

Castrol ON single phase immersion cooling fluids: Checklist and general troubleshooting



This checklist is designed to help data centre operators prepare for the installation and use of Castrol immersion cooling fluids in their systems. It covers key considerations and actions that, if followed, can help prevent common issues seen in deployments. While specific advice will vary, this guide serves as a broad framework to ensure system reliability and fluid compatibility.

1. General Preparations

i. Material Compatibility

- Ensure that all IT equipment and immersed components (e.g., servers, cabling, connectors) are evaluated for **material compatibility** with immersion cooling.
- Confirm that thermal interface materials (TIMs), gaskets, seals, and other materials are suitable for long-term exposure to Castrol DC fluids.

Note: Castrol offers **testing services** prior to deployment to ensure system compatibility with their fluids.

ii. Installation Compliance

- Verify that the **immersion cooling tank** is installed in accordance with the **manufacturer's manual**.
- Ensure all **electrical connections** and **plumbing** (e.g., fluid inlet/outlet) meet regulatory standards and the manufacturer's guidelines.
- Obtain **approval** from your facilities team or certified specialists to verify that installation complies with local regulations and safety standards.

iii. IT Equipment Preparation

- Confirm that all **cables and connectors** used within the immersion cooling system are specifically tested and approved for use in a submerged environment.
- Remove non-immersion-rated materials, such as **incompatible thermal pastes**, before filling the tank.

iv. System Cleanliness

- Ensure the immersion cooling system has been thoroughly **cleaned** and is free of any **contamination**, debris, or residual fluids.
- Follow manufacturer guidelines to properly **flush the tank, CDU (Coolant Distribution Unit), and HX (Heat Exchanger)** to eliminate contaminants or previous fluids.

2. Fluid Handling and Sampling

i. Fluid Sampling:

- Take fluid samples** at two critical points:
 - **After filling the system** but before submerging IT equipment.
 - **After submersion** of IT equipment to check for contamination or changes in the fluid.

ii. Fluid Storage and Handling:

- Store Castrol DC fluids in a **clean, temperature-controlled** environment.
- Ensure fluid-handling equipment (e.g., hoses, containers) is free from debris and other contaminants before introducing fluid into the system.

3. Detailed Step-by-Step Procedures

i. Pre-Filling Tank and Equipment Check:

Tank Preparation

- Verify the tank is completely empty of any residual fluids, oils, or particles.
- Follow manufacturer instructions for cleaning, typically involving flushing the tank and all associated piping (CDU, HX, etc.).
- Check for any signs of corrosion or damage within the tank, and address as necessary.

Fluid Compatibility Check

- Ensure IT equipment, including all critical components (such as **thermal interface materials**), is fully **compatible** with the Castrol DC fluid. If in doubt, request a **compatibility test** from Castrol.

ii. During the Filling Process:

Fluid Filling

- Fill the tank slowly to minimise the introduction of air bubbles into the system.
- Once the fluid is in the tank, allow time for any suspended particles to settle or to be filtered out.

Sampling During Filling

- After the tank is filled but before IT immersion, take a **sample** of the fluid for testing. Look for contaminants, particulate matter, or unexpected chemical reactions.

iii. Submersion of IT Equipment:

Preparation Before Submerging

- Ensure IT equipment has undergone all necessary checks, including:
 - Removal of incompatible **thermal pastes**.
 - Ensuring **connectors** and cables are rated for submersion.
- Confirm that **all components** to be immersed are in optimal operating condition.

Post-Submersion Sampling

- After the IT equipment is submerged, take another **fluid sample** to verify the condition of the fluid. Look for any changes, such as discoloration or foreign particles.

4. Post-Installation and Operational Checks

i. Fluid Maintenance:

- Set up a **regular schedule** for fluid monitoring, including routine **fluid sampling** and **analysis** to ensure the ongoing health of the fluid.
- Follow manufacturer guidelines for **fluid replacement** intervals to avoid degradation over time.

ii. System Performance Monitoring:

- Continuously monitor system performance, particularly **thermal performance** and fluid flow rates, to ensure the cooling system is functioning efficiently.
- Be aware of signs of system degradation such as **increased temperatures**, reduced cooling performance, or visual changes in the fluid.

iii. Component Wear and Tear:

- Regularly inspect **immersed components** for signs of wear, corrosion, or material degradation.
- Schedule periodic maintenance to check the condition of **pipings**, the **CDU**, and other fluid-handling components.

5. Common Issues to Avoid

- ✓ Ensure all thermal paste on IT components is replaced with materials rated for immersion cooling.
- ✗ Avoid deploying systems where cables and connectors haven't been tested for fluid submersion.
- ✗ Prevent system contamination by cleaning all tanks and CDUs thoroughly before filling.
- ✓ Double-check material compatibility for all submerged components to avoid equipment failure due to incompatible materials.

By following this checklist, data centre operators can significantly reduce the likelihood of issues related to fluid contamination, material compatibility, and improper installation. This proactive approach should help ensure smooth operation and extend the life of both the IT equipment and the cooling fluid.



For any additional information or concerns, please contact your Castrol representative or reach out via email at liquidcooling@bp.com.

Troubleshooting

The following table summarises the potential risks, barriers and actions for handling the thermal management fluid at the customer site as technical support guide for troubleshooting any issues with the fluid quality or performance:

Topic	Risk	Barrier	Action
Contaminated/ off-spec product goes into IT equipment	The fluid may contain impurities or additives that can affect the electrical conductivity, corrosion resistance, or heat transfer capacity of the fluid.	Filtration & testing	Ensure that the fluid is filtered and tested before filling the IT equipment. Please refer to the system cleaning section in the checklist and follow manufacturer guidelines to properly flush the tank, CDU (Coolant Distribution Unit), and HX (Heat Exchanger) to eliminate contaminants or previous fluids.
Remaining fluid, water, or cleaning solution in the tank (First Fill)	The fluid may be diluted or contaminated by the residual substance in the tank, which can alter its properties and performance.	Flushing	Always follow the tank manufacturer's filling procedure when adding Castrol ON Immersion Cooling Fluids to your system. The tank and system should be clean and pre-inspected to avoid contamination (see Pre-Filling Tank and Equipment Check in the checklist.)
Top up or replace previous fluid in the tank from competitor. Mixability and contamination.	The fluid may not be compatible or miscible with the previous fluid in the tank, which can cause phase separation, precipitation, or degradation of the fluid.	Lab test before topping up our fluid	Take representative samples of the existing fluid in the tank and send them to the lab for testing. The lab will determine the compatibility and mixability of the fluid with our product and advise on the best course of action. Do not top up or replace the fluid without the lab approval.
Wrong product used put into the tank	The fluid may not have the intended properties or performance for the application, which can damage the IT equipment or compromise the cooling efficiency.	Clear labelling, segregation of product	Check the label of the fluid before putting it into the tank. Make sure that the fluid matches the product name, code, and batch number on the delivery note. Store the fluid separately from other products and avoid any confusion or mix-up.

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