OPEN

Compute Project

Large Quick Connector Specification

Version 1.0

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Contents

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2. Compliance with OCP Tenets

2.1 Openness

This specification contains necessary details for valve suppliers (beyond those listed in the contributors) to recreate the design contributed to Open Compute.

2.2 Efficiency

The OCP large quick connector has been specified to enable dripless and interoperable liquid transport connections at the rack-level with high flow rates and minimal pressure drop. This results in minimal impact to pumping systems compared to other components in a liquid cooling loop.

2.3 Impact

While similar sized quick connectors are widely available in the market, these components are not interoperable across vendors/suppliers. In addition, at the size required for rack-level connections, such devices require large forces which may place a physical burden on personnel operating ITE in data centers. The OCP large quick connector addresses these concerns by focusing on a dripless, interoperable and ergonomic design.

2.4 Scale

The OCP large quick connector is primarily intended for rack-level connections, primarily to technical cooling (secondary) loops. In addition, these components can be utilized for liquid transport connections across adjacent racks, such as for air-assisted liquid cooling applications. The combination of these use cases should lead to high volume deployments achieving significant scale.

2.5 Sustainability

The OCP large quick connector is designed with a focus on minimizing natural resources and costs. This is achieved through a minimum (continuous) operating life expectancy of 10 years and a focus on minimizing pumping power.

3. Version Table

Date	Version #	Author	Description
02.21.23	1.0	Meta Platforms, Inc.	Updates to comply with OCP specification template (adding compliance with OCP tenets, and version table)

4. Scope

This document defines the technical specifications for large dripless interoperable quick connectors used in liquid transport for use in cooling of electronics in a data center environment.

5. Overview

As liquid cooling of IT gear is becoming more prevalent in the data center environment, from increasing IT gear temperatures and higher power efficiency demands, there is greater demand for a large quick

connector that can interface between facility plumbing, IT gear rack manifolds, CDUs, heat exchangers, and other similar large connections.

This specification defines dimensions and performance for a large quick connector with universal interchangeability and the interfaces required for an ergonomic hand mate, dripless, and hot-pluggable connection.

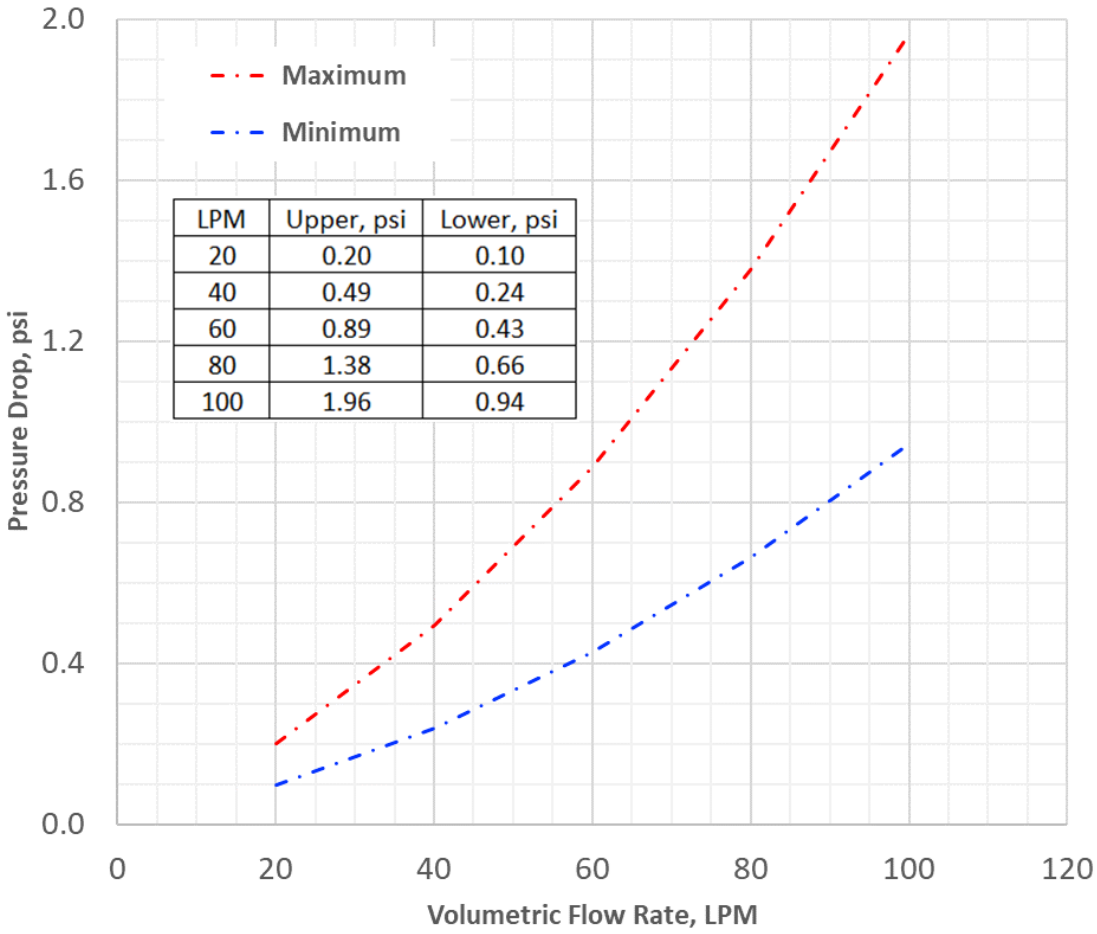
5.1 Terms and Definitions

- Plug
  - Also called nipple, side of the coupling that pushes into socket, contains external sleeve with threads
- Socket
  - Side of the coupling with a cavity that receives the plug
- Coupling
  - Pair of plug and socket that forms a dripless interface
- P-Q
  - Measure of pressure drop at varying flow rates, used to quantify acceptable performance range of coupling
- Termination
  - Interface at end of both plug and socket that can be used to connect or adapt to other parts of the end system
- ACME
  - A standardized trapezoidal screw thread form that is used when high load and low torque is preferred
- Higbee Cut
  - A specific cut added to screw threads to produce a blunt start, eliminates the chance of cross-threading
- BSPP
  - British Standard Parallel Pipe thread, a standardized constant diameter pipe thread that is used with an accompanying gasket to form a seal between two parts

6. Performance Requirements

6.1 Flow Rate, Pressure, and Temperature

- Max Flow Rate: > 100 LPM
  - Per ISO18869 defined setup and pressure/flow parameters
- Flow impedance performance
  - Requirements below are based on a coolant temperature of 35°C and with 25% propylene glycol-water mixture as the working medium
  - Requirements below must be met for both flow directions (socket-to-plug and plug-to-socket)



- Working Pressure: 35psi @ 60C, Max operating pressure: 175psi (12 bar)
- Temperature: 60C Max operating, -20C to 70C during non-operation

6.2 Ergonomics/Mating

An important effort in the development of this large quick connector was to reduce mating difficulty by the end user, especially in less-than-ideal space, lighting, temperature constraints, as well as mating/de-mating under positive pressure in a live liquid loop environment. A screw-to-connect mechanism was chosen over a push-to-connect mechanism to leverage the mechanical advantage of a thread.

- Max torque to mate < 5 Nm (dry conditions)
    - Measured on the outer surface of the rotating sleeve on plug side, assuming socket is stationary

6.3 Fluid Loss

- Spillage: < 0.15 mL per disconnect
    - Per ISO18869

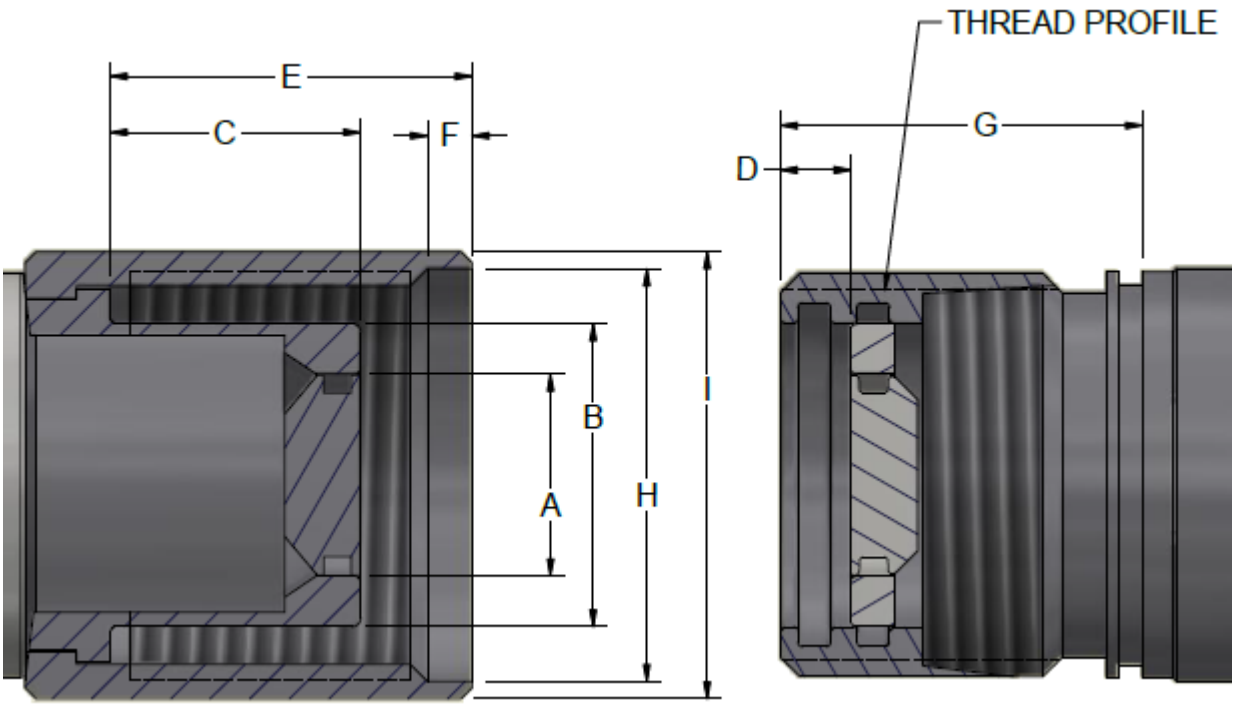
6.4 Service Life

- 10 years min continuous use at rated pressure, temperature
- Storage life: 5 years min, -20C to 70C during non-operation

6.5 Durability

- The coupling pair must withstand 100 mate/de-mate cycles over service life with no degradation in performance as defined in previous sections

7. Mechanical Form



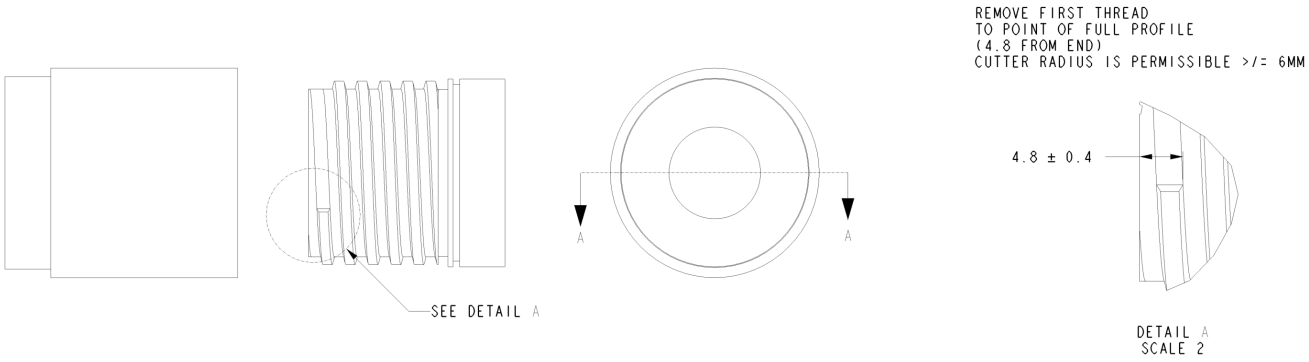
Dimension	Nominal (mm)	Tolerance (mm)
A	21.8	±0.03
B	34.4	±0.03
C	35.0	±0.05
D	10.0	±0.25
E	43.0	±0.30

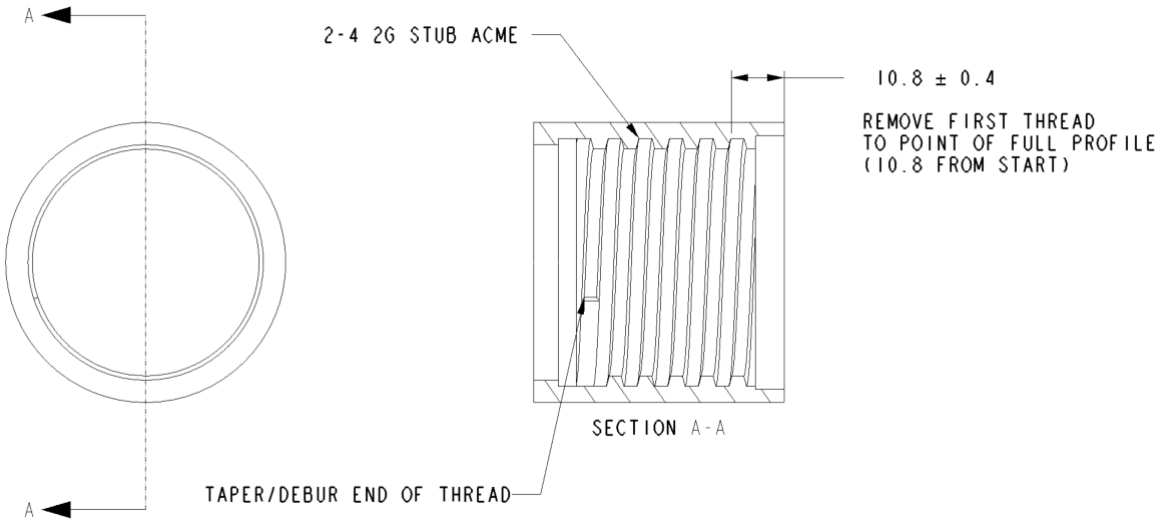
F	6.0	±0.15
Valve Travel	25.0	±0.30
A-length (to start of chamfer)	8.2	MAX
G	42	±0.15
H	52.4	±0.05
I	58	MAX
Plug Thread	ACME 2-4 Stub (remove first thread to point of full profile 10.8mm, from flat face)	±0.40
Socket Thread	ACME 2-4 Stub (remove first thread to point of full profile 4.8mm, from flat face)	±0.40

Dimensions are in millimeters

7.1 Mating Thread

- ACME-2G 2-4 Stub External Thread (socket side)
- ACME-2G 2-4 Stub Internal Thread (plug side)
- Higbee Cut – Both internal and external threads to have a Higbee Cut (blunt start) to prevent cross-threading, as defined below
    - Add taper/debur at end of internal and external thread





7.2 End Terminations

- Both plug and socket end to terminate in G1 (BSPP 1”) thread per ISO R228
    - Other end terminations or adapters to be determined by vendor
- End termination outer diameter/hex to be determined by manufacturer

8. Wetted Materials

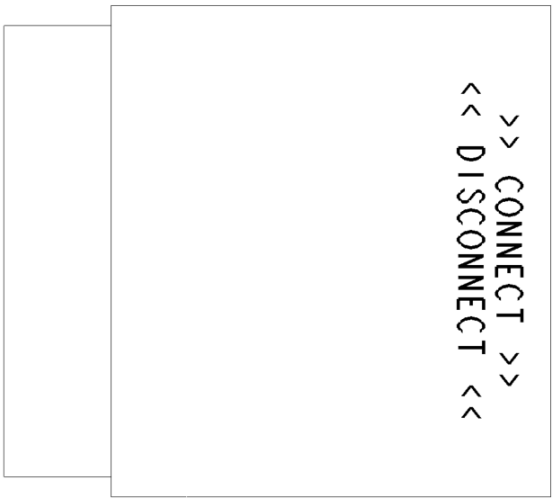
Non wetted: sleeve plating or different from SS

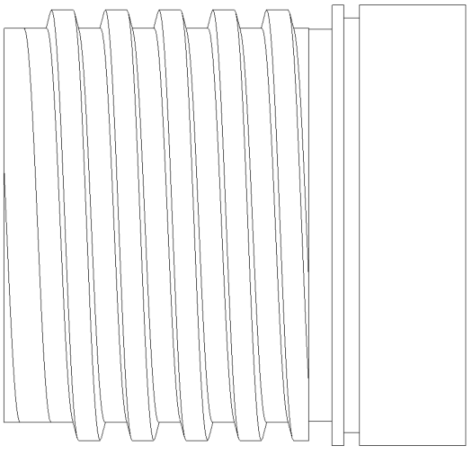
List:

- 3XX Stainless Steel
- 17-7 Stainless Steel
- EPDM (seals)
    - Compatible with propylene glycol-water mixture (such as DOWFROST LC25) and treated water
    - EPDM material to meet flammability requirements as stated in UL 62368-2
    - Manufacturer to test for compatibility and other mechanical/chemical properties

9. Part Marking

- Plug sleeve to be clearly marked with “Connect” and “Disconnect” label as well as arrows to specify mate direction, as shown in figure below:





- Manufacturer part number to be clearly marked on both plug and socket, per manufacturer's discretion

10. Safety and Regulatory

- Manufacturer to meet all safety and regulatory requirements listed under UL 62368-2