

Requirements Toolbox Report

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Chapter 1: Requirement Set: BMS_SRS

Description

Software Requirements Document "Battery Management System (BMS)"

1. Introduction

1.1 Purpose

This document defines the software requirements for the Battery Management System (BMS). The BMS ensures safe, efficient, and reliable operation of a battery module comprising multiple cells.

1.2 Scope

The BMS software interfaces with the charger, inverter, and precharge circuit. It manages battery state estimation, fault detection, balancing, charging, discharging, and power distribution. The system supports a 3-cell battery pack.

1.3 Definitions, Acronyms, and Abbreviations

- * BMS: Battery Management System
- * SOC: State of Charge
- * SOH: State of Health
- * Vfb: Vehicle Feedback Interface
- * Stateflow: MATLAB tool for state machine modeling
- * Precharge Circuit: Safely charges capacitors on system startup

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 84 | 0 | 0 | 84 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 84 | 0 | 0 | 0 | 0 | 84 |

Change Information [Change issue\(s\) found in 22 requirement\(s\).](#)

1 General Requirements

Requirement Type Container

ID #1

Description

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 11 | 0 | 0 | 11 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 11 | 0 | 0 | 0 | 0 | 11 |

1.1 Battery Module Management

Requirement Type Container

ID #2

Description

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 2 | 0 | 0 | 2 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 2 | 0 | 0 | 0 | 0 | 2 |

1.1.1 Battery_No

Requirement Type Functional

ID #3

Description

The BMS shall manage the operation of a 3-cell battery module.

Change Information No change issue detected.

Links

Artifact [BMS_CYRS.slreqx](#)

 [Battery Module Operation](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

1.1.2 Battery_Limit

Requirement Type Functional

ID #4

Description

The battery voltage shall operate within the range of 9V to 16.8V, in accordance with the safe operating limits of 3.0V - 4.2V lithium-ion battery cells.

Change Information [Change issue detected.](#)

Links

Artifact [BMS_CYRS.slreqx](#)

 [Voltage Thresholds](#) (⇒Related to)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

1.2 Safety and Efficiency

Requirement Type Functional

ID #5

Description

The BMS shall detect and protect the battery from unsafe conditions such as over-voltage, under-voltage, over-temperature, and short circuits.

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 7 | 0 | 0 | 7 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 7 | 0 | 0 | 0 | 0 | 7 |

1.2.1 Over-voltage

Requirement Type Functional

ID #6

Description

Over-voltage: 4.2V per cell (total 12.6V).

Change Information No change issue detected.

Links

Artifact [BMS_CYRS.slreqx](#)

 [Voltage Thresholds](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

1.2.2 Under-voltage

Requirement Type Functional

ID #7

Description

Under-voltage: 3.0V per cell (total 9.0V).

Change Information No change issue detected.

Links

Artifact [BMS_CYRS.slreqx](#)

 [Voltage Thresholds](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

1.2.3 Over-temperature

Requirement Type Functional

ID #8

Description

Over-temperature: 60°C.

Change Information No change issue detected.

Links

Artifact [BMS_CYRS.slreqx](#)

 [Environmental Limitations](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

1.2.4 Under-temperature

Requirement Type Functional

ID #9

Description

Under-temperature: -10°C.

Change Information No change issue detected.

Links

Artifact [BMS CYRS.sreqx](#)

 [Environmental Limitations](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

1.2.5 Charging Over-Current

Requirement Type Functional

ID #10

Description

Charging Over-Current shall not exceed 15A maximum.

Change Information No change issue detected.

Links

Artifact [BMS CYRS.sreqx](#)

 [Current Thresholds](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

1.2.6 Discharging Over-Current

Requirement Type Functional

ID #11

Description

Discharging Over-Current shall not exceed 30A maximum.

Change Information No change issue detected.

Links

Artifact [BMS CYRS.sreqx](#)

 [Current Thresholds](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

1.3 System Interfaces

Requirement Type Container

ID #12

Description

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 2 | 0 | 0 | 2 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 2 | 0 | 0 | 0 | 0 | 2 |

1.3.1 Charging and Discharging

Requirement Type Functional

ID #13

Description

The BMS shall regulate charging and discharging processes to maximize efficiency and extend battery life.

Change Information [Change issue detected.](#)

Links

Artifact [BMS_CYRS.slreqx](#)

 [Charge and Discharge Regulation](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

1.3.2 System Interfaces

Requirement Type Functional

ID #22

Description

The BMS shall provide robust interfaces to support integration with external systems, including but not limited to chargers, inverters, and precharge circuits.

Change Information [Change issue detected.](#)

Links

Artifact [BMS_CYRS.slreqx](#)

 [External System Interface](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

2 Functional Interfaces**Requirement Type** Container**ID** #23**Description****Change Information** No change issue detected.**Implementation Status**

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 13 | 0 | 0 | 13 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 13 | 0 | 0 | 0 | 0 | 13 |

2.1 BMS INPUTS**Requirement Type** Container**ID** #14**Description**

BMS INPUTS

| Port Interface | Data Element | Type | Units | Description |
|-----------------|--------------|---------|-------|------------------------------|
| VfbStateRequest | StateRequest | Enum | - | Request from vehicle network |
| VfbCellVoltages | CellVoltage | Float32 | V | Voltage of each cell |

| | | | | |
|--------------------------|-----------------------|------------|----|-------------------------------|
| VfbCellTemperatures | CellTemperature | Floating32 | °C | Temperature of each cell |
| VfbPackVoltage | TotalPackVoltage | Floating32 | V | Total voltage of battery pack |
| VfbPackCurrent | PackCurrent | Floating32 | A | Current flowing through pack |
| VfbChargerVoltageOutput | ChargerOutputVoltage | Floating32 | V | Output voltage from charger |
| VfbInverterVoltageOutput | InverterOutputVoltage | Floating32 | V | Output voltage to inverter |

Change Information No change issue detected.

Implementation Status

| | | | |
|-------|-------------|-----------|------|
| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|

| | | | |
|---|---|---|---|
| 7 | 0 | 0 | 7 |
|---|---|---|---|

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 7 | 0 | 0 | 0 | 0 | 7 |

2.1.1 State Request

Requirement Type Functional

ID #15

Description

The BMS shall accept a State Request from the vehicle network to define the operational state.
(State: Balancing-Charging-Driving)

| Name | Data Element | Data Type | Unit | Range |
|-----------------|--------------|-----------|------|---------|
| VfbStateRequest | StateRequest | Enum | - | [0 : 2] |

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

2.1.2 Cell Voltages

Requirement Type Functional

ID #16

Description

The BMS shall receive individual voltage measurements for each cell block (cells in series) at sample rate of 10KHz.

| Name | Data Element | Data Type | Unit | Range | Dimensions |
|-----------------|--------------|-----------|------|-------------------|------------|
| VfbCellVoltages | CellVoltage | Float32 | V | 0V to 5V per cell | # Cells |

Change Information No change issue detected.

Links

Artifact [BMS_CYRS.slreqx](#)

 [Real-Time Monitoring](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
|-------|-------------|-----------|------|

| | | | |
|---|---|---|---|
| 1 | 0 | 0 | 1 |
|---|---|---|---|

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

2.1.3 Cell Temperatures

Requirement Type Functional

ID #17

Description

The BMS shall receive temperature readings for each cell block (cells in series) at sample rate of 10KHz.

| Name | Data Element | Data Type | Unit | Range | Dimensions |
|---------------------|-----------------|-----------|------|---------------|------------|
| VfbCellTemperatures | CellTemperature | Float32 | °C | -10°C to 60°C | # Cells |

Change Information [Change issue detected.](#)

Links

Artifact [BMS_CYRS.slreqx](#)

 [Real-Time Monitoring](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

2.1.4 Pack Voltage

Requirement Type Functional

ID #18

Description

The BMS shall receive the total voltage of the battery pack terminals (+Ve Batt and -Ve Batt) at sample rate of 10KHz.

| Name | Data Element | Data Type | Unit | Range |
|----------------|------------------|-----------|------|------------|
| VfbPackVoltage | TotalPackVoltage | Float32 | V | 0V to 120V |

Change Information No change issue detected.

Links

Artifact [BMS_CYRS.slreqx](#)

 [Real-Time Monitoring](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

2.1.5 Pack Current

Requirement Type Functional

ID #19

Description

The BMS shall receive the total current flowing through the battery pack at sample rate of 10KHz.

- VfbPackCurrent > 0 indicates battery pack charging.
- VfbPackCurrent < 0 indicates battery pack discharging.

| Name | Data Element | Data Type | Unit | Range |
|----------------|--------------|-----------|------|-------------|
| VfbPackCurrent | PackCurrent | Float32 | A | -30A to 30A |

Change Information No change issue detected.

Links

Artifact [BMS_CYRS.slreqx](#)

 [Real-Time Monitoring](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

2.1.6 Charger Voltage

Requirement Type Functional

ID #20

Description

The BMS shall receive the charger output voltage.

| Name | Data Element | Data Type | Unit | Range |
|------|--------------|-----------|------|-------|
|------|--------------|-----------|------|-------|

| | | | | |
|-------------------------|-----------------------|---------|---|---------------|
| VfbChargerVoltageOutput | ChargerOutput Voltage | Float32 | V | -180V to 180V |
|-------------------------|-----------------------|---------|---|---------------|

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

2.1.7 Inverter Voltage

Requirement Type Functional

ID #21

Description

The BMS shall receive the inverter output voltage.

| Name | Data Element | Data Type | Unit | Range |
|--------------------------|------------------------|-----------|------|---------------|
| VfbInverterVoltageOutput | InverterOutput Voltage | Float32 | V | -180V to 180V |

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

2.2 BMS OUTPUTS

Requirement Type Container

ID #26

Description

BMS OUTPUTS

| Port Interface | Data Element | Type | Units | Description |
|------------------------|----------------------|---------|-------|---------------------------------|
| VfbStateOfCharge | StateOfCharge | Float32 | % | Calculated state of charge |
| VfbBmsOperationalState | OperationalState | Enum | - | Current operational state |
| VfbCurrentLimits | CurrentLimits | Float32 | A | Computed current limitations |
| VfbBalanceCommands | BalanceCommand | Boolean | - | Commands to balance cell charge |
| VfbChargeCurrentCmd | ChargeCurrentCommand | Float32 | A | Command current for charging |

| | | | | |
|------------------|------------------|---------|---|-------------------------------|
| VfbContactorCmds | ContactorCommand | Boolean | - | Commands to manage contactors |
|------------------|------------------|---------|---|-------------------------------|

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 6 | 0 | 0 | 6 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 6 | 0 | 0 | 0 | 0 | 6 |

2.2.1 State of Charge (SOC)

Requirement Type Functional

ID #27

Description

The BMS shall output the State of Charge (SOC) as a percentage of battery charge.

| Name | Data Element | Data Type | Unit | Range |
|------------------|---------------|-----------|------|------------|
| VfbStateOfCharge | StateOfCharge | Float32 | % | 0% to 100% |

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

2.2.2 Operational State

Requirement Type Functional

ID #28

Description

The BMS shall output the current operational state.
(State: Standby-Charging-Discharging-Fault)

| Name | Data Element | Data Type | Unit | Range |
|------------------------|------------------|-----------|------|---------|
| VfbBmsOperationalState | OperationalState | Enum | - | [0 - 3] |

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

2.2.3 Current Limits

Requirement Type Functional

ID #29

Description

The BMS shall output the calculated current limits.

| Name | Data Element | Data Type | Unit | Range |
|------------------|---------------|-----------|------|-------------|
| VfbCurrentLimits | CurrentLimits | Float32 | A | -30A to 30A |

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

2.2.4 Balancing Commands

Requirement Type Functional

ID #30

Description

The BMS shall output a Boolean array indicating the cell balancing commands.

| Name | Data Element | Data Type | Unit | Range |
|--------------------|----------------|-----------|------|-------|
| VfbBalanceCommands | BalanceCommand | Boolean | - | - |

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

2.2.5 Charge Current Command

Requirement Type Functional

ID #31

Description

The BMS shall output the current command for charging the battery.

| Name | Data Element | Data Type | Unit | Range |
|---------------------|----------------------|-----------|------|-----------|
| VfbChargeCurrentCmd | ChargeCurrentCommand | Float32 | A | 0A to 15A |

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

2.2.6 Contactor Command

Requirement Type Functional

ID #32

Description

The BMS shall output a Boolean array indicating the contactor commands.

contactor for:

- Positive pole of the Charger
- Negative pole of the Charger
- Pre-charge of the Charger

- Positive pole of the Inverter
- Negative pole of the Inverter
- Pre-charge of the Inverter

| Name | Data Element | Data Type | Unit | Range |
|----------------------|------------------|-----------|------|-------|
| VfbContactorCommands | ContactorCommand | boolean | - | - |

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3 Software Architecture

Requirement Type Functional

ID #33

Description

The BMS software shall have a modular architecture for easy maintenance and upgrades.

The BMS software shall be divided in this Modules:

1. Main State Machine
2. Current Limits Calculation
3. SOC/SOH Estimation
4. Balancing Logic

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 34 | 0 | 0 | 34 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 34 | 0 | 0 | 0 | 0 | 34 |

3.1 Main State Machine**Requirement Type** Container**ID** #34**Description**

The BMS shall execute the Main State Machine every 50 ms.

The Main State Machine has 4 main functionalities:

1. Manage the BMS status evolution on driving requests and safety
2. Calculate the correct charging mode
3. Monitors current, voltage and temperature faults for safety
4. Securely close and open the contacts to the charger and inverter

Change Information No change issue detected.**Implementation Status**

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 7 | 0 | 0 | 7 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 7 | 0 | 0 | 0 | 0 | 7 |

3.1.1 BMS Main State Machine: Interfaces**Requirement Type** Container**ID** #71**Description****Change Information** No change issue detected.**Implementation Status**

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 2 | 0 | 0 | 2 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 2 | 0 | 0 | 0 | 0 | 2 |

3.1.1.1 Inputs**Requirement Type** Functional**ID** #72**Description**

BMS MAIN STATE MACHINE INPUTS

| Port Interface | Data Element | Type | Units | Description |
|--------------------------|-----------------------|---------|-------|-------------------------------|
| VfbStateRequest | StateRequest | Enum | - | Request from vehicle network |
| VfbCellVoltages | CellVoltage | Float32 | V | Voltage of each cell |
| VfbCellTemperatures | CellTemperature | Float32 | °C | Temperature of each cell |
| VfbPackVoltage | TotalPackVoltage | Float32 | V | Total voltage of battery pack |
| VfbPackCurrent | PackCurrent | Float32 | A | Current flowing through pack |
| VfbChargerVoltageOutput | ChargerOutputVoltage | Float32 | V | Output voltage from charger |
| VfbInverterVoltageOutput | InverterOutputVoltage | Float32 | V | Output voltage to inverter |

| | | | |
|-------------------|----------------|---------------------------------|--------------------------------------|
| | | o a t 3 2 | |
| VfbCurrentLimits | CurrentLimits | F l o a t 3 2 | A Current Limits for safety |
| VfbMaxCellVoltage | MaxCellVoltage | F l o a t 3 2 | V Max Cell Voltage Limits for safety |
| VfbMaxCellVoltage | MinCellVoltage | F l o a t 3 2 | V Max Voltage Limits for safety |

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.1.1.2 Outputs

Requirement Type Functional

ID #73

Description

BMS MAIN STATE MACHINE OUTPUTS

| Port Interface | Data Element | T y p e | U n i t s | Description |
|----------------|--------------|------------------|-----------------------|-------------|
| | | | | |

| | | | | |
|------------------------|------------------|---------|---|-------------------------------|
| VfbBmsOperationalState | OperationalState | Enum | - | Current operational state |
| VfbChargeCurrentReq | ChargeCurrentReq | Boolean | - | Request to the charger |
| VfbContactorCommands | ContactorCommand | Boolean | - | Commands to manage contactors |

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.1.2 BMS State calculation

Requirement Type Functional

ID #74

Description

The Main State Machine shall support accurate state transitions between the BMS Mode (Standby - Charging - Driving - State) based on State Request, Relay Contactors States (Charger and Inverter), and Fault.

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.1.3 Charging Mode calculation

Requirement Type Functional

ID #75

Description

The Main State Machine shall support accurate state transitions between the Chargin Mode (Init - Constant Current "CC" - Constant Voltage "CV")

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.1.4 Relay Charger Commands

Requirement Type Functional

ID #76

Description

The Main State Machine shall support accurate Opening and closing for the Relays (Pre-charger, Positive, and Negative) for the Charger

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.1.5 Relay Inverter Commands

Requirement Type Functional

ID #77

Description

The Main State Machine shall support accurate Opening and closing for the Relays (Pre-charger, Positive, and Negative) for the Inverter

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.1.6 Fault Monitor Calculation

Requirement Type Functional

ID #78

Description

The Main State Machine shall detect the Faults of :

- Current Limitations "Over Current Pack Faut"
- Voltages Limitations "Over/Under Voltage Pack Faut"
- Temperature Limitaions "High/Low Cell Temperature Faut"

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.2 Current Limits Calculation

Requirement Type Functional

ID #35

Description

The BMS shall calculate current limits every 100 ms.

The Current Limit Calculation must calculate Minimum and Maximum Cell Voltage and the Current limits.

Change Information No change issue detected.

Links

Artifact [BMS CYRS.slreqx](#)

 [Current Limit Enforcement](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 5 | 0 | 0 | 5 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 5 | 0 | 0 | 0 | 0 | 5 |

3.2.1 BMS Current Limit Calculation: Interfaces

Requirement Type Container

ID #79

Description

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 2 | 0 | 0 | 2 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 2 | 0 | 0 | 0 | 0 | 2 |

3.2.1.1 Inputs

Requirement Type Functional

ID #80
Description

BMS CURRENT LIMIT CALCULATION INPUTS

| Name | Data Element | Data Type | Unit | Range |
|-----------------|--------------|-----------|------|------------------------|
| VfbCellVoltages | CellVoltage | Float32 | V | 3.0V to 4.2 V per cell |

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.2.1.2 Outputs

Requirement Type Functional

ID #81
Description

BMS CURRENT LIMIT CALCULATION OUTPUTS

| Port Interface | Data Element | Type | Units | Description |
|-------------------|----------------|---------|-------|------------------------------------|
| VfbCurrentLimits | CurrentLimits | Float32 | A | Current Limits for safety |
| VfbMaxCellVoltage | MaxCellVoltage | Float | V | Max Cell Voltage Limits for safety |

| | | | | |
|-------------------|----------------|---------------------------------|---|-------------------------------|
| | | 3 2 | | |
| VfbMaxCellVoltage | MinCellVoltage | F l o a t 3 2 | V | Max Voltage Limits for safety |

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.2.2 BMS Current Limit Calculation: Min/Max Calculation

Requirement Type Functional

ID #82

Description

The BMS shall calculate the Min/Max Voltages between cells.

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.2.3 BMS Current Limit Calculation: Charge/Discharge Current Limit

Requirement Type Functional

ID #83

Description

The BMS shall calculate the Charge/Discharge Current Limit with $\pm 0.01A$ resolution.

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.3 SOC Estimation

Requirement Type Functional

ID #36

Description

The BMS shall estimate SOC every 200 ms.

The State Of Charge Estimation shall estimate SOC with a resolution of 1% and accuracy of $\pm 3\%$. (SOC_CC, SOC_KF, SOC_EKF).

Change Information No change issue detected.

Links

Artifact [BMS_CYRS.slreqx](#)

 [SOC and SOH Estimation](#) (\Rightarrow Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 6 | 0 | 0 | 6 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 6 | 0 | 0 | 0 | 0 | 6 |

3.3.1 BMS SOC Estimation: Interfaces

Requirement Type Container

ID #84

Description

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 2 | 0 | 0 | 2 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 2 | 0 | 0 | 0 | 0 | 2 |

3.3.1.1 Inputs

Requirement Type Functional

ID #85

Description

BMS SOC ESTIMATION INPUTS

| Port Interface | Data Element | Type | Units | Description |
|----------------|--------------|------|-------|-------------|
| | | | | |

| | | | | |
|---------------------|-----------------|---------------------------------|--------|------------------------------|
| VfbCellTemperatures | CellTemperature | F l o a t 3 2 | ° C | Temperature of each cell |
| VfbCellVoltages | CellVoltage | F l o a t 3 2 | V | Voltage of each cell |
| VfbPackCurrent | PackCurrent | F l o a t 3 2 | A | Current flowing through pack |

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.3.1.2 Outputs

Requirement Type Functional

ID #86

Description

BMS SOC ESTIMATION OUTPUTS

| Port Interface | Data Element | T y p e | U n i t s | Description |
|------------------|---------------|-----------------------|-----------------------|----------------------------|
| VfbStateOfCharge | StateOfCharge | F l o a t | % | Calculated state of charge |

| | | | |
|--|--|---|--|
| | | 3 | |
| | | 2 | |

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.3.2 BMS SOC Estimation: Coulomb Counting

Requirement Type Functional

ID #87

Description

The BMS shall calculate the SOC with Coulomb Counting following the Req.

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.3.3 BMS SOC Estimation: SOC UKF

Requirement Type Functional

ID #88

Description

The BMS shall calculate the SOC with UKF following the Req.

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.3.4 BMS SOC Estimation: SOC EKF

Requirement Type Functional

ID #89

Description

The BMS shall calculate the SOC with EKF following the Req.

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.4 SOH Estimation**Requirement Type** Functional**ID** #37**Description**

The BMS shall estimate SOH every 200 ms.

The State Of Health Estimation shall estimate SOH with a resolution of 1% and accuracy of $\pm 3\%$. (SOH_CC, SOH_KF, SOH_EKF).**Change Information** No change issue detected.**Links****Artifact** [BMS_CYRS.slreqx](#) [SOC and SOH Estimation](#) (\Rightarrow Implements)**Implementation Status**

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 6 | 0 | 0 | 6 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 6 | 0 | 0 | 0 | 0 | 6 |

3.4.1 BMS SOH Estimation: Interfaces**Requirement Type** Container**ID** #90**Description****Change Information** No change issue detected.**Implementation Status**

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 2 | 0 | 0 | 2 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 2 | 0 | 0 | 0 | 0 | 2 |

3.4.1.1 Inputs**Requirement Type** Functional**ID** #91**Description**

BMS SOH ESTIMATION INPUTS

| Port Interface | Data Element | Type | Units | Description |
|---------------------|-----------------|---------|-------|------------------------------|
| VfbCellTemperatures | CellTemperature | Float32 | °C | Temperature of each cell |
| VfbCellVoltages | CellVoltage | Float32 | V | Voltage of each cell |
| VfbPackCurrent | PackCurrent | Float32 | A | Current flowing through pack |

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.4.1.2 Outputs

Requirement Type Functional

ID #92

Description

BMS SOH ESTIMATION OUTPUTS

| Port Interface | Data Element | Type | Units | Description |
|----------------|--------------|------|-------|-------------|
| | | | | |

| | | | | | |
|------------------|---------------|---------------------------------|---|----------------------------|--|
| | | | | t s | |
| VfbStateOfCharge | StateOfCharge | F l o a t 3 2 | % | Calculated state of charge | |

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.4.2 BMS SOH Estimation: Coulomb Counting

Requirement Type Functional

ID #93

Description

The BMS shall calculate the SOH with Coulomb Counting following the Req.

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.4.3 BMS SOH Estimation: SOC UKF

Requirement Type Functional

ID #94

Description

The BMS shall calculate the SOH with UKF following the Req.

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.4.4 BMS SOH Estimation: SOC EKF

Requirement Type Functional

ID #95

Description

The BMS shall calculate the SOH with EKF following the Req.

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.5 Balancing Logic

Requirement Type Functional

ID #38

Description

The BMS shall execute balancing logic every 250 ms.

The Balancing Logic shall securely close and open the contacts to the charger and inverter.

Change Information No change issue detected.

Links

Artifact [BMS_CYRS.slreqx](#)

 [Cell Balancing](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 5 | 0 | 0 | 5 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 5 | 0 | 0 | 0 | 0 | 5 |

3.5.1 BMS Balancing Logic Interfaces

Requirement Type Container

ID #96

Description

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 2 | 0 | 0 | 2 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 2 | 0 | 0 | 0 | 0 | 2 |

3.5.1.1 Inputs

Requirement Type Functional

ID #97

Description

BMS BALANCING LOGIC INPUTS

| Port Interface | Data Element | Type | Units | Description |
|-------------------|----------------|---------|-------|------------------------------------|
| VfbStateRequest | StateRequest | Enum | - | Request from vehicle network |
| VfbCellVoltages | CellVoltage | Float32 | V | Voltage of each cell |
| VfbMaxCellVoltage | MaxCellVoltage | Float32 | V | Max Cell Voltage Limits for safety |
| VfbMaxCellVoltage | MinCellVoltage | Float32 | V | Max Voltage Limits for safety |

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.5.1.2 Outputs

Requirement Type Functional

ID #98

Description

BMS BALANCING LOGIC OUTPUTS

| Port Interface | Data Element | Type | Units | Description |
|--------------------|----------------|---------|-------|---------------------------------|
| VfbBalanceCommands | BalanceCommand | Boolean | - | Commands to balance cell charge |

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.5.2 BMS Balancing Logic: Balancing Voltage Difference

Requirement Type Functional

ID #99

Description

The BMS shall balance cell charge/discharge levels when voltage difference exceeds 100 mV.

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.5.3 BMS Balancing Logic: Balancing ON/OFF

Requirement Type Functional

ID #100

Description

the Balancing Logic shall send the command to activate/deactivate the balancing Process.

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.6 User Interface

Requirement Type Container

ID #66

Description

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 4 | 0 | 0 | 4 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 4 | 0 | 0 | 0 | 0 | 4 |

3.6.1 User Interface: Monitoring and Configuration

Requirement Type Functional

ID #105

Description

The BMS shall provide a user interface that facilitates both monitoring of system status and configuration of operational parameters.

Change Information [Change issue detected.](#)

Links

Artifact [BMS CYRS.slreqx](#)

 [User Monitoring Interface](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.6.2 User Interface: Alerts and Notifications

Requirement Type Functional

ID #106

Description

The BMS shall provide visual and audible alerts to notify users of any critical alarms or warnings.

Change Information [Change issue detected.](#)

Links

Artifact [BMS_CYRS.slreqx](#)

 [Alerts and Notifications](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.6.3 User Interface: Configuration

Requirement Type Functional

ID #107

Description

The BMS shall provide a user interface that enables users to configure settings, including charging profiles and fault thresholds.

Change Information No change issue detected.

Links

Artifact [BMS_CYRS.slreqx](#)

 [Configurable Settings](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

3.6.4 User Interface: Diagnostics

Requirement Type Functional

ID #108

Description

The BMS shall supply comprehensive diagnostic information to facilitate maintenance and troubleshooting activities.

Change Information No change issue detected.

Links

Artifact [BMS_CYRS.slreqx](#)

 [Diagnostic Information](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
|-------|-------------|-----------|------|

| | | | |
|---|---|---|---|
| 1 | 0 | 0 | 1 |
|---|---|---|---|

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

4 Reliability and Maintainability

Requirement Type Container

ID #39

Description

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 6 | 0 | 0 | 6 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 6 | 0 | 0 | 0 | 0 | 6 |

4.1 Self-Calibration

Requirement Type Functional

ID #40

Description

The BMS shall calibrate sensors at least every 48 hours or when temperature changes by 5°C.

Change Information [Change issue detected.](#)

Links

Artifact [BMS_CYRS.slreqx](#)

 [Self-Diagnostics](#) (⇒Related to)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

4.2 Self-Diagnostics

Requirement Type Functional

ID #41

Description

The BMS shall perform self-diagnostics periodically to detect component failures.

Change Information No change issue detected.

Links

Artifact [BMS_CYRS.slreqx](#)

 [Self-Diagnostics](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

4.3 Fault Tolerance

Requirement Type Container

ID #65

Description

The BMS shall remain operational during minor component failures by employing fault-tolerant mechanisms.

Change Information [Change issue detected.](#)

Links

Artifact [BMS_CYRS.slreqx](#)

 [Fault Tolerance](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 4 | 0 | 0 | 4 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 4 | 0 | 0 | 0 | 0 | 4 |

4.3.1 Voltage Cell Monitoring

Requirement Type Functional

ID #101

Description

The BMS shall monitor cell voltages in real time with Voltage accuracy: $\pm 0.05V$.

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

4.3.2 Temperature Cell Monitoring

Requirement Type Functional

ID #102

Description

The BMS shall monitor cell temperatures in real time with Temperature accuracy: $\pm 1^{\circ}C$.

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

4.3.3 Package Currunt Monitoring**Requirement Type** Functional**ID** #103**Description**The BMS shall monitor Package Currunt in real time with Voltage accuracy: $\pm 0.01A$.**Change Information** No change issue detected.**Implementation Status**

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

4.3.4 Package Voltage Monitoring**Requirement Type** Functional**ID** #104**Description**The BMS shall monitor Package Voltage in real time with Voltage accuracy: $\pm 0.1V$.**Change Information** No change issue detected.**Implementation Status**

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

5 Fault Notifications**Requirement Type** Container**ID** #60**Description****Change Information** No change issue detected.**Implementation Status**

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 4 | 0 | 0 | 4 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
|-------|--------|-----------|--------|------------|------|

| | | | | | |
|---|---|---|---|---|---|
| 4 | 0 | 0 | 0 | 0 | 4 |
|---|---|---|---|---|---|

5.1 Fault Detection

Requirement Type Functional

ID #61

Description

The BMS shall detect system fault event (specifically over-voltage, under-voltage, over-temperature, and short circuits).

Change Information [Change issue detected.](#)

Links

Artifact [BMS_CYRS.slreqx](#)

 [Fault Detection](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

5.2 Fault Response

Requirement Type Functional

ID #62

Description

The BMS shall initiate a response within 50 milliseconds of fault detection.

Change Information [Change issue detected.](#)

Links

Artifact [BMS_CYRS.slreqx](#)

 [Fault Detection](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

5.3 Fault Code

Requirement Type Functional

ID #63

Description

The BMS shall notify users of critical faults and provide error codes for troubleshooting.

Change Information [Change issue detected.](#)

Links

Artifact [BMS CYRS.slreqx](#)

 [Fault Notifications](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

5.4 Fault Notifications

Requirement Type Functional

ID #64

Description

The BMS shall provide notifications for system faults (e.g., over-voltage, short circuit) via both visual and audible alerts, with a response time of less than 100 ms.

Change Information [Change issue detected.](#)

Links

Artifact [BMS CYRS.slreqx](#)

 [Alerts and Notifications](#) (⇒Related to)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

6 Communication Requirements

Requirement Type Functional

ID #42

Description

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 7 | 0 | 0 | 7 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 7 | 0 | 0 | 0 | 0 | 7 |

6.1 Communication Protocols

Requirement Type Functional

ID #43

Description

The BMS shall support standard MODBUS communication protocols for interfacing with external devices (e.g., vehicle network, charger, inverter).

Change Information [Change issue detected.](#)

Links

Artifact [BMS_CYRS.sreqx](#)

 [Communication Protocols](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

6.2 Communication Latency

Requirement Type Functional

ID #44

Description

The BMS shall ensure that communication latency does not exceed 100 milliseconds.

Change Information [Change issue detected.](#)

Links

Artifact [BMS_CYRS.sreqx](#)

 [Communication Latency](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

6.3 Communication Interfaces

Requirement Type Functional

ID #45

Description

The BMS shall have an API or diagnostic interface accessible via Bluetooth or USB for data logging, diagnostics, and system configuration.

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

6.4 Data Reporting

Requirement Type Functional

ID #46

Description

The BMS shall report key system parameters (SOC, temperature, voltage, current, etc.) to external devices in real-time.

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

6.5 Security

Requirement Type Container

ID #111

Description

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 2 | 0 | 0 | 2 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 2 | 0 | 0 | 0 | 0 | 2 |

6.5.1 Data Security

Requirement Type Functional

ID #112

Description

The BMS shall secure communication and data using Advanced Encryption Standard (AES).

Change Information [Change issue detected.](#)

Links

Artifact [BMS_CYRS.slreqx](#)

 [Data Security](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

6.5.2 Access Control

Requirement Type Functional

ID #113

Description

The BMS shall incorporate robust access control mechanisms to prevent unauthorized access to its system functionalities and data.

Change Information [Change issue detected.](#)

Links

Artifact [BMS_CYRS.slreqx](#)

 [Access Control](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

7 Logging and Data Recording

Requirement Type Container

ID #47

Description

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 3 | 0 | 0 | 3 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 3 | 0 | 0 | 0 | 0 | 3 |

7.1 Error Recording

Requirement Type Functional

ID #48

Description

The BMS shall log the error codes of the detected fault event.

Change Information [Change issue detected.](#)

Links

Artifact [BMS_CYRS.slreqx](#)

 [Data Logging](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

7.2 Operational Data Recording

Requirement Type Functional

ID #55

Description

The BMS shall log operational data, including cell voltage, current, temperature, and SOC, with a minimum frequency of 1 Hz for analysis and diagnostics.

Change Information [Change issue detected.](#)

Links

Artifact [BMS_CYRS.slreqx](#)

 [Data Logging](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

7.3 Recording Limit

Requirement Type Functional

ID #56

Description

Logs must be stored for a minimum of 30 days and should be accessible via diagnostic interfaces.

Change Information [Change issue detected.](#)

Links

Artifact [BMS_CYRS.slreqx](#)

 [Data Logging](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

8 Software Updates

Requirement Type Container

ID #57

Description

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 2 | 0 | 0 | 2 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 2 | 0 | 0 | 0 | 0 | 2 |

8.1 Updates_Req

Requirement Type Functional

ID #58

Description

The BMS shall support over-the-air (OTA) software updates with secure mechanisms to avoid unauthorized access.

Change Information No change issue detected.

Links

Artifact [BMS CYRS.slreqx](#)

 [OTA Updates](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

8.2 Updates_Limit

Requirement Type Functional

ID #59

Description

Updates shall be applied with minimal downtime, not exceeding 30 seconds.

Change Information No change issue detected.

Links

Artifact [BMS CYRS.slreqx](#)

 [OTA Updates](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

9 Acceptance Criteria

Requirement Type Container

ID #67

Description

Change Information No change issue detected.

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 4 | 0 | 0 | 4 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 4 | 0 | 0 | 0 | 0 | 4 |

9.1 Functional Safety

Requirement Type Functional

ID #68

Description

The BMS shall be designed, implemented, and validated in accordance with the ISO 26262 functional safety standard, ensuring that all relevant safety measures and protocols are rigorously adhered to.

Change Information [Change issue detected.](#)

Links

Artifact [BMS CYRS.slreqx](#)

 [Industry Standards](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

9.2 Regulatory Compliance

Requirement Type Functional

ID #69

Description

The BMS shall comply with all applicable regulatory requirements for automotive and energy storage applications by leveraging Model Advisor in accordance with MAAB guidelines, thereby ensuring full conformance with industry standards and governmental regulations.

Change Information [Change issue detected.](#)

Links

Artifact [BMS CYRS.slreqx](#)

 [Regulatory Compliance](#) (⇒Implements)

 [Battery Module Operation](#) (⇒Related to)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

9.3 Acceptance Criteria**Requirement Type** Container**ID** #70**Description****Change Information** No change issue detected.**Implementation Status**

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 2 | 0 | 0 | 2 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 2 | 0 | 0 | 0 | 0 | 2 |

9.3.1 Real-World Performance**Requirement Type** Functional**ID** #109**Description**

The BMS shall undergo rigorous testing in real-world scenarios, including edge cases such as high temperatures and sudden load changes, to validate its reliability and performance.

Change Information [Change issue detected.](#)**Links****Artifact** [BMS_CYRS.slreqx](#)
 [Real-World Testing](#) (⇒Implements)
Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |

9.3.2 Documentation and Independent Verification**Requirement Type** Functional**ID** #110**Description**

Comprehensive test plans, procedures, and independent verification reports shall confirm that all acceptance criteria are met.

Change Information No change issue detected.

Links

Artifact [BMS CYRS.slreqx](#)

 [Functional Requirements Compliance](#) (⇒Implements)

Implementation Status

| Total | Implemented | Justified | None |
|-------|-------------|-----------|------|
| 1 | 0 | 0 | 1 |

Verification Status

| Total | Passed | Justified | Failed | Unexecuted | None |
|-------|--------|-----------|--------|------------|------|
| 1 | 0 | 0 | 0 | 0 | 1 |











Appendix












Artifact List



Requirement Set files:

| # | Name | Folder | Revision |
|---|-----------------|--|----------|
| 1 | BMS_CYRS.slreqx | H:\0\New MAAM\10 - MBD\Battary Management System\SWE.1 SRS | 16 |

Change Issues

| # | Link | Changed Target | Stored Information | Actual Information |
|----|--|---|--|--|
| 1 |  Voltage Thresholds | BMS SRS:4 (Source) | Revision: 55 (Timestamp: 21-Mar-2025 06:02:40) | Revision: 56 (Timestamp: 21-Mar-2025 06:02:40) |
| 2 |  Real-World Testing | BMS SRS:109 (Source) | Revision: 58 (Timestamp: 21-Mar-2025 08:01:12) | Revision: 59 (Timestamp: 21-Mar-2025 08:01:12) |
| 3 |  Fault Detection | BMS SRS:61 (Source) | Revision: 54 (Timestamp: 21-Mar-2025 06:27:01) | Revision: 56 (Timestamp: 21-Mar-2025 06:27:01) |
| 4 |  Data Logging | BMS SRS:48 (Source) | Revision: 54 (Timestamp: 21-Mar-2025 06:43:50) | Revision: 56 (Timestamp: 21-Mar-2025 06:46:57) |
| 5 |  External System Interface | BMS SRS:22 (Source) | Revision: 2 (Timestamp: 21-Mar-2025 06:07:01) | Revision: 56 (Timestamp: 21-Mar-2025 06:07:01) |
| 6 |  Communication Latency | BMS SRS:44 (Source) | Revision: 51 (Timestamp: 21-Mar-2025 07:48:53) | Revision: 58 (Timestamp: 21-Mar-2025 07:48:53) |
| 7 |  Communication Protocols | BMS SRS:43 (Source) | Revision: 50 (Timestamp: 20-Mar-2025 08:59:55) | Revision: 56 (Timestamp: 21-Mar-2025 06:48:52) |
| 8 |  Alerts and Notifications | BMS SRS:64 (Source) | Revision: 54 (Timestamp: 21-Mar-2025 06:27:05) | Revision: 56 (Timestamp: 21-Mar-2025 06:27:05) |
| 9 |  Industry Standards | BMS SRS:68 (Source) | Revision: 56 (Timestamp: 21-Mar-2025 07:33:22) | Revision: 57 (Timestamp: 21-Mar-2025 07:33:22) |
| 10 |  Fault Notifications | BMS SRS:63 (Source) | Revision: 54 (Timestamp: 21-Mar-2025 06:27:05) | Revision: 56 (Timestamp: 21-Mar-2025 06:27:05) |

| | | | | |
|--------|---|---|--|--|
| 1 1 |  Fault Tolerance | BMS SRS:65 (Source) | Revision: 54 (Timestamp: 21-Mar-2025 06:33:08) | Revision: 57 (Timestamp: 21-Mar-2025 06:54:32) |
| 1 2 |  Access Control | BMS SRS:113 (Source) | Revision: 1 (Timestamp: 21-Mar-2025 08:06:02) | Revision: 60 (Timestamp: 21-Mar-2025 08:06:02) |
| 1 3 |  Self-Diagnostics | BMS SRS:40 (Source) | Revision: 50 (Timestamp: 21-Mar-2025 06:45:44) | Revision: 56 (Timestamp: 21-Mar-2025 06:45:44) |
| 1 4 |  Data Logging | BMS SRS:56 (Source) | Revision: 54 (Timestamp: 21-Mar-2025 06:44:58) | Revision: 56 (Timestamp: 21-Mar-2025 06:47:08) |
| 1 5 |  Real-Time Monitoring | BMS SRS:17 (Source) | Revision: 47 (Timestamp: 20-Mar-2025 08:28:09) | Revision: 56 (Timestamp: 21-Mar-2025 06:11:52) |
| 1 6 |  Alerts and Notifications | BMS SRS:106 (Source) | Revision: 56 (Timestamp: 21-Mar-2025 06:58:07) | Revision: 57 (Timestamp: 21-Mar-2025 06:59:06) |
| 1 7 |  Data Security | BMS SRS:112 (Source) | Revision: 1 (Timestamp: 21-Mar-2025 08:05:53) | Revision: 60 (Timestamp: 21-Mar-2025 08:05:53) |
| 1 8 |  Battery Module Operation | BMS SRS:69 (Source) | Revision: 56 (Timestamp: 21-Mar-2025 07:39:44) | Revision: 58 (Timestamp: 21-Mar-2025 07:55:19) |
| 1 9 |  Regulatory Compliance | BMS SRS:69 (Source) | Revision: 56 (Timestamp: 21-Mar-2025 07:39:44) | Revision: 58 (Timestamp: 21-Mar-2025 07:55:19) |
| 2 0 |  User Monitoring Interface | BMS SRS:105 (Source) | Revision: 56 (Timestamp: 21-Mar-2025 06:59:19) | Revision: 57 (Timestamp: 21-Mar-2025 06:59:19) |
| 2 1 |  Data Logging | BMS SRS:55 (Source) | Revision: 54 (Timestamp: 20-Mar-2025 10:03:46) | Revision: 56 (Timestamp: 21-Mar-2025 06:47:00) |

| | | | | |
|--------|---|--|--|--|
| 2 2 |  Charge and Discharge Regulation | BMS SRS:13 (Source) | Revision: 7 (Timestamp: 21-Mar-2025 06:01:03) | Revision: 56 (Timestamp: 21-Mar-2025 06:01:03) |
| 2 3 |  Fault Detection | BMS SRS:62 (Source) | Revision: 54 (Timestamp: 21-Mar-2025 06:27:05) | Revision: 56 (Timestamp: 21-Mar-2025 06:27:05) |