenter environment) requirements for fit and function.

![Diagram](image)

**Table 3 UQDB Socket Dimensional Specification**

<table>
<thead>
<tr>
<th>Size</th>
<th>B</th>
<th>C</th>
<th>T</th>
<th>U</th>
<th>V</th>
<th>W</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerance Value</td>
<td>±0.025</td>
<td>±0.025</td>
<td>±0.1</td>
<td>±0.1</td>
<td>±0.1</td>
<td>MAX</td>
<td>REF</td>
</tr>
<tr>
<td>UQDB02</td>
<td>Ø6.71</td>
<td>Ø3.63</td>
<td>2.3</td>
<td>11.2</td>
<td>16.5</td>
<td>21.4</td>
<td>7.1</td>
</tr>
<tr>
<td>UQDB04</td>
<td>Ø11.15</td>
<td>Ø7.14</td>
<td>3.7</td>
<td>16.0</td>
<td>19.6</td>
<td>25.4</td>
<td>10.4</td>
</tr>
<tr>
<td>UQDB06</td>
<td>Ø14.38</td>
<td>Ø9.47</td>
<td>4.4</td>
<td>19.0</td>
<td>22.4</td>
<td>28.4</td>
<td>13.2</td>
</tr>
<tr>
<td>UQDB08</td>
<td>Ø17.56</td>
<td>Ø10.75</td>
<td>5.6</td>
<td>22.0</td>
<td>25.2</td>
<td>31.4</td>
<td>16.0</td>
</tr>
</tbody>
</table>

Dimensions are in millimeters.
Dimensions are in millimeters.

* SA = Self Alignment. Shall be incorporated into the connector housing the dimension specified is a radial allowance.

** Dimension is to the Keep-Out-Zone (KOZ) which is a volume bounded by the datum B, the features defined by dimensions H and K, the 145-degree angle and the dimension V and extends radially outward from the cylindrical plug to cylindrical keep in volume bounded by dimension W.

Datum E. This surface is the mating surface to the chassis datum and controls the location of the mounting surface relative to Datum B so that IT equipment can be designed to accept UQDB by using the following equation to calculate the nominal fully engaged distance between mating surface: X(Plug) + V(socket) – S = nominal distance

*** The drawing above does not show the minimum required diameter for the termination seal defined in ISO 11926-3 and ISO 11926-1 supplier is responsible to define the geometry for the termination features in the ball contact surface area, identified in Figure 4 UQD Plug Dimensions, the minimum hardness is 24 HRC.
3.1 Terminations
Termination options are left to the discretion of the manufacturer. At a minimum, a straight thread o-ring boss (ORB) termination on the socket and plug shall be available in the sizes described in Table 5 UQD Terminations.

Table 5 UQD Terminations

<table>
<thead>
<tr>
<th>Size</th>
<th>Plug</th>
<th>Socket</th>
</tr>
</thead>
<tbody>
<tr>
<td>UQD02</td>
<td>Straight, O-Ring Boss, Stud End -04 PER ISO 11926-3 to mate with port per ISO 11926-1-4</td>
<td>Straight, O-Ring Boss, Stud End -06 PER ISO 11926-3 to mate with port per ISO 11926-1-6</td>
</tr>
<tr>
<td>UQD04</td>
<td>Straight, O-Ring Boss, Stud End -06 PER ISO 11926-3 to mate with port per ISO 11926-1-6</td>
<td>Straight, O-Ring Boss, Stud End -08 PER ISO 11926-3 to mate with port per ISO 11926-1-8</td>
</tr>
<tr>
<td>UQD06</td>
<td>Straight, O-Ring Boss, Stud End -08 PER ISO 11926-3 to mate with port per ISO 11926-1-8</td>
<td>Straight, O-Ring Boss, Stud End -10 PER ISO 11926-3 to mate with port per ISO 11926-1-10</td>
</tr>
<tr>
<td>UQD08</td>
<td>Straight, O-Ring Boss, Stud End -10 PER ISO 11926-3 to mate with port per ISO 11926-1-10</td>
<td>Straight, O-Ring Boss, Stud End -12 PER ISO 11926-3 to mate with port per ISO 11926-1-12</td>
</tr>
</tbody>
</table>

Terminations shall meet the operating and burst pressure performance requirements specified in this document.

3.2 Outer Envelope Requirements
The limiting use case for all sizes are the following:

- For height envelope assume multiple units stacked on a pitch of one rack unit height (1U) or 44.45mm.
- For overall diameter it is recommended to minimize to allow for finger access.
- For length it is recommended to minimize to allow for a maximum clearance within the cabinet.

4. Performance Requirements
In order to comply with this document, the coupling shall meet or exceed the performance requirements listed below.

4.1 Ergonomics Requirements
It is recommended to minimize coupling and decoupling forces for hand mate connectors see
### Ergonomic Requirements

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Requirement</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum coupling force</td>
<td>Supplier to publish coupling force versus pressure</td>
<td>Required</td>
</tr>
</tbody>
</table>

### Coupling Force

<table>
<thead>
<tr>
<th>Size</th>
<th>Maximum Coupling force @ Zero Pressure</th>
<th>Coupling force @ Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>UQDB02</td>
<td>&lt; 12 lbf</td>
<td>Supplier to publish coupling force versus pressure</td>
</tr>
<tr>
<td>UQDB04</td>
<td>&lt; 14 lbf</td>
<td>Supplier to publish coupling force versus pressure</td>
</tr>
<tr>
<td>UQDB06</td>
<td>&lt; 15 lbf</td>
<td>Supplier to publish coupling force versus pressure</td>
</tr>
<tr>
<td>UQDB08</td>
<td>&lt; 16 lbf</td>
<td>Supplier to publish coupling force versus pressure</td>
</tr>
</tbody>
</table>

### Shelf & Service Life Requirements

UQD performance requirements shall be met when exposed to the following life cycles at end of life.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Requirement</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum coupling force</td>
<td>Supplier to publish coupling force versus pressure</td>
<td>Required</td>
</tr>
</tbody>
</table>
4.3 Durability Requirements

The socket must withstand 5000 make and break cycles. All performance requirements listed in Section 4 Performance Requirements must be met or exceeded when the socket and plug are mated in the first (time 0) and 5000th cycle and at end of service life required in Table 8.

4.4 Fluid Loss Requirements

The fluid loss per couple and decouple shall meet or exceed the performance requirements given in Table 9 Fluid Loss Requirement. Fluid loss requirements to be measured with water as the fluid medium.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>UQD02</th>
<th>UQD04</th>
<th>UQD06</th>
<th>UQD08</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum fluid loss per couple/decouple cycle at 0 psi</td>
<td>0.020 ml</td>
<td>0.025 ml</td>
<td>0.035 ml</td>
<td>0.070 ml</td>
<td>Required</td>
</tr>
</tbody>
</table>

---

1 Shelf life is defined as the period of time after manufacturing and prior to service that the component must remain useable.

2 Service life is defined as the period of time following a period of shelf life (storage), including time zero up to the maximum shelf life, that last up to end of service life.
### 4.5 Flow Rate, Pressure and Temperature Requirements

#### Table 10 Flow and Temperature Requirements

<table>
<thead>
<tr>
<th>Parameter</th>
<th>UQDB02</th>
<th>UQDB04</th>
<th>UQDB06</th>
<th>UQDB08</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum operating pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Required</td>
</tr>
<tr>
<td>Minimum burst pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Required</td>
</tr>
<tr>
<td>Minimum Cv³ at minimum engagement</td>
<td>0.25</td>
<td>0.80</td>
<td>1.55</td>
<td>2.40</td>
<td>Required</td>
</tr>
<tr>
<td>Flow Rating³</td>
<td>At least 0.55 GPM</td>
<td>At least 1.7 GPM</td>
<td>At least 3.0 GPM</td>
<td>At Least 4.7 GPM</td>
<td>Recommended Manufacturer discretion (ratings shall be published by supplier)</td>
</tr>
<tr>
<td>Operating temperature range³</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Required</td>
</tr>
<tr>
<td>Shipping temperature range³</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Required</td>
</tr>
</tbody>
</table>

³ Cv are reported for water.

⁴ Flow rating is for water.

⁵ Support for higher temperature range is desirable as an option as there are known solutions that may operate in the range 17°C - 75°C. It is expected that rating would be published by supplier.

⁶ Shipping may include charged systems.
5. Marking Requirements

Identification as UQD and nominal size are required per Table 11 Marking Requirements. Marking can be positioned per manufacturer’s discretion on any visual external surface of the plug and socket.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Requirement</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification as Universal Quick Disconnect indicating universal interchangeability and size on both plug and socket</td>
<td>Must have visual identifier as follows corresponding to the associated size</td>
<td>Required</td>
</tr>
<tr>
<td>UQDB02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UQDB04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UQDB06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UQDB08</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.1 Identification

Within digital or printed catalogs supplier shall identify products meeting these requirements as “Dimensional & performance requirements conform to OCP Universal Quick Disconnect Blind-Mate (UQDB) Specification rev 1.0”

6. Wetted Materials

Supplier to ensure materials used in the construction of UQDB are compatible with end user cooling loop fluid.

7. Safety and Regulatory Requirements

In order for systems to comply with end-product Information Communication and Technology (ICT) equipment safety standards, liquid filled component (LFC) component manufacturers need to ensure parts are compliant with IEC 62386-1:2018 (or later) standard, clause G.15.

8. Acknowledgements

Would like to thank the following companies and people for their contribution to this specification. From Avic Jonhon Optronic Technology Company, Hanyu Lou. From CPC (Colder Products Company), Dennis Downs, Elizabeth Langer and Barry Nielsen. From Fujikura, Thang Nguyen and Vijit Wuttijumnong. From Intel Corporation, Peggy Burroughs, Juan Cevallos, Peipei Ding, Jessica Gullbrand, Jordan Johnson, David Shia, Rodel Samiley, Sean Sivapalan. Bret Henkel and Casey Winkel. From LBNL Open Specification for a Liquid Cooled Rack Working Group, Dale Sartor. From Parker Hannifin Corporation, Quick Coupling Division, Cameron Koller, Todd Lambert, Timothy Marquis and Lenny Nick.
9. References


[9] OCP Universal Quick Disconnect (UQD) Specification 1.0