

Software Requirements Specification (SRS) for Normal/General Mode

System Name: Direct Liquid Cooling (DLC) In-Row

Module: Normal/General Mode

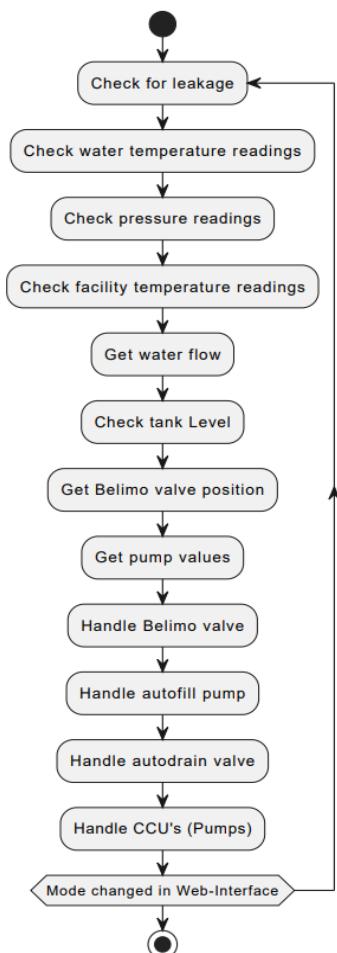
Version: 1.0

Date: May 30, 2025

Author: Prateek Bawane

1. Introduction

Normal Mode



1.1 Purpose

This document defines the functional and non-functional software requirements for the Normal Mode operation of a Direct Liquid Cooling (DLC) system. It details how system components are monitored and controlled during standard operation.

1.2 Scope

The specification covers:

- Sensor data validation
- Valve and pump operation
- Web interface-triggered state changes
- Sequential control logic for temperature, pressure, and fluid handling

1.3 Definitions

- **Belimo Valve:** Electrically actuated control valve
- **CCU:** Central Control Unit
- **Autofill Pump:** Adds coolant when levels are low
- **Autodrain Valve:** Removes coolant under specific conditions

2. System Overview

Normal Mode refers to the standard operation state where the DLC system is fully functional and continuously monitors and controls the cooling environment based on sensor inputs and predefined logic.

3. Functional Requirements

3.1 Leak Detection

- **FR1.1:** On entering Normal Mode, the system shall first check for leakage.
- **FR1.2:** If leakage is detected, the system shall prevent further operation and raise an alarm.

3.2 Sensor Monitoring

- **FR2.1:** The system shall read water temperature sensors.
- **FR2.2:** The system shall read pressure sensors.
- **FR2.3:** The system shall read facility temperature sensors.
- **FR2.4:** The system shall measure water flow.

- **FR2.5:** The system shall check tank water levels.

3.3 Component Status Evaluation

- **FR3.1:** The system shall retrieve the position of the Belimo valve.
- **FR3.2:** The system shall get current pump values (operational status, speed, etc.).

3.4 Component Control

- **FR4.1:** The system shall actuate the Belimo valve based on thermal and flow requirements.
- **FR4.2:** The system shall activate the autofill pump when tank level is below threshold.
 - The filling pump has the function of maintaining the static pressure of the system (low pressure zone) within limits adjacent to those determined by the customer at the commissioning phase. Normally the system static pressure (with all the pumps off) should be around 1bar (+/-0,5bar).
 - The refill pump will fill the system with coolant when the pressure drops below a limit (e.g. Hysteresis refill pressure=-0,2bar below the static pressure set by the customer), and fill the system to the pressure set by the customer. This value of 0,2bar should be verified in the laboratory and increased or decreased if necessary.
 - The refill pumps should be activated for at least a few seconds per day to avoid deposits created by the Propylene Glycol that could block the pump.
- **FR4.3:** The system shall open the autodrain valve when draining criteria are met.
- **FR4.4:** The system shall coordinate CCU-controlled pumps as per thermal demand and system configuration.

3.5 Web Interface Interaction

- **FR5.1:** A mode change initiated through the web interface shall override current operations and reinitialize the mode logic.

4. Non-Functional Requirements

4.1 Performance

- Sensor read and control action loop must complete within 5 seconds.
- System must respond to web interface commands within 1 second.

4.2 Reliability

- All critical sensors must have redundancy or fallback mechanisms.

4.3 Maintainability

- All sensor readings and valve/pump actions must be logged with timestamps.

4.4 Usability

- Clear status indicators and fault logs should be accessible via the web interface.

5. Flow Summary

The Normal Mode follows this sequence:

1. **Leak check**
 2. **Sensor data acquisition** (temperature, pressure, flow, level)
 3. **Component status collection** (valves, pumps)
 4. **Component control** (valves, pumps)
 5. **System state update via web interface**
-