Software Requirements Specification (SRS) for Boot Mode

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

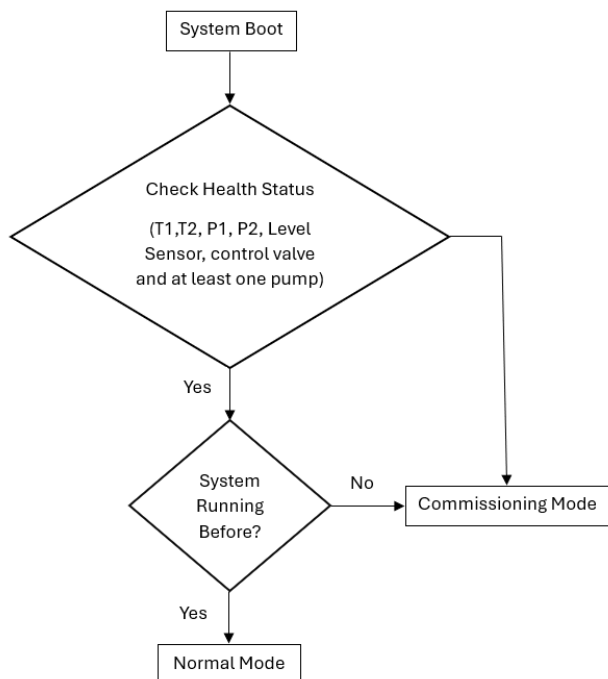**Module: Boot Mode**

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Author : Prateek Bawane

1. Introduction

Boot Mode

Internal

1.1 Purpose

This document specifies the software requirements for the Boot Mode in a Direct Liquid Cooling (DLC) system. The Boot Mode is a critical part of the system startup process and determines how the cooling infrastructure resumes operation after a shutdown or power cycle.

1.2 Scope

The scope covers:

- Configuration management during bootup
- System health check logic
- Mode determination (cold start or warm start)
- Manual and automatic control of pumps during boot
- Fail-safe behavior to avoid cooling losses

1.3 Definitions

- **CCU:** Central Control Unit
- **Boot Mode:** System behavior during power-up or restart
- **Health Status:** Operational readiness of system components
- **Decommissioning Mode:** A reset state for system reconfiguration
- **T1/T2, P1/P2, Tank (Level sensor) and pumps:** Sensors and components indicating system readiness

2. Overall Description

2.1 Product Perspective

Boot Mode is integrated into the firmware of the DLC control system. It interacts with CCU configurations, pump controls, sensor data, and system health diagnostics.

2.2 User Needs

- Automatic recovery after restart without manual reconfiguration
- Safe and efficient transition to normal operation
- Manual override for testing and diagnostics

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3. Functional Requirements

3.1 Configuration Management

- **FR1.1**: CCU configuration shall be saved and restored across system reboots.
- **FR1.2**: On boot, the system shall load saved configuration unless a new CCU is added, in which case a new configuration process shall be triggered.

3.2 Boot Context Recognition

- **FR2.1**: System shall maintain a bit-flag identifier ~~to determine if the last shutdown was clean or if this is the first startup.~~ as an indication if the system was running before.
- **FR2.2**: This bit-flag shall reset upon entering decommissioning mode.

> **Commented [PS1]:** in general this bit is just an indication if the system was running before or not. It doesn't make a difference between a clean or not clean shutdown.

3.3 Health Status Evaluation

- **FR3.1**: System shall evaluate component readiness during boot using the following:
  - T1, T2: Temperature sensors (Should be connected and working)
  - P1, P2: Pressure sensors (Should be connected and working)
  - Tank: Fluid level sensor (Tank should not be empty)
  - Control Valve status (Valve should be connected and working)
- **FR3.2**: If all components are operational and at least one pump is functional, system shall enter Normal Mode.
- **FR3**.3: If Check Health Status fails, system shall enter ~~Decommissioning~~ Commissioning Mode

> **Commented [PS2]:** Maybe more detailed: T1, T2 ,P1, P2, are connected; Tank is != 0; Control Valve connected

> **Commented [PS3]:** Commisioning Mode

3.4 Mode Handling

- **FR4.1**: If the system was running previously and did not shut down properly, it shall skip full initialization and resume Normal Mode directly to prevent cooling interruption.
- **FR4.2**: If conditions are not met, system shall enter ~~Decommissioning~~ Commissioning Mode

> **Commented [PS4]:** Commisioning

~~3.5 Manual Pump Control~~

- ~~**FR5.1**: Operator shall be able to activate pumps manually for a defined time period via the user interface.~~

> **Commented [PS5]:** during commissioning mode the user has manual control over the hole system. This time period things are just some smaller extra feature like other Routines

> **Commented [PP6R5]:** @Philipp Schneider Should I remove this?

> **Commented [PS7R5]:** I guess it is located in the commissioning mode not the boot mode

> **Commented [PP8R5]:** Ok @Philipp Schneider removing then

4. Non-Functional Requirements

4.1 Reliability

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- System must ensure safe operation even in the event of incomplete or unexpected shutdown.

4.2 Performance

- Boot sequence must complete within 60 seconds under nominal conditions.

4.3 Maintainability

- Configuration and health evaluation logs must be persisted for diagnostics.

4.4 Usability

- Clear status indicators must inform the operator of the current boot mode and system health.

5. Assumptions and Constraints

- The system hardware (sensors, pumps, CCUs) are correctly installed and functioning.
- Firmware must comply with safety and redundancy standards for cooling systems.
- All configurations are stored in non-volatile memory.

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