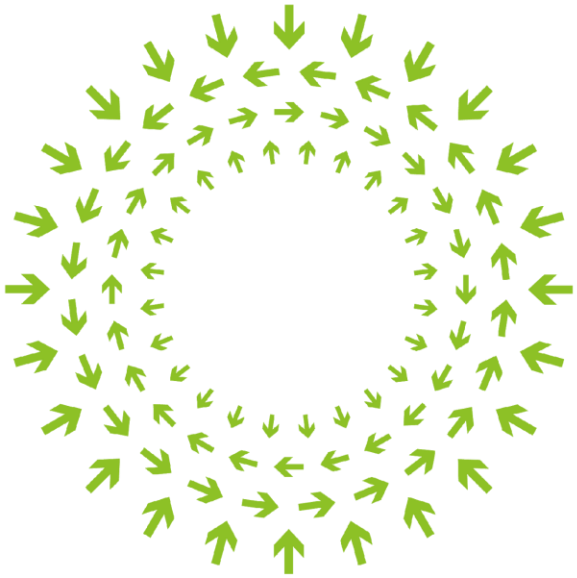

OPEN

Compute Project

Warranty Guidelines for Immersion Cooled Technology Components, Equipment and Systems

Revision 1.0

Last updated: April 26, 2024

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Revision History

Date	Version	Description
April 26, 2024	1.0	Final publication document

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1. Introduction

In January 2023, The Immersion Warranty workstream sub-group was chartered to address the open issues surrounding the concerns and mitigations of risks related to the failure or potential failure of IT equipment (ITE), related parts and systems in different liquid cooling environments.

The group developed and maintained an industry review and produced updates with information guided by generally accepted sourcing, shipping, accounting and legal standards and practices for both human readable and machine-readable expression of written warranties for information technology components, equipment, and systems offered in the US market focused on Generally Accepted Accounting Principles (GAAP)[1]. Accounting and legal standards vary globally based on the buyers and sellers' locations, so readers are encouraged to seek and share their local expertise on contracts, sales, and warranties -- this document is illustrative and suggestive only. Sample content and related public metadata when available is sourced from Information Technology Equipment (ITE) manufacturers, resellers, integrators and service providers through public disclosures and publications.

Related sources:

- Webcasts and website pages of trustworthy authorities
- Product documentation
- Emails from employees of firms offering product warranties
- Public documentation presented in trade shows and other public and private venues

1.1 Charter

This workstream is focused on the identification of what warranties are and why warranties are not consistently offered for immersion cooling solutions. We seek to bring forth a consideration of how we as industry leaders can collectively understand and manage the risks of IT equipment and systems loss within immersion cooling systems. There are a wide variety of factors that lead to unknown and unmitigated risks; such as a lack of MTBF data and the amount of variation in immersion solutions, the immersion fluids and variable deployment methods.

[1] The Financial Accounting Standards Board (FASB) Accounting Standards Codification (Codification or ASC) is the single source of authoritative nongovernmental U.S. generally accepted accounting principles (US GAAP). https://asc.fasb.org/Home

This workstream seeks out the underlying structures which influence warranty decisions by manufacturers and formulates best practices with suggestions and methods to improve the volume and consistency of warranty coverage offered for immersion cooled IT equipment to buyers.

Different groups at OCP influenced our findings including existing warranties in related industries, material compatibility, reliability understanding and test methods for it, including thermal impact and signal integrity were all considered in this document version.

1.2 Scope

This workstream operates with the following assumptions and boundaries:

- The focus is on IT equipment only, including IT components (CPU, GPU, NPU, ASIC, IC++).
- The focus is on skilled and trained personnel using appropriate PPE during interaction with the equipment.
- For liquid coolants, the OCP Immersion Fluid specification is referred to as the set of liquids under consideration as coolants. While we understand that many different fluids can be used to cool ITE, we have narrowed our focus on these alone given current participation.
- Variations of different types of TCS loops and fluids are in scope and considered
- Comparisons of warranties offered for air cooled IT equipment and related industries are in scope and we sought to highlight the differences for immersion cooling.
- For material compatibility, the OCP whitepaper “Material Compatibility in Immersion Cooling” is referred to as a basis of key technical assumptions.
- Further work continues in the Material Compatibility and related workstreams.

This workstream does not:

- Develop new test methodologies
- Interpret implied warranty
- Distinguish variable warranty coverage across different regions
- Compare costs of warranties

1.3 Requirements

This workstream addresses and identifies how OCP and members may define, classify, categorize, and suggest peer reviewed best practices for understanding the collective product risks and how Sellers may mitigate them in the ongoing maturation of Immersion cooling system market.

- Warranty statements should be included in all sales contracts in standardized machine-readable data tables for immersion cooling system environments.
- Part numbering methods, nomenclature, and serial numbers need to be categorized and standardized within immersion cooling system environments to existing accepted accounting and inventory standards by the UN, ISO and others.

Data structures for the above data and metadata are suggested for member discussion and rapid consensus building to harmonize warranty production in the interest of Buyers.

1.4 Deliverables

- Identification of reference immersion system asset bundles and taxonomy
- System memory exists in context of a motherboard mount and in relation to specific CPU, not standalone
- Identification of related risks and financial levers for mitigation through warranties
- Analysis on how immersion affects MTBF of various components
- Analysis of fluid quality management during usage, like periodic check-ups/maintenance which may be part of customer responsibilities
- Identify responsibilities to be addressed by various stakeholders in the industry (cleaning procedures, material compatibility analysis, fluid quality maintenance etc.,)
- Provide sample warranty statements

2. Warranty Information

For the purposes of this document, a warranty is defined as the following:

> A written promise from a company (typically a Manufacturer) to a Buyer to repair or replace a Product that develops or has a fault within a particular period of time, or to do a piece of work again if it is not satisfactory.

Two common types of warranties offered are Express and Extended warranties. Express warranties are written warranty statements offered directly by the Seller to the Buyer. Extended warranties are written warranty statements offered by the Retailer or Seller but fulfilled by the Manufacturer.

2.1 Government Regulations

This section highlights warranty requirements imposed by government entities at a high level. In most deployment locations, there are laws in place that establish a set of minimum requirements for product warranties. These laws will vary depending on the location where the product is sold and/or installed. Given the current participation in the workgroup we have focused on two legal venues; the EU and US.

European Union	On 1 January 2022, Directive (EU) 2019/771 on certain aspects concerning contracts for the sale of goods entered into application. It replaced the Consumer Sales and Guarantees Directive (1999/44/EC). Under the Directive, the seller is liable to the consumer for any lack of conformity which exists at the time when the goods were delivered and which becomes apparent within two years of that time.
United States	Product warranties offered on consumer products in the United States are governed under federal law by the Magnuson-Moss Warranty Act. Under this act, the Federal Trade Commission (FTC) has adopted a set of rules under this act pertaining to Stating Terms and Conditions of Your Written Warranty, making warranties Available Prior to Sale, and advertising warranties.

2.2 Business Guidance

Anything not dictated by laws regarding warranties is a business decision typically based on a risk assessment or other internal policy of the Manufacturer, Retailer and/or Seller. Quality Assurance (QA) and other teams typically provide risk assessment to accounting, finance, product and business units, and often provide a recommendation. Ultimately the decision to offer warranty is usually nominated by a Product Lead and validated by Legal Counsel in collaboration with Accounting and Finance leads as appropriate given all the industry context and other commercial factors present.

2.3 Reliability

Ultimately every product has been designed for a usable period of time, its product lifetime which usually commences upon first commercial use. The reliability of a product can be measured a number of different ways but whether it continues to be useful is probably the most important. Warranty will typically define expected uses and can mention uncovered use cases and how long the product will last within these covered use cases.

3. Warranties for Immersion Cooling

3.1 Immersion Cooling

For the purposes of this document[2], immersion cooling refers to the use of IT equipment while partially or completely submerged in a dielectric fluid for the purpose of temperature range contained operation, usually with a minimum and maximum threshold preset. More information about cooling environments is provided in the *OCP Base Specification for Immersion Fluids*[3] document which we consider an essential prerequisite to this document.

From a pure scientific approach, air is simply another type of dielectric cooling fluid. Almost all warranties for IT equipment today assume air cooling of components through airflow as an acceptable use case and often the only approved use case. One method to rapidly offer warranty terms that explicitly apply to immersion cooling can be to inherit existing air-cooling product warranties to cover operation of devices in a list of cooling fluids, with air being one of the fluids which is covered. By applying this framework, expanding the terms of the warranty becomes an exercise in adding to the list of fluids which are specifically covered, or excluded, from the warranty.

In fact, the use of air for cooling assumes a certain level of cleanliness, air quality, and moisture level that is typically suboptimal. In some cases, systems are put into place for filtering air, reducing humidity and monitoring for air pollution. That could lead to corrosion with the goal of preserving IT equipment reliability. It is well-known that oxygen can oxidize copper creating high resistance connections, this the use of plating on connectors and busbars. We seek to take this collective experience and extend it to all coolants where particle filtering, moisture control and contamination monitoring is required to preserve the operational integrity and reliability of the IT equipment.

[2] Harmonization within OCP groups continues to achieve consistent definitions.
[3] Open Compute Project website. Base Specification for Immersion Fluids. Revision 1.0, Version 1.0. December 1 2022: https://www.opencompute.org/documents/ocp-base-specification-for-immersion-fluids-20221201-pdf

Exclusions are nothing new to warranties. Most warranties found today will have several explicit warranty exclusion statements including this sample from Hypertec[4];

The following exclusions apply to all Service options:

- *Replacement of non-critical parts that do not impede ability to perform critical business functions, included, but are not limited to bezels, mechanical chassis, frames, hard drive blanks, rail kits, cable management accessories, batteries etc.;*
- *Preventative maintenance;*
- *Installation, de-installation or relocation services;*
- *Operating systems and applications;*
- *Repairs necessitated by software related issues, or as a result of alteration, adjustment, or repair by anyone other than Hypertec;*
- *Support for Product damaged by misuse, accident, abuse (such as, but not limited to, use of incorrect line voltages, use of incorrect fuses, use of incompatible devices or accessories, improper or insufficient ventilation, or failure to follow operating instructions), modification, unsuitable physical or operating environment, improper maintenance by Customer (or Customer's representatives), neglect by Customer or any third party, removal or alteration of equipment or parts identification labels, or failure caused by a product for which Hypertec is not responsible;*
- *Support for damage resulting from Force Majeure;*
- *Any activities or Services not expressly described in this Agreement;*
- *Hypertec IS NOT RESPONSIBLE FOR THE PERFORMANCE OR SUPPORT OF OTHER VENDORS' PRODUCTS OR SERVICES.*

While it is assumed by many buyers that a server is a single product, in almost all cases it is a bundled product, a specific collection of products designed to work together given a specific subset of use cases. These use cases can also be delineated as inclusions or exclusions in the warranty statements.

Also of note is the Force Majeure clause[5], which should be carefully considered.

[4] Hypertec website. https://hypertec.com/support-services-policy/

[5] Force majeure is a contract clause that is included in contracts to remove liability for unforeseeable and unavoidable catastrophes that interrupt the expected course of events and prevent participants from fulfilling obligations. These clauses generally cover natural disasters, such as hurricanes, tornadoes, and earthquakes, as well as human actions, such as armed conflict and man-made diseases. Source: Investopedia.com https://www.investopedia.com/terms/f/forcemajeure.asp

Most servers will offer warranty in terms of years per category. So 1-year parts and labor as a limited warranty. Extended warranty is often a value-added option sought by Buyers in the sales contract. Large scale buyers can typically negotiate better warranty terms and conditions than individual buyers.

Conditions can apply to the warranty as well. For illustrative purposes, here are the conditions as offered by Hypertec for illustration;

Payment. *Customer will prepay for Services to be provided under this Agreement.*

Confidential, Proprietary or Personal Information or Data. *Customer agrees that any information or data disclosed or sent to Hypertec, over the telephone, electronically or otherwise, does not contain any confidential, proprietary or personal information or data. Customer is solely responsible for its data.*

Assignment and Subcontracting. *Services shall not be assigned or transferred without the prior written consent of Hypertec. Hypertec may use affiliates or other qualified subcontractors ("Service Providers") to perform its obligations hereunder.*

Suspension; Termination of Services. *Hypertec reserves the right to suspend or terminate Services if Hypertec determines, in its sole discretion, that Services are being misused, being used by any user other than Customer, or being used in breach of this Agreement.*

Limits to Scope and Changes to Service. *Hypertec is not obligated to provide any Services that are not expressly described in this Agreement. In addition, in the course of providing any Services, Hypertec may in its sole discretion determine that the issue is beyond the scope of Services. Customer agrees that Hypertec may not be able to diagnose or solve a Customer's particular problem. Hypertec may at any time, change or modify any of the terms and conditions set forth in this Agreement, including the Service options or warranty periods.*

Service Warranty. *Hypertec will perform Services in a diligent and commercially reasonable manner in accordance with generally accepted industry standards. Replacement part(s) may not be new but will be in good working order and at least functionally equivalent to the item replaced. Customer must notify Hypertec of any failure to so perform within 10 days after the date on which such failure first occurs. In such case, Hypertec will use commercially reasonable efforts to correct such failure within a reasonable period of time. If, after reasonable efforts, Hypertec is not able to correct such deficiencies for reasons for which Hypertec is responsible, Customer may terminate the affected Services for cause by providing written notice to Hypertec. The warranty term for Products commences upon shipment from Hypertec's facility. Any Products repaired or serviced by Hypertec shall be warranted for the remainder of the original warranty period.*

Warranty Limitations and Disclaimer. *The Service Warranty above do not cover problems that arise from: (i) accident or neglect by Customer or any third party; (ii) any third party items or services with which the Product is used or other causes beyond Hypertec's control; (iii) installation, operation or use not in accordance with Hypertec's instructions and the applicable documentation; (iv) use in an environment, in a manner or for a purpose for which the Product was not designed; (v) modification, alteration or repair by anyone other than Hypertec personnel; or (vi) causes attributable to normal wear and tear. Hypertec has no obligation for: (1) software installed or used beyond the licensed use, or (2) Product whose original identification marks have been altered or removed. Products and Services are not fault-tolerant and are not designed or intended for use in hazardous environments requiring fail-safe performance, such as any application in which the failure of the Products or Services could lead to death, bodily injury, or physical or property damage (collectively, "High-Risk Activities"). Hypertec expressly disclaims any express or implied warranty of fitness for High-Risk Activities.* ***OTHER THAN THE SERVICES WARRANTY ABOVE, AND TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, HYPERTEC AND ITS AFFILIATES: (I) MAKE NO OTHER EXPRESS WARRANTIES; (II) DISCLAIM ALL IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE AND NON-INFRINGEMENT; AND (III) DISCLAIM ANY WARRANTY ARISING BY STATUTE, OPERATION OF LAW, COURSE OF DEALING OR PERFORMANCE OR USAGE OF TRADE.***

Limitations of Liability and Remedies. *IN NO EVENT WILL HYPERTEC, ITS AFFILIATES, SUBCONTRACTORS OR SERVICE PROVIDERS BE LIABLE FOR INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY NATURE OR ANY LOSS OF REVENUE, PROFIT; LOST OR CORRUPTED DATA OR SOFTWARE; LOSS OF USE OF A SYSTEM OR NETWORK; BUSINESS INTERRUPTION OR DOWNTIME COSTS; PRODUCTS OR THIRD-PARTY PRODUCTS NOT BEING AVAILABLE FOR USE; REMOVAL AND/OR REINSTALLATION COSTS; REPROCUREMENT COSTS; MANUFACTURING EXPENSES; OVERHEAD; INJURY TO REPUTATION OR LOSS OF CUSTOMERS, IN EACH CASE EVEN IF HYPERTEC HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. CUSTOMER'S RECOVERY FROM HYPERTEC FOR ANY AND ALL CLAIMS SHALL NOT EXCEED THE TOTAL AMOUNT OF ALL FEES PAID BY CUSTOMER TO HYPERTEC DURING THE PRIOR 12 MONTHS FOR SERVICES UNDER WHICH THE CLAIM FIRST AROSE IRRESPECTIVE OF THE NATURE OF THE CLAIM, WHETHER IN CONTRACT, CIVIL LIABILITY, TORT, DELICT, WARRANTY, STRICT LIABILITY, NEGLIGENCE OR OTHERWISE. THE REMEDIES PROVIDED IN THIS AGREEMENT ARE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES.*

Force Majeure. *Neither party shall be liable to the other for any delay or failure to perform any of its obligations (other than for the payment of fees) caused by Force Majeure. If such delay or failure lasts longer than 30 days, then the other party may immediately terminate, in whole or in part, this Agreement by giving written notice to the delayed party. "Force Majeure" refers to circumstances beyond a party's reasonable control including, without limitation, act of God, war, riot, civil commotion, terrorist acts, malicious damage, governmental or regulatory actions, accident, breakdown of plant or machinery, local or national emergency, explosions, fire, natural disasters, severe weather or other catastrophes, epidemics/pandemics, general import/export/customs process problems affecting supplies to Hypertec or to Customer, shortages in materials, failure of a utility service or transport network, embargo, strike, lock out or other industrial dispute (whether involving Hypertec's workforce or any other party), or default of suppliers or subcontractors due to any of the preceding events.*

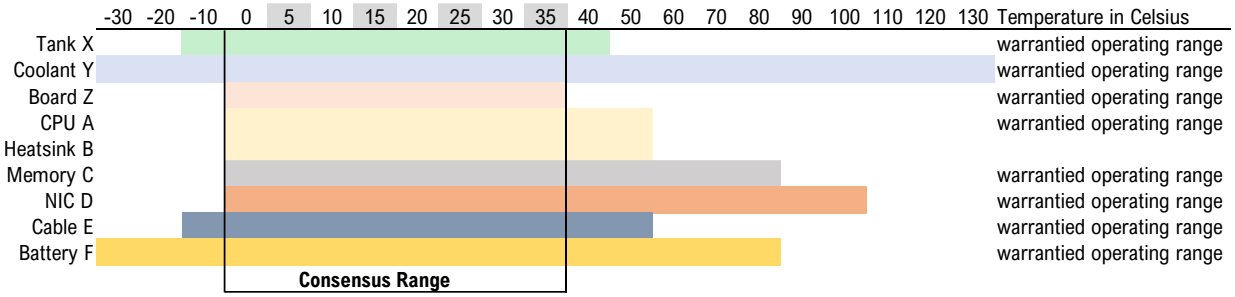
Governing Law. *Any disputes arising in connection with this Agreement will be governed by the laws of the Province of Quebec and the federal laws of Canada applicable therein, without regard to conflicts of law principles. Any dispute shall be brought exclusively in the court of competent jurisdiction in the District of Montreal, Quebec.*

Entire Agreement. *The terms and conditions of this Agreement constitute the entire understanding between Hypertec and Customer relating to the provision of Services described herein and will supersede any previous communication, representation or agreement whether oral or written. Customer's pre-printed, additional or different terms and conditions on any order or form will not apply. Customer's acceptance of this Agreement is deemed to occur upon Customer's purchase of Services.*

3.2 Immersion Risk Factors

- **Fluid Compatibility with Components used in the manufacturing of IT equipment** – Immersion cooling relies on the use of cooling fluids or coolants to dissipate heat. It is crucial to specify coolants that are deemed compatible by the manufacturers of the IT equipment covered under the warranty prior to testing to ensure the warranty remains intact throughout the usage period.

  Proposed solution: Focus on components that are most likely to fail due to compatibility mismatch, and whose failure will result in the highest severity outcome. Starting with elastomers and plastics. Create a set of recommended materials that will work with each type of fluid: Refined Group III, PAO, GTL, Ester, etc. This is important because elastomers are in seals (poor seal causes leaks - loss of fluid is ignition risk & personnel risk), plastics jacket high-powered components, and TIMs ensure proper thermal dissipation from hot spots).
- **Temperature Limits** – Immersion cooling systems are designed to maintain stable temperatures for IT equipment over years of lifetime use. Manufacturers often define acceptable operating temperature ranges and hard limits and it is important that system operators maintain equipment per manufacturer's guidelines to retain warranty compliance. Here is an illustration of how different overlapping operating ranges per motherboard components can impact the final solution operating range. In this case Board Z's operating range is limiting operation above 35°C (when most immersion applications like to run from 40°C to 60°C).



- Maintenance Requirements – Immersion cooling systems can require varying levels of regular maintenance to monitor fluid quality and system integrity. Operators should be fully trained in specific systems, personal protection equipment, safety procedures, and audit limits for both environmental and financial compliance.

  Proposed solution: Some fluid vendors are starting to offer fluid quality monitoring service and/or systems to relieve the need within the data center operations.

3.3 Warranty Challenges

Lack of Consistent Warranty Periods – Warranty periods for IT equipment typically range from 1 to 7 years often depending on the timing of a new generation of IT equipment platforms. Alternatively there has been an expressed desire in the industry to go to 10 or 20 years for the immersion fluid. Without a clear and consistent requirement, experiments and case studies cannot be arranged to provide the information needed to support a warranty.

Proposed Solution: Because of material compatibility concerns it is recommended that the specifications of the "used" immersion cooling fluid be evaluated if its use is to be extended to cover another generation of IT equipment. Therefore experiments looking for 7 years of IT Equipment life will yield information for any shorter time periods.

Lack of Data – Immersion cooling within the mainstream commercial sector is a relatively new and specialized cooling method. While private laboratory and military sites have used this method for decades, extraordinarily little public information is available on the long-term product viability. The lack of historical data could make it challenging to confidently offer warranty coverage without knowing the long-term effects on the devices. Recent fluid/material compatibility efforts have been focused on the impact of immersion cooling fluid contact with individual components. But there are many components' suppliers and material options when making an air-cooled server.

Proposed Solution: Could invite specific speakers to workstream meetings to offer case studies on their experience with reliability. Look towards end users and/or system integrators to collect reference data.

Another solutions would be to work a component/fluid material compatibility test procedure that would be acceptable for determining whether a fluid/component is compatible for immersion cooling system. This could be done at the component SKU level to create a list of immersion ready: wire harnesses, electrolytic capacitors, Thermal interface materials, label adhesives, etc.

Increased Claims – Despite the fact that immersion cooling decreases IT equipment exposure to thermal shocks and oxidation, there are concerns that operating in an immersion cooled environment could impact the reliability and longevity of devices, leading to higher warranty claim rates and increased costs.

Proposed Solution: Are there larger deployments that can share their experiences? Crypto use cases may be useful because many of the component materials are the same (with the caveat that custom ASIC cooling is not fully representative of the majority of use cases for enterprise computing today). Consider a repository of existing communications on immersion demonstrations. A third-party reliability assessment maybe using Highly Accelerated Life Testing techniques would be good for assessing these risks.

Fluid Variability – Different fluids may have different material compatibility and effects on device performance and reliability. System and Server Manufacturers might be hesitant to cover all possible fluids and may find it difficult to validate the impact of different fluids on their products.

Proposed Solution: Best to refer these concerns to fluid specification published last year and Fluids/Materials workstream. The purpose is to help narrow down fluid selection based on properties that are most important to the manufacturer. The reason we did the specification was to show compatibility and identify materials that are compatible across the board. Recommendation is to limit the warranty clause to fluids that meet the OCP spec, and to bias toward materials that have broad compatibility (i.e. wire insulation limited to particular materials).

Operational Variability – Immersion cooling systems may vary significantly from customer to customer. This variability might make it challenging to determine if device failures are related to the cooling method or other user-specific factors. Specifically, things like maintenance of fluids, heat rejection loop connected to the system running at different temperatures, maintenance of pumps, etc. that are out of scope for a warranty consideration.

Proposed Solution: End users need to take responsibility for the cooling environment and maintaining consistent performance. Other than fluid specifics, operational boundaries should be consistent with air. Worth noting that operational bandwidth should be higher due to higher thermal capacity of liquid cooling compared to air. Most CPUs are only running at ~85% capacity due to self-regulating operational temperature in air. Manufacturers should provide signals that allow operators to ensure the system is operating within spec. Manufacturers should also include popular immersion-specific system modifications (e.g., different heat sink designs) in their evaluations. Known issues/modifications are well documented in "Design Guidelines for Immersion Optimized IT Equipment" publication - also references material compatibility. Consider firmware changes specific to the operating environment to affect unique operational limits.

Material/Hardware Variability - The manufacturers' own tolerances contributing to uncertainty.

Proposed Solution: Recommend an evaluation of the operational parameters of the device in immersion. Recommend testing with fluids that have the highest viscosity, lowest flow rate within the temperature limits of the system.

Logistical Complexity – For data centers in industry segments not accustomed to the use of oils and chemicals, handling warranty claims related to immersion cooling could be more complex than air cooled systems because of contact with a variety of fluids potentially in use, and may require investment in new or additional diagnostic procedures and support, potentially increasing the administrative burden and expenses. Often legal will want to see a tag identifying what fluid(s) the equipment has been in contact with.

Proposed Solution: Should include example(s) of what these complexities might be. Recommended warranty returns are received in a known state – cleaned or unmodified before sending the return. If prior approved for return, a certain amount of liquid-proof packaging should be provided by the manufacturer for returns, and customers should support cleaning of equipment before it is returned. Returns should be tagged to identify fluids that the equipment has been in contact with, including any potential chemical specifications.

Open question to look into: Are there any government regulations that may apply to shipping equipment that has been in contact with cooling liquid?

If equipment is returned where there is suspicion of operating conditions that have not been met, manufacturers may request more information from the integrator or end user to confirm that operation, fluid quality, etc. were within the specified parameters at the time of failure. Manufacturers may consider including specific requirements for verification in their warranty terms (providing fluid samples/analysis, immersion system operation logs, etc.), although may choose to only exercise these provisions on a case-by-case basis.

Non-Standard Usage – An environment with tighter thermal control may encourage some customers to operate their devices (further) outside of the standard operating guidelines, placing additional stress on non-thermal related failure modes.

Proposed Solution: Recommend independent auditable temperature monitoring and logging.

Lack of Domain Accountability - It is challenging to find specific people who are responsible for writing warranties for new and emerging technologies within manufacturing companies.

Proposed Solution: Legal and Actuary functions are critical to assessing risk and mitigating both for the manufacturer and the buyer. As company fiduciaries these staffers must get these docs drafted and passed through so products can be compelling in the marketplace.

Lawsuits and Litigation - Risk of exposure to legal liability related to risk of chemical exposure.

Proposed Solution: Occupational risk exists for all ITE cooling methods, including air. Proper personnel training helps to mitigate risk severity and likelihood. PPE should be mandatory and will significantly reduce the risk of exposure. For most operating systems, slips, splashes, and equipment droppage (poor grip) are going to be the most common issues but this varies greatly.

Lack of Contextual Awareness - For data centers in industry segments not accustomed to the use of oils and chemicals, understanding of the magnitude of (or lack of) risks involved.

Proposed Solution: Recommend best practices from adjacent industries that use fluids with similar or equivalent composition, e.g., specialty chemicals, fuels, petroleum, lubricants, transformer oils, etc. other industries that have used industrial coolants for decades.

4. Glossary

Many terms are used in warranties to accelerate broad and rapid consensus between contracting parties. We have sought to normalize terminology with a harmonized OCP Immersion glossary, so we maintain a consistent set of terms across the Immersion project documentation set. The most recent definitions can be found here

https://docs.google.com/spreadsheets/d/1jk0-xSvULP8gyxGE9eCVuDAdRji4R_R3YUmtxkVxx3w/edit#gid=616377973

Bill of Materials (BOM)	A Bill of Materials is a comprehensive list of raw materials, components, assemblies, and other items needed to manufacture a product, along with the quantities of each.
Buyer	A person who makes a purchase of Product or Products. A significant point to note is that the Owner may not necessarily be the original Buyer, which can in some cases impact the Warranty.
Examination	An agreed upon process of post-sales inspection of possibly warrantied products by the Warrantor after the Buyer has claimed to the Warrantor that the product is defective, and the Buyer has returned said Product to Warrantor for evaluation of claims per the requirements set forth in the Sales Contract.
Express Warranty	Written guarantees made by a seller or manufacturer regarding the quality, performance, or other characteristics of a product.
Extended Warranty	A written guarantee within a service contract or protection plan, typically an optional plan that offers additional coverage beyond the express warranty provided with a product.
Manufacturer	An individual, group, or company that owns or runs a manufacturing plant.
Owner	The individual, company, or organization that has purchased and holds legal ownership. A significant point to note is that the Owner may not necessarily be the original Buyer, which can in some cases impact the Warranty.
Product	Something that is made to be sold, usually something that is produced by an industrial process or, less commonly, something that is grown or obtained through farming.
Retailer	A person, shop, or business that sells goods to the public.
Sales Contract	A contract under which Seller transfers or agrees to transfer the ownership of Product to a Buyer and the Buyer agrees to pay a price, for everything included in the contract.
Seller	A trader who offers to transfer the ownership of goods to a Buyer if the Buyer agrees to pay a price, for everything included in the Sales Contract which may or may not include a Warranty.

Statement of Warranties (SOWs)	In the context of product sales and services, a Statement of Warranties (SoWs) is a written document that outlines the specific guarantees provided by the manufacturer or seller regarding the condition, functionality, and life span of a product. Each statement must have a definition, a set of conditions, a specific event to begin Warranty coverage and a time period.
Stock Keeping Unit (SKU)	A unique alphanumeric code that is used to identify a product or service for inventory management purposes.
Supplier	A company, person, etc. that provides things that people want or need, especially over a long period of time with a set of Sales Contracts.
System Integrator (SI)	A company or individual that specializes in bringing together different subsystems into a whole and ensuring that those subsystems function together effectively.
System Operator	A System Operator is an individual or team responsible for the daily operation, maintenance, monitoring and continuity of a system.
Warrantied Product	A product that is covered by a warranty.
Warrantor	The entity (individual or company) that provides a warranty statement. In the context of a product or service, the warrantor offers assurance that a product and/or service will meet certain documented standards or that it will perform as described.
Warranty	A written promise from a company to repair or replace a Product that develops a fault within a particular period of time, or to do a piece of work again if it is not satisfactory
Warranty Period	The period of time during which the warrantor is liable for repair or replacement of any defective part of the Warrantied Product as performed under the Sales Contract.
Warranty Statement	Any written statement provided by Seller to the purchasers of products manufactured by Seller, setting forth warranties, guaranties, rights of return, rights of credit, exclusions or other indemnities issued in respect of such manufactured products. *Sample: Seller warrants that Product(s) furnished pursuant to this Contract shall, when used in accordance with the Product documentation, be able to accurately process date/time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000, including leap year calculations.*

5. References

OCP Base Specification for Immersion Fluids, Revision 1.0:
https://www.opencompute.org/documents/ocp-base-specification-for-immersion-fluids-20221201-pdf

OCP Immersion Requirements, Revision 2.10:
https://www.opencompute.org/documents/ocp-acs-immersion-requirements-rev-2-v1-00-pdf

OCP Immersion Project: on-going projects information (see wiki for details):
https://www.opencompute.org/wiki/Cooling_Environments/Immersion

OCP Material Compatibility in Immersion Cooling, Revision 1.0
https://www.opencompute.org/documents/material-compatibility-in-immersion-cooling-document-version-1-0-nov-28-2022-1-pdf

Cambridge Dictionary
https://dictionary.cambridge.org/us/dictionary/english/product

Law Insider Dictionary
https://www.lawinsider.com/dictionary/

6. Schedule of Warranties

For the table of immersion industry warranty data, we suggest specific metadata field names we are tracking by manufacturer including;

1) Manufacturer Trade Name
2) Manufacturer Legal Name
3) Manufacturer DUNS
4) Manufacturer Part #
5) Product SKU
6) Product Type and Subtype
    a) System (Aggregate of products)
    b) Integrated Circuit (IC)
        i) Central Processing Unit CPU
        ii) Graphic Processing Unit GPU
        iii) Network Processing Unit NPU
            (1) Network Interface Card NIC
        iv) Basic Input/Output System BIOS
        v) Random Access Memory RAM
    c) Motherboard
    d) Daughtercard
    e) Power Supply
    f) Storage Unit
        i) Hard Disk Drive HDD
        ii) Solid State Drive SSD
    g) Other Component
        i) Cable
            (1) Data
            (2) Power
7) Standard Warranty Begins
8) Standard Warranty Duration Years
9) Standard Warranty Duration Months
10) Standard Warranty Duration Days
11) Standard Warranty URL location
12) Standard Warranty limitations
13) Standard Warranty inclusions
14) Standard Warranty Country USA
15) Extended Warranty Begins
16) Extended Warranty Duration Years

17) Extended Warranty Duration Months
18) Extended Warranty Duration Days
19) Extended Warranty URL location
20) Extended Warranty limitations
21) Extended Warranty inclusions
22) Extended Warranty Cost USD

7. Warranty Statement Template

7.1 Coverage Scope:

Manufacturer [Company Name] ("Manufacturer") warrants that the [Product Name] ("Product") is free from defects in materials and workmanship under normal use and service for a period of [Warranty Duration] from the date of purchase. Normal usage is considered 24/7/365 usage for 2/3/5/7/9 years of continuous cooling in a coolant approved by the manufacturer. The approved coolants are;

- Brand X Product Y Model Z Revision x.x

7.2 What Is Covered:

This warranty covers any malfunction or failure of the Product's components resulting from manufacturing defects, provided that the Product has been used, maintained, and installed in accordance with the Manufacturer's guidelines.

- Safety Guidelines
- Coolant guidelines
- Install guidelines
- Maintenance guidelines
- Decommissioning guidelines

7.3 What Is Not Covered:

This warranty does not cover damage or malfunctions resulting from:

- Misuse, abuse, or neglect
- Unauthorized modifications or repairs
- Improper installation or maintenance
- Accidents, natural disasters, or power surges
- Non-compliance with Manufacturer's guidelines

7.4 Warranty Claims:

To initiate a warranty claim, the customer must:

- Contact Manufacturer's Customer Support within the warranty period
- Provide proof of purchase (receipt or invoice)
- Follow the instructions provided by Customer Support

7.5 Warranty Remedies:

If a valid warranty claim is approved by Manufacturer, the remedies may include:

- Repair of the Product using new or refurbished parts
- Replacement of the Product with a new or refurbished unit
- Refund of the purchase price, at Manufacturer's discretion

7.6 Transferability:

This warranty is non-transferable and applies only to the original purchaser of the Product.

7.7 Limitations:

To the extent permitted by law, Manufacturer's liability under this warranty is limited to the cost of repair, replacement, or refund, as specified above. Manufacturer shall not be liable for any incidental or consequential damages.

7.8 Governing Law:

This warranty is governed by the laws of [Jurisdiction]. Any disputes arising from this warranty shall be resolved in [Jurisdiction]'s courts.

7.9 Contact Information:

For warranty claims and inquiries, please contact Manufacturer's Customer Support:

- Manufacturer Phone: [Customer Support Phone Number]
- Manufacturer Email: [Customer Support Email Address]
- Manufacturer Website: [Manufacturer Website]
- System Integrator Phone: [Customer Support Phone Number]
- System Integrator Email: [Customer Support Email Address]
- System Integrator Website: [Manufacturer Website]
- Reseller Phone: [Customer Support Phone Number]
- Reseller Email: [Customer Support Email Address]
- Reseller Website: [Manufacturer Website]

Schedule A: Products immersed

Manufacturer Trade Name	Manufacturer Legal Name	Manufacturer DUNS	Manufacturer Part #	Product SKU	Product Type and Subtype	Standard Warranty Begins	Standard Warranty Duration Years	Standard Warranty Duration Months	Standard Warranty Duration Days	Standard Warranty URL location	Standard Warranty limitations	Standard Warranty inclusions	Standard Warranty Country USA	Extended Warranty Begins	Extended Warranty Duration Years	Extended Warranty Duration Months	Extended Warranty Duration Days	Extended Warranty URL location	Extended Warranty limitations	Extended Warranty inclusions	Extended Warranty Advisory Cost as USD	Extended Warranty Advisory Cost as Percentage
3M	3M Company	6173082	[none]	[none]	System	invoice date							USA								$10,000	3%
Alibaba	Alibaba China Technology Co Ltd		[none]	[none]	System	invoice date							USA								$10,000	3%
Asperitas	Aecorsis BV		[none]	[none]	System	invoice date							USA								$10,000	3%
ByteDance	Bytedance Ltd		[none]	[none]	System	invoice date							USA								$10,000	3%
Cargill	Cargill, Incorporated.	6249189	[none]	[none]	System	invoice date							USA								$10,000	3%
Chemours	The Chemours Company	79479503	[none]	[none]	System	invoice date							USA								$10,000	3%
Coolit	Coolit Systems Inc.		[none]	[none]	System	invoice date							USA								$10,000	3%
Dell	Dell		[none]	PowerEdge C6520	System	invoice date																
ElectroCool	Engineered Fluids		[none]	[none]	System	invoice date							USA								$10,000	3%
GRC	Green Revolution Cooling, Inc.		[none]	[none]	System	invoice date							USA								$10,000	3%
IBM	INTERNATIONAL BUSINESS MACHINES CORPORATION	809375298	[none]	[none]	System	invoice date																
Iceotope	Iceotope Technologies Limited		[none]	[none]	System	invoice date							USA								$10,000	3%
Intel	Intel Corporation	947897855	[none]	[none]	System	invoice date																
LiquidCool	LiquidCool Solutions		[none]	[none]	System	invoice date							USA								$10,000	3%
LiquidStack	LiquidStack Holding B.V.		[none]	[none]	System	invoice date							USA								$10,000	3%
Lubrizol	Lubrizol Corporation		[none]	[none]	System	invoice date							USA								$10,000	3%
Opticool	DSI Ventures, Inc.		[none]	[none]	System	invoice date							USA								$10,000	3%
Shell	Shell		[none]	[none]	System	invoice date							USA								$10,000	3%
Solvay	Solvay SA	130868656	[none]	[none]	System	invoice date							USA								$10,000	3%
Submer	Submer Tecnologies, S.L.		[none]	[none]	System	invoice date							USA								$10,000	3%
Supermicro	SUPER MICRO COMPUTER, INC.	809102239	[none]	[none]	System	invoice date	###	###	###	http	CPU	adva	USA	invoice date	0003	0036	1095	http	CPU	adva	$10,000	3%
TMGCore	TMGcore, Inc		[none]	[none]	System	invoice date							USA								$10,000	3%
UL	UL LLC	78351534	[none]	[none]	System	invoice date							USA								$10,000	3%
Wiwynn	Wiwynn Corporation		[none]	[none]	System	invoice date							USA								$10,000	3%
more here	more here	more here	more here	more here	more here	more here	more	more	more	more	more	more	more here	more here	more here	more here	more here	more	more	more	more here	
					System	upon receipt	###	###	###						0001	0012	0090				$ 1,000	
					IC - CPU	on power up	###	###	###						0002	0018	0180					
					IC - GPU	on first doll	###	###							0003	0024						
					IC - NPU	invoice date																
					IC - BIOS																	
					RAM																	
					Motherboard																	
					Daughtercard																	
					Power Supply																	
					Storage - HDD																	
					Storage - SDD																	
					Cable - Data																	
					Cable - Power																	

Schedule B: Warranty commodity codes

Commodity_UN	Commodity Name_UN
40151575	Brushless coolant pump
25174004	Engine coolant
43202222	Computer cable
43202217	Computer cable holder
41121521	Automated liquid handling system accessories
39121420	Liquid tight connectors
41121501	Robotic or automated liquid handling systems
41112412	Pressure gauge
41111954	Liquid sensor
43201830	Solid state drive SSD
43201513	Motherboards
43201503	Central processing unit CPU processors
43201402	Memory module cards
43201404	Network interface cards
43211502	High end computer servers
43211501	Computer servers
43211520	Barebone computer
43201401	Graphics or video accelerator cards
43201411	Peripheral component interconnect PCI card
43201834	Storage device controller
43201803	Hard disk drives
43201802	Hard disk arrays
43201507	Daughterboards
43201414	Hard disk protector
41112407	Liquid level controls or instruments
60104713	Liquid expansion apparatus
43201531	Video capture boards
43222612	Network switches
43201416	Data acquisition board
43211610	Computer country or localization kits
43221721	Radio frequency data communication equipment
43221704	Radio core equipment
43222619	Video networking equipment
43201559	Serial port cards
43201409	Wireless network interface cards
43201403	Modem cards
43222604	Content delivery networking equipment
43222615	Storage area network SAN switch
43201560	Coprocessor
43201522	Parallel port cards
43222642	Routing switcher
41113329	Suspended solids SS tester
41113319	Water analyzers
41113314	Oil content monitors analyzers
43201552	Hardware or telephony adapters
43201618	Computer rack component
43223108	WLAN wireless access network equipment and components
43223107	WLAN mobile core network equipment and components
43201609	Storage device trays or assemblies
43201608	Removable drive frames
43202010	Pen or flash drive
43201610	Backplane or panels or assemblies
43201605	Expanders
43201604	Electronic equipment bays or baskets
43201603	Chassis stacking components
43201602	Network equipment chassis
43201601	Computer chassis
43201407	Peripheral controller cards
43201406	Optical network transmit cards
43201405	Optical network receive cards
41111932	Liquid leak detectors
43222607	Cache engine equipment
43221724	Time synchronized generator
43211617	Universal serial bus USB extension cable
43211614	Bluetooth universal serial bus USB adapter
43201835	Network attached storage NAS device
43201557	Redundant array of independent disks RAID controllers
43201410	Switch ports or cards
43222622	Server load balancer
43222609	Network routers
43222605	Network gateway
43201415	Subscriber identity module SIM card
43201558	Fibre channel controller

Schedule C: Warranty Map

Warranty Map for Immersion Cooled Systems	DES	MFR	AFR	DIS	RES	INT	OPS	AUD	INS	BUY
Asset Category	Designer	Manufacturer	Authorized Factory/Refinery	Distributor	Reseller	Integrator	Operator	Auditor	Insurer	Buyer
Processing Systems	ServerSystem									
CPUs										
GPUs										
NPUs										
ASICs										
Memory										
Storage										
Management										
Security										
Cables & Connectors										
Tax, Ship, Install										
Power Systems	ServerPower									
Power Shelf										
Sensors										
Management										
Cables & Connectors										
Tax, Ship, Install										
Cooling Systems	ServerCooling									
Coolant										
Sensors										
Management										
Cables & Connectors										
Tax, Ship, Install										
Network Systems	ServerNetwork									
Switch Port										
Transmitters										
Management										
Cables & Connectors										
Tax, Ship, Install										

About Open Compute Project

The Open Compute Project (OCP) is a collaborative Community of hyperscale data center operators, telecom, colocation providers and enterprise IT users, working with the product and solution vendor ecosystem to develop open innovations deployable from the cloud to the edge. The OCP Foundation is responsible for fostering and serving the OCP Community to meet the market and shape the future, taking hyperscale-led innovations to everyone. Meeting the market is accomplished through addressing challenging market obstacles with open specifications, designs and emerging market programs that showcase OCP-recognized IT equipment and data center facility best practices. Shaping the future includes investing in strategic initiatives and programs that prepare the IT ecosystem for major technology changes, such as AI & ML, optics, advanced cooling techniques, composable memory and silicon. OCP Community-developed open innovations strive to benefit all, optimized through the lens of impact, efficiency, scale and sustainability.

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