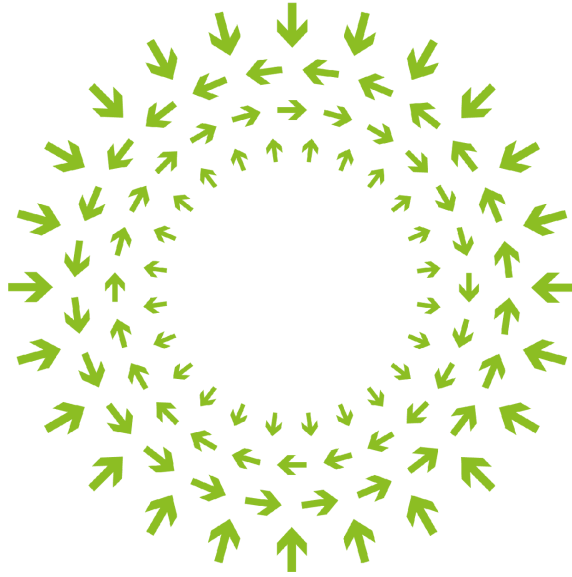




OPEN

Compute Project

Cooling Environments: Cold Plate Sub-Project

Single-Phase Direct-to-Chip Cold Plate Test Specification

1.0.0

Test Specification

Effective September 3, 2026

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1.2. Acknowledgements

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List all companies or individuals who may have assisted you with the specification by providing feedback and suggestions but did not provide any IP.

2. Compliance with OCP Tenets

This Test Specification defines a vendor-neutral, de-facto industry baseline for testing and validation of single-phase Direct-to-Chip (D2C) cold plates used in data center environments. It aligns with the Open Compute Project core tenets as follows.

2.1. Openness

This specification is openly published and vendor-neutral. It defines what is measured: measurand, units, test conditions, and required resolution and uncertainty. Any method demonstrably capable of resolving the specified criterion is admissible, and no proprietary fixtures, consumables, or software are required to execute the procedures or interpret results. Future Product Specifications may reference these methods and tighten acceptance limits without redefining the underlying test.

2.2. Efficiency

A common test baseline eliminates duplicated qualification effort: suppliers validate once against a shared criterion rather than satisfying a different bespoke regime for each operator, and operators are relieved of authoring and maintaining their own methods. Because the methods draw on established industry standards, adopters can execute them with existing laboratory capability rather than developing new apparatus. The result is shorter qualification cycles, lower cost to bring a cold plate design to market, and fewer redundant evaluations of the same design across the ecosystem.

2.3. Impact

This specification is intended to serve as the common industry reference for verifying D2C cold plates, replacing subjective quality claims with comparable, quantitative results. It supplies the verification layer that existing OCP liquid cooling contributions depend on, creating a multiplier effect. It also enables a more robust supply chain: operators can qualify alternate and second-source cold plates against one objective criterion rather than against a single supplier's internal practice.

2.4. Scale

This specification is written to be adopted at ecosystem scale rather than to scale within a single factory. Every test is defined in a uniform structure, description, setup, test fluid, temperatures, timing, and acceptance criteria, so that any supplier, integrator, or independent laboratory can execute it without bespoke apparatus or additional guidance. Methods are built on widely

available industry standards (ASTM®, ISO®, IEC®), so adoption requires no unique capability and no single organization's tooling.

The test set is additive. A subset may be applied during early design iteration, with the full array executed for design qualification, allowing adopters to scale effort to the maturity of the design. Because the specification defines methods and reporting rather than platform-specific limits, it can be reused across cold plate generations and system architectures without being re-authored, and results remain comparable as the number of participating suppliers grows.

2.5. Sustainability

This specification defines a complete array of test procedures spanning leakage and pressure integrity, thermal and hydraulic performance, mechanical robustness, environmental and reliability exposure, material and fluid compatibility, and cleanliness. Cold plates that pass this array before entering production are fully validated across all relevant metrics and demonstrated to hold up across the full service lifecycle.

Validating to that depth before a design is released is the sustainability contribution. A design qualified against the full array does not leak engineered coolant or treated water in service, does not fail early and force replacement of the surrounding node or rack, and does not degrade through material or fluid incompatibility over its intended life. Faults are found and corrected at the design stage, where the cost is a small number of test articles, rather than in deployment, where the cost is coolant loss, downtime, and the embodied energy and materials of prematurely replaced hardware.

3. Overview

Overview

This document defines an OCP Test Specification that establishes a vendor-neutral, de-facto industry baseline for verifying single-phase Direct-to-Chip (D2C) cold plates used in data center liquid cooling systems. It provides common test terminology, standardized test methods and conditions, and defined acceptance criteria to enable comparable results, consistent qualification, and simplified procurement.

Within the OCP modular specification framework, this specification defines the Test layer, intended to be referenced and extended by future Product Specifications. It focuses on aligning the ecosystem on how cold plate functionality and integration are verified, without prescribing the design choices that produce a conforming result.

This Test Specification addresses common industry challenges, including inconsistent definitions, fragmented qualification practices, and non-comparable evaluation criteria across suppliers. Its utility within the Open Compute Project ecosystem is to provide a shared basis of verification that accelerates adoption of liquid cooling, supports multi-party collaboration, and enables objective evaluation of interoperable and second-source solutions.

Unless explicitly stated otherwise, this Test Specification does not define or constrain specific dimensions, materials, manufacturing processes, connector types, or design performance targets. It specifies how a characteristic is measured and evaluated, not how it is achieved. Such details are intentionally deferred to future OCP Product Specifications, or to system-level requirements, in order to preserve openness and enable innovation.

4. Test Specification

4.1. Description

A single-phase Direct-to-Chip (D2C) cold plate is a liquid-cooled heat exchanger that interfaces to a heat-generating device through a thermal interface material (TIM) and transfers heat into a single-phase closed liquid loop. As liquid cooling moves from limited deployment to mainstream data center use, the cold plate becomes a component sourced from many suppliers and integrated across many platforms.

This document is an OCP Test Specification. It defines vendor-neutral test methods, test conditions, and acceptance criteria by which a single-phase D2C cold plate is verified. It specifies how a characteristic is measured and evaluated, not how it is achieved. This specification covers design and prototype qualification. Production and factory acceptance testing — including sampling plans, in-line screening, and production acceptance limits — are outside its scope and may differ in method and criteria.

The specification addresses fragmentation in how cold plates are qualified today: inconsistent terminology, supplier-specific test practices, and evaluation criteria that cannot be compared across vendors. An operator currently has no reliable basis for determining whether two cold plates were held to equivalent standards, and a supplier must satisfy a different bespoke regime for each customer. Its utility within the Open Compute Project ecosystem is to supply the verification layer that existing liquid cooling contributions depend on — enabling comparable results, objective second-sourcing, and qualification effort spent once rather than repeated per customer relationship.

4.2. Goals and Objectives

The vision is a liquid cooling ecosystem in which cold plate verification is shared infrastructure rather than a per-supplier negotiation, so that procurement and integration decisions rest on comparable evidence.

Goals of this specification:

- Establish a de-facto industry baseline for verifying single-phase D2C cold plates.
- Define test methods that are reproducible across suppliers, laboratories, and time.

- Reduce ecosystem fragmentation by replacing supplier-specific qualification practice with a common reference.
- Provide a verification foundation that future OCP Product Specifications reference and extend rather than redefine.

Objectives:

- Each defined test specifies its measurand, units, test conditions, and required measurement resolution and uncertainty, such that results obtained independently by supplier and operator are comparable within stated limits.
- Every characteristic declared mandatory by the corresponding design specification has a defined verification method.
- Calibration, reference standards, and record-keeping requirements are defined so results remain traceable.
- Each test is executable using established industry-standard methods and commonly available laboratory capability, so no adopter is excluded by equipment access.
- OCP contributors need a Design Specification that can be extended by downstream specifications.

4.3. Common Abbreviations

- D2C: Direct to Chip
- DLC: Direct Liquid Cooling
- TTV: Thermal Test Vehicle
- TIM: Thermal Interface Material
- UQD: Universal Quick Disconnect

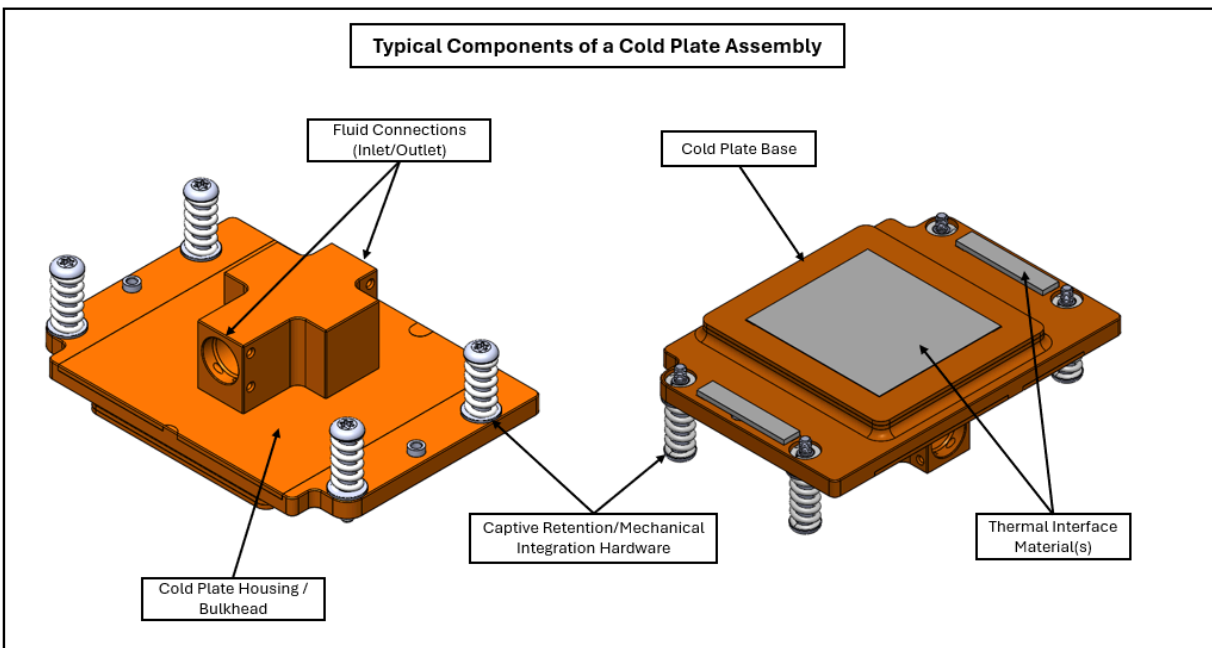


Figure 1: Typical Components of a Cold Plate Assembly

5. Test and Validation Requirements

This section covers all of the validation tests required for a Cold plate. This section does not cover typical production testing.

5.1. Leakage & Pressure

Leak Detection

Test Description	Detects micro-leaks in cold plate assemblies using pressurized hydrogen or helium gas. The cold plate is sealed and pressurized, then leak detection is performed via vacuum chamber, sniffer probe, or immersion bubble testing. Leak rate criteria are referenced to INFICON industry guidelines.
Test Setup	Fully assembled cold plate, including all connectors and seals, pressurized and sealed.
Test Fluid	Hydrogen (typically as forming gas: 5% H ₂ , 95% N ₂) or helium gas.
Test Temperatures	Ambient laboratory temperature unless otherwise specified by the customer.

Timing/Transition Rate	Hold at test pressure for the specified dwell time (typically 5–10 minutes).
Acceptance Criteria	No leaks detected by sniffer probe. Leak rate criteria should align with INFICON industry guidelines ¹ (e.g., < 0.6 SCCM for water-tight).

Gas Pressure Decay / Dwell

Test Description	The cold plate is pressurized with a specified gas (air, nitrogen, hydrogen, or helium) and monitored for pressure decay over a defined dwell period. Differential pressure measurement may be used for increased sensitivity. Leak rate criteria are referenced to INFICON industry guidelines ¹ .
Test Setup	Assembled cold plate, pressurized and isolated from external influences.
Test Fluid	Air, nitrogen.
Test Temperatures	Ambient laboratory temperature unless otherwise specified.
Timing/Transition Rate	Dwell period as specified by internal specification (typically 5–30 minutes).
Acceptance Criteria	Pressure decay within allowable limits (e.g., less than 0.5% loss over dwell period); no leaks detected.

Hydrostatic Pressure / Dwell

Test Description	The cold plate is filled with liquid and hydrostatically pressurized to its maximum rated operating pressure for 5 minutes, then to three times the maximum operating pressure for 2 minutes. Checks for leaks, deformation, and structural integrity. Dimensions measured before and after to ensure no permanent deformation. Test pressure may reference IEC 62368-1 or UL requirements.
Test Setup	Fully assembled cold plate, including connectors and seals, filled and pressurized.
Test Fluid	Water or specified cooling fluid (e.g., water/glycol mixture). It is preferable to use a fluid that has color and/or is observable with UV light.

Test Temperatures	Typically performed at room temperature (20–25°C) unless otherwise specified.
Timing/Transition Rate	5 minutes at maximum operating pressure; 2 minutes at 3× maximum operating pressure.
Acceptance Criteria	Using a UV light for inspection, no detectable leaks or deformation are present during or after the test; dimensions statistically equivalent before and after the test. Test pressure may reference IEC 62368-1 ² or UL requirements ³ .

Burst Pressure

Test Description	This is a destructive test to determine the maximum pressure the cold plate assembly can withstand before failure. The cold plate is pressurized (using water or specified fluid) until rupture or until reaching three times the minimum proof pressure, whichever is lower. The test is performed on both fully assembled and disconnected components to verify the robustness of all interfaces. The pressure rise rate should be controlled as per ISO® 18869 ⁴ . The acceptance criterion is that the burst pressure exceeds the minimum requirement, with no rupture or leaks below that threshold.
Test Setup	Fully assembled cold plate, including connectors and seals; also tested in disconnected state if specified.
Test Fluid	Water or specified test fluid.
Test Temperatures	Ambient laboratory temperature (unless otherwise specified).
Timing/Transition Rate	Pressure rise rate per ISO® 18869 ⁴ (e.g., gradual increase to failure, typically 1–5 bar/min).
Acceptance Criteria	Burst pressure is above the minimum required (e.g., >20 bar); no rupture or leaks below specified threshold.

5.2. Thermal & Flow

Thermal Resistance

Test Description	The cold plate is mounted with the recommended TIM material onto a thermally functional processor stack or TTV. The cold plate heat exchanger is connected to a cooling loop. After ensuring no bubbles in the test loop, the fluid flow rate is stabilized and power is applied to the processor. Once the sink temperature (Base of the Cold plate) and incoming fluid temperature stabilize, the measured pressure drop, case temperature, fluid inlet temperature, applied power, and flow rate are recorded. Thermal resistance is calculated as $R=(T_s-T_i)/P$. The test is repeated at multiple flow rates to generate a performance curve. The diagram below shows a typical test setup and position of thermocouples.
Test Setup	Assembled cold plate on processor, in cooling loop.
Test Fluid	Water or specified cooling fluid (e.g., water/glycol mixture).
Test Temperatures	Fluid temperature typically $45^{\circ}\text{C} \pm 2^{\circ}\text{C}$.
Timing/Transition Rate	Stabilize temperatures before measurement; test at multiple flow rates.
Acceptance Criteria	Thermal resistance meets product specification at all tested flow rates; performance curve is within specified limits.

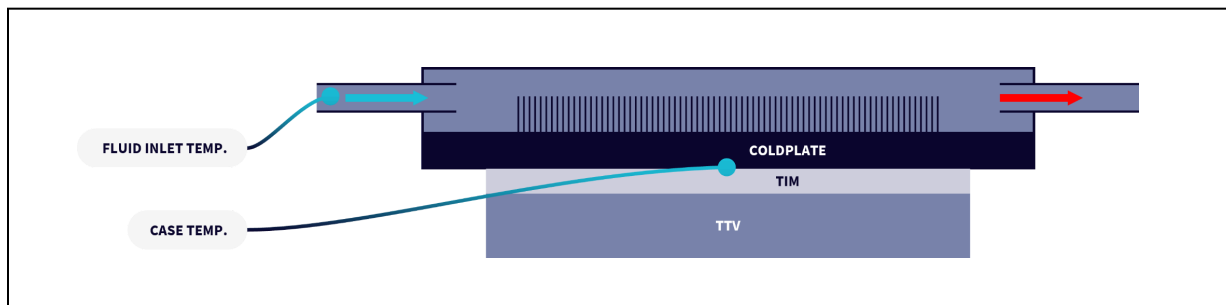


Figure 2: Diagram to show Thermocouple positioning for Thermal Resistance Test

Pressure Drop

Test Description	The cold plate is installed in a laboratory bench-scale cooling system loop with the cold plate, tubing and quick disconnects. Pressure is measured at the inlet and outlet at constant flow rates. The pressure drop is calculated as the difference between the pressure recorded in the test setup and the tare setup (loop without cold plate). The test is performed at multiple flow rates (typically 25% to 150% of rated flow), if the cold plate is designed for flow in both directions, it should be tested under both scenarios. Results are reported as a curve fit equation for pressure drop vs. flow rate.
Test Setup	Assembled cold plate in test loop.
Test Fluid	Water or specified cooling fluid.
Test Temperatures	Fluid temperature typically $45^{\circ}\text{C} \pm 2^{\circ}\text{C}$.
Timing/Transition Rate	Select at least six flow rates from 25% to 150% of rated flow, including 100% of rated flow.
Acceptance Criteria	Pressure drop below maximum allowed by cooling system; curve fit coefficients (A, B) meet product specification; minimum Cv at rated flow is achieved.

Flow Rate

Test Description	The cold plate is tested to verify minimum and maximum flow rates. Flow rate curves are generated by measuring flow at increasing rates up to $<1.5 \text{ m/s}$ to ensure no erosion or leaks. The test is performed in the directions prescribed and at multiple flow rates.
Test Setup	Assembled cold plate in test loop.
Test Fluid	Water or specified cooling fluid.
Test Temperatures	Fluid temperature typically $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$.
Timing/Transition Rate	Test at multiple flow rates up to maximum recommended velocity.
Acceptance Criteria	Flow rate meets product specification; no erosion or leaks at maximum flow.

5.3. Mechanical & Structural

Retention Force

Test Description	The retention force test measures the force required to retain the cold plate or connector in place. A pulling force (typically 30N $\pm$ 10%) is applied for 5 seconds in any direction on the tubing or connector using a calibrated pull gauge. The test is performed on both mated and unmated assemblies to verify the robustness of the retention mechanism. The test ensures that the cold plate remains securely attached during installation, operation, and servicing.
Test Setup	Assembled cold plate with tubing attached.
Test Temperatures	Ambient laboratory temperature unless otherwise specified.
Timing/Transition Rate	Apply force for 5 seconds in each direction.
Acceptance Criteria	No rupture or leakage during or after test; retention force meets or exceeds product specification.

Flatness

Test Description	The flatness of the cold plate base is measured using ISO® 12781-2:2011 ⁵ methodology. Precision metrology equipment (surface plate, dial indicator, or CMM) is used to ensure the bottom surface is within specified tolerances. The test is performed prior to assembly and is critical for ensuring proper thermal contact and mechanical fit. Any distortion or deformation may impact performance.
Test Setup	Cold plate base, prior to assembly.
Test Temperatures	Ambient laboratory temperature unless otherwise specified.
Acceptance Criteria	Flatness within product specification; no visible distortion or deformation.

Stiffness

Test Description	The stiffness of the cold plate assembly is measured by applying specified loads and measuring deflection using calibrated force application and displacement measurement. The test ensures the cold plate maintains integrity under operational loads and does not deform excessively, which could compromise thermal or mechanical performance. The test is performed in accordance with product technical specifications.
Test Setup	Assembled cold plate.
Test Temperatures	Ambient laboratory temperature unless otherwise specified.
Acceptance Criteria	Stiffness meets or exceeds product specification; deflection is within allowable limits.

5.4. Reliability & Environmental

Operational Temperature Cycling

Test Description	The cold plate is exposed to repeated temperature extremes to simulate operational conditions. The plate is cycled between low and high temperatures (e.g., 10°C for 72h, then 65°C for 72h, then back to room temp). After cycling, a hydrostatic pressure test is performed to check for leaks or performance degradation. This test is performed with the cold plate connected to the cooling loop and under pressure.
Test Setup	Assembled cold plate in cooling loop, pressurized.
Test Fluid	Water or specified cooling fluid.
Test Temperatures	Cycle between 10°C and 65°C, dwell 72h at each temperature.
Timing/Transition Rate	5–10°C/min transition rate; dwell times as specified.
Acceptance Criteria	No visible leakage; passes hydrostatic pressure test after cycling; no performance degradation.

Non-Operational Temperature Cycling (Shipping)

Test Description	Simulates shipping environmental exposures. The cold plate is cycled between -40°C for 72h and +70°C for 72h, then back to room temp. Helium leak tests are performed prior to and after cycling. The test is performed with the cold plate capped and pressurized.
Test Setup	Assembled cold plate, capped and pressurized.
Test Fluid	Air at specified pressure.
Test Temperatures	Cycle between -40°C and +70°C, dwell 72h at each temperature.
Timing/Transition Rate	5–10°C/min transition rate; dwell times as specified.
Acceptance Criteria	No visible leakage; helium leak rate $\leq 1 \times 10^{-5}$ mbar-L/s after test.

Shock

Test Description	Applies mechanical shock to the cold plate assembly per product qualification standards. After shock, inspect for cosmetic damage and perform hydrostatic pressure test to check for leaks or damage. The test is performed with the cold plate mounted on a representative product board with representative retention HW mechanical boundary conditions.
Test Setup	Assembled cold plate on processor stack.
Test Fluid	Water or specified cooling fluid (if under pressure during test).
Test Temperatures	Ambient laboratory temperature unless otherwise specified.
Timing/Transition Rate	Shock pulse duration and magnitude per product specification.
Acceptance Criteria	No leaks, no cosmetic damage, thermal performance statistically equivalent after test.

Vibration

Test Description	Applies vibration to the cold plate assembly per product qualification standards. After vibration, inspect for cosmetic damage and perform hydrostatic pressure test to check for leaks or damage. The test is performed with the cold plate mounted on a representative product board with representative retention HW mechanical boundary conditions.
Test Setup	Assembled cold plate on processor stack.
Test Fluid	Water or specified cooling fluid (if under pressure during test).
Test Temperatures	Ambient laboratory temperature unless otherwise specified.
Timing/Transition Rate	Vibration frequency, amplitude, and duration per product specification.
Acceptance Criteria	No leaks, no cosmetic damage, thermal performance statistically equivalent after test.

Salt Spray (Corrosion)

Test Description	Assesses corrosion resistance of exterior surfaces. The cold plate is exposed to salt spray per ASTM® B117 ⁶ (5% NaCl solution, 35°C, 8h). After exposure, inspect for corrosion, pitting, or leaks. Hydrostatic pressure test is recommended post-exposure. The test is performed with the cold plate sealed and placed in the chamber.
Test Setup	Assembled cold plate.
Test Fluid	5% NaCl solution (for salt spray chamber).
Test Temperatures	35°C chamber temperature.
Timing/Transition Rate	8 hours exposure at 35°C.
Acceptance Criteria	No corrosion, pitting, or discoloration; passes hydrostatic pressure test after exposure.

Fluid Compatibility/Corrosion

Test Description	Verifies chemical compatibility and corrosion resistance of wetted surfaces. The test is performed with all wetted materials in the cooling loop. The metal compatibility is tested with specified cooling fluid per modified ASTM® D8040⁷ (glassware corrosion test) followed by fluid analysis D6130⁸ (ICP trace elements), D1287⁹ (pH), D1121¹⁰ (reserve alkalinity), & D5827¹¹ (IC anions). Ion concentration, pH, and reserve alkalinity are measured. The test is performed with all wetted materials in the cooling loop. Compatibility of elastomers with the cooling fluid is tested per ASTM® D471¹², and changes in volume, hardness (Shore A) and tensile properties are evaluated per D412¹³ and D2240¹⁴. The compatibility of plastics in the cooling loop is tested per ASTM® D543¹⁵, followed by D638¹⁶ (tensile properties), D2240¹⁴ (Shore D hardness) and volume measurements to evaluate the changes in properties. For brazing materials, the ASTM® D7933¹⁷ (coolant stagnation) test method is used, followed by analysis of trace impurities in the cooling fluid with ICP (D6130⁸). The exposure temperature can be adjusted according to the operating conditions.
Test Setup	As specified in ASTM® standards.
Test Fluid	Specified cooling fluid (water/glycol mix, etc.).
Test Temperatures	As specified in ASTM® standards.
Timing/Transition Rate	As specified in ASTM® standards.
Acceptance Criteria	No significant corrosion, leaching, or degradation; meets product specification for cooling fluid and all tested materials.. A detailed list of acceptable limits can be found in the referenced OCP documents.

Humidity

Test Description	Exposes product to high/low humidity conditions to assess resistance to condensation and corrosion. The cold plate is exposed to 40°C @ 93% RH for 16h and 40°C @ 10% RH for 16h. After exposure, inspect for leaks, rust, or oxidation. Hydrostatic pressure test is performed post-exposure.
Test Setup	Assembled cold plate.
Test Fluid	Water/glycol mix or specified cooling fluid.
Test Temperatures	40°C chamber temperature.
Timing/Transition Rate	Dwell times as specified; ramp rates as specified.
Acceptance Criteria	No leaks, rust, or oxidation; passes hydrostatic pressure test after exposure.

5.5. Cleanliness

Flush/Cleanliness

Test Description	The cold plate heat exchanger is flushed with clear fluid while immersed in an ultrasonic bath. The discharged fluid is inspected for discoloration and particulate content. Must meet cleanliness standards (particulate <50µm). The test ensures that the cold plate is free of manufacturing debris and suitable for installation in a liquid cooling system.
Test Setup	Assembled cold plate.
Test Fluid	Clear flushing fluid (e.g., deionized water).
Test Temperatures	Ambient laboratory temperature unless otherwise specified.
Timing/Transition Rate	Flush duration and ultrasonic bath time per internal specification.
Acceptance Criteria	Discharged fluid is clear; particulate <50µm; meets cleanliness requirements for installation.

6. Compliance

Conformance requires completion and reporting of all tests listed below using the methods in Section 5. Conformance is established at design qualification and does not constitute production acceptance.

ITEM	REQUIREMENT	MANDATORY	PASS/FAIL
1	Helium Leak Detection	Y	
2	Gas Pressure Decay / Dwell	Y	
3	Hydrostatic Pressure / Dwell	Y	
4	Burst Pressure	Y	
5	Thermal Resistance	Y	
6	Pressure Drop	Y	
7	Flow Rate	Y	
8	Retention Force	Y	
9	Flatness	Y	
10	Stiffness	Y	
11	Operational Temperature Cycling	Y	
12	Non-Operational Temperature Cycling (Shipping)	Y	
13	Shock	Y	
14	Vibration	Y	
15	Salt Spray (Corrosion)	Y	
16	Fluid Compatibility / Corrosion	Y	
17	Humidity	Y	
18	Flush / Cleanliness	Y	

6.1. Appendix

1. **INFICON®** – *Leak Detection Industry Guidelines*
<https://www.inficon.com/en/news/setting-up-a-leak-rate-specification>
2. **International Electrotechnical Commission (IEC)** – *IEC® 62368-1: Audio/Video, Information and Communication Technology Equipment – Safety Requirements*
<https://webstore.iec.ch/en/publication/69308>
3. **UL® Solutions** – *UL® Safety Requirements Corresponding to IEC® 62368-1*
<https://www.ul.com/services/iec-62368-1-testing-certification>
4. **International Organization for Standardization (ISO®)** – *ISO® 18869: Hydraulic Fluid Power — Test Methods for Couplings Actuated with or without Tools*
<https://www.iso.org/standard/63640.html>
5. **International Organization for Standardization (ISO®)** – *ISO® 12781-2:2011 — Geometrical Product Specifications (GPS) — Flatness*
<https://www.iso.org/standard/53625.html>
6. **ASTM® International** – *ASTM® B117 — Standard Practice for Operating Salt Spray (Fog) Apparatus*
<https://www.astm.org/b0117-19.html>
7. **ASTM® International** – *ASTM® D8040 — Standard Guide for Glassware Corrosion Testing*
<https://www.astm.org/d8040.html>
8. **ASTM® International** – *ASTM® D6130 — Determination of Trace Elements by ICP*
<https://www.astm.org/d6130.html>
9. **ASTM® International** – *ASTM® D1287 — Standard Test Method for pH of Engine Coolants*
<https://www.astm.org/d1287.html>
10. **ASTM® International** – *ASTM® D1121 — Standard Test Method for Reserve Alkalinity of Engine Coolants*
<https://www.astm.org/d1121.html>
11. **ASTM® International** – *ASTM® D5827 — Standard Test Method for Analysis of Anions by Ion Chromatography*
<https://www.astm.org/d5827.html>

12. **ASTM® International** – *ASTM® D471 — Standard Test Method for Rubber Property—Effect of Liquids*
<https://www.astm.org/d0471-16ar21.html>
13. **ASTM® International** – *ASTM® D412 — Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension*
<https://www.astm.org/d0412.html>
14. **ASTM® International** – *ASTM® D2240 — Standard Test Method for Rubber Property—Durometer Hardness*
<https://www.astm.org/d2240.html>
15. **ASTM® International** – *ASTM® D543 — Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents*
<https://www.astm.org/d0543.html>
16. **ASTM® International** – *ASTM® D638 — Standard Test Method for Tensile Properties of Plastics*
<https://www.astm.org/d0638.html>
17. **ASTM® International** – *ASTM® D7933 — Standard Test Method for Coolant Stagnation Corrosion Testing*
<https://www.astm.org/d7933.html>