

INGECON SUN STORAGE 1PLAY

Matching Test Case Guideline for Li-Ion battery

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1 Introduction and purpose

The present document describes the test cases for the matching test between Li-Ion battery packs and the INGECON SUN STORAGE 1Play inverter.

2 Matching Test Measurement Case

2.1 BMS Monitoring Test

Check all monitoring values of the battery via display of the inverter (BMS Monitoring).

2.1.1 Test Procedures

- 1) Connect CAN communication wire between battery and inverter.
- 2) Configure the correct lithium battery profile in the inverter.
- 3) Battery should send CAN frames periodically with real values from battery.
- 4) Check all values in BMS Monitoring in the inverter.

- If needs more information about this test, please contact Ingeteam.

2.1.2 Test Criteria

- All values as battery voltage, current, SOC, SOH, charge/discharge voltage, charge/discharge current...etc should be right values. (BMS Monitoring)
- The counter of status communication between BMS and inverter should increase from 0 to 14 periodically.

2.2 BMS Current Limit Following Test

Battery BMS transmits battery information including charge/discharge current limit to inverter, and the inverter shall follow this current limit and operate within this current limit.

Check the current control of the inverter when battery BMS sends and changes current limit.

2.2.1 Test Procedures

- 5) Connect CAN communication wire between battery and inverter.
- 6) Configure the correct lithium battery profile in the inverter.
- 7) Battery should send CAN frames periodically with right values, real value from battery.
- 8) Charge the battery with maximum rated power.
- 9) Decrease the DC Charge Current Limit to 50% of maximum rated power by sending the CAN frame.
- 10) Measure the current limit tracking time and waveform of charging current by oscilloscope.
- 11) Repeat step 5 to step 6 with charging DC Charge Current Limit to 30%, 10%, 0%.
- 12) Repeat step 4 to step 7 with discharging the battery.

- If needs more information about this test, please contact Ingeteam.

2.2.2 Test Criteria

- The inverter charge/discharge current shall follow the BMS current limit within 3 seconds.
- Current error between “Battery Current” and “Current charge/discharge limitation” should be below 1A.

2.3 BMS Alarm Test

Check all alarm signal of the battery, including over-current protection, over-voltage protection, etc. is normally recognized from inverter. Check the inverter operation when battery is in alarm state.

2.3.1 Test Procedures

- 1) Connect CAN communication wire between battery and inverter.
- 2) Configure the correct lithium battery profile in the inverter.
- 3) Battery should send CAN alarm frame with all alarms signals.

Battery_alarm Location								
COB-ID 0x406	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 2	High Current Discharge	Cell Imbalance	BMS Internal	Low Temp.	High Temp.	Low Voltage	High Voltage	High Current charge

Inverter stops charging/discharging battery immediately when any alarm signal occurs.
Inverter informs via display to end-user when battery is in fault status.

- 4) Check all alarms in the display of the inverter (BMS Monitoring → press OK → Alarm Monitoring) and check inverter operation.
 - For more information about BMS diagnosis CAN protocols, please refer to ABH2010IMB04 “Ingeteam BMS protocol” document.

2.3.2 Test Criteria

- The inverter shall receive all kind of battery alarm signal successfully; also inverter can recognize the BMS diagnosis correctly via Display (BMS Monitoring → press OK → Alarm Monitoring).
- Inverter shall stops charging/discharging immediately when any fault signal occurs.
- Display of the inverter can inform to end-user when battery is in fault status.

2.4 Loss of Communication (LOC) Test.

Check the inverter behavior when LOC between BMS and inverter occurs during the inverter's operation.

2.4.1 Test Procedures

- 1) Charge the battery with maximum rated power.
- 2) Disconnect the communication wire between inverter and battery during charging.
- 3) Check inverter operation and behavior by current sensor, oscilloscope.
- 4) Repeat step 1 to 3 with discharge the battery.

2.4.2 Test Criteria

- The inverter shall stop charging/discharging within 5 seconds after LOC occurs.
- The system shall recover automatically when communication is established again.

2.5 Full Charging/Discharging Test

Check the system behavior when full charging and discharging the battery pack.

2.5.1 Test Procedures

- 1) Fully discharge the battery with maximum rated power.
 - 2) Fully charge the battery with maximum rated power.
 - 3) Take 30 minutes rest time
 - 4) Fully discharge the battery with maximum rated power.
- Select lower power between the inverter maximum rated power and the battery's.
 - Charge/discharge stop point depends on inverter operation concept or battery diagnosis. (Ex. SOC or battery voltage)

2.5.2 Test Criteria

- Inverter shall charge and discharge the battery within operating range. Lower limit depends on the battery discharge voltage or battery SOC 0% or Low SOC limit of inverter. Upper limit depends on battery charge voltage or battery SOC 100% or Upper SOC limit of inverter.
- When end of charge process, battery voltage should not exceeds battery charge voltage value (CV charge mode).
- When end of discharge process, battery voltage should not below battery discharge voltage value (CV discharge mode).
- Inverter should follow the current limit during whole operation.
- Test result should include the graph of Time to SOC / Current / Battery Voltage.

2.6 Abnormal Status Test (Sudden Turning off Test)

Check the inverter and battery operation when system is in abnormal status.

2.6.1 Test Procedures

- 1) Sudden turning off the Grid breaker during charging/discharging the battery.
- 2) Sudden turning off the PV breaker during the charging/discharging the battery.
- 3) Sudden turning off the Battery breaker during the charging/discharging the battery.

2.6.2 Test Criteria

- During sudden turning off, peak voltage of battery side should be below the maximum battery voltage allowed.
- In the battery, no fuse blown, no BMS blown and normal operation of main contactor.