

ESS Compartment Commissioning Checklist V2.14

Check done by

Date and Time

Location

Chassis No.

	Serial No.
ESS Pack	
MCU	
DCDC	
ETM* Model 1	
ETM* Model 2	
*Electrical Test Meter	

	Serial No.
MGU / ESS Bulkhead HVAC Adapter	
MCU HVDC Adapter	
ESS MCU HVDC Adapter	
ESS DCDC HVDC Adapter	
DCDC ESS HVDC Adapter	
ESS on LV Hatch Adapter	
HV5 ESS HVDC Adapter	

Review and understand **9.3.1 HV System Important Safety Information** prior to performing checklist.

All checks listed below have to be done in case of an initial ESS compartment commissioning!

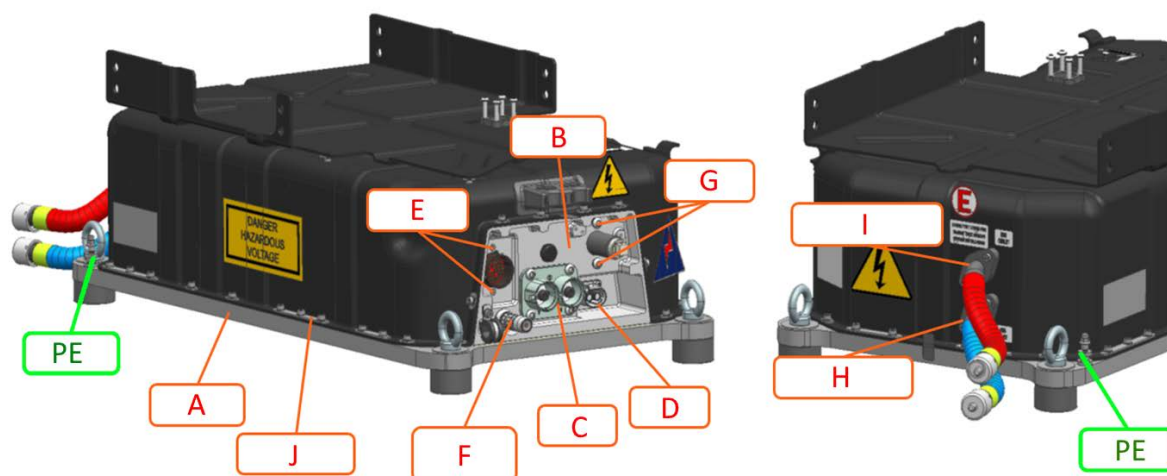
Do NOT connect 12 V supply prior to functional tests.

Refer to **9.11 Reference Information** of the System Documentation for further examples of measurement points and measurement adapter usage.

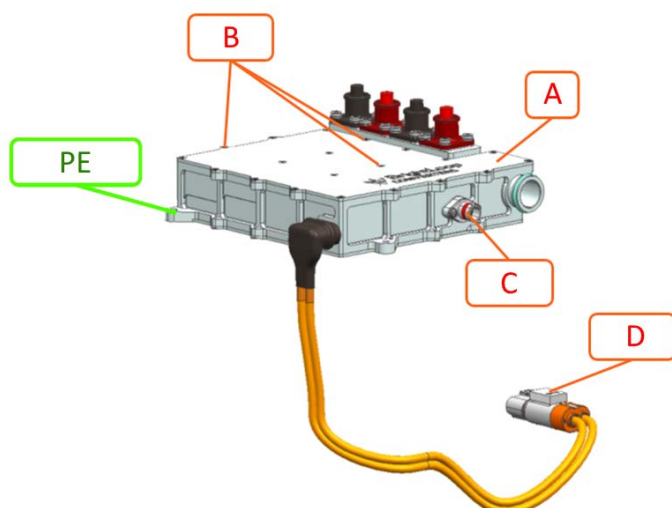
Pre-requisites



No	Test Item	Description	Reference	Value
1.	Component parts bonding resistance HV Components must not be used if they have any damage!	Bonding resistance of each electrically conductive housing part (covers, connectors, etc.) of ESS, MCU & DCDC must be checked towards the component PE interface. Check MCU for visible damages.	no damage	
2.	Bonding resistance MCU	A → PE	< 10 mOhm	
3.		B → PE	< 10 mOhm	
4.		C → PE	< 10 mOhm	
5.		D → PE	< 10 mOhm	



6.	HV Components must not be used if they have any damage!	Check ESS for visible damages.	no damage
7.		A → PE	< 40 mOhm
8.		B → PE	< 40 mOhm
9.		C → PE	< 40 mOhm
10.		D → PE	< 40 mOhm
11.	Bonding resistance ESS	E → PE	< 40 mOhm
12.		F → PE	< 40 mOhm
13.		G → PE	< 40 mOhm
14.		H → PE	< 40 mOhm
15.		I → PE	< 40 mOhm
16.		J → PE	< 40 mOhm



17.	HV Components must not be used if they have any damage!	Check DCDC for visible damages.	no damage
18.	Bonding resistance DCDC	A → PE	< 40 mOhm
19.		B → PE	< 40 mOhm
20.		C → PE	< 40 mOhm
21.		D → PE	< 40 mOhm
22.	Measuring Adapters	Check Adapters for visible damages.	no damage
23.	HV Cables and Connectors	Check all cables and connectors for visible damages.	no damage

Insulation Resistance HV <-> LV

Ensure no residual voltage is present in each component before Isolation measurement. HV potentials should be shorted together when checking each component to save time. Insulation resistance is checked in both directions (polarities). If a particular test result is outside the given range, remove the shorts and check individually to aide investigation. Be sure to remove any shorts after isolation testing.

a) Measuring Adapters

Check continuity between connector ground and LV ground connections.

Check insulation resistance of all measuring adapters between the HV potentials and the LV connections (to include HVIL connections, where applicable).

No	Test Item	Description	Reference	Value
24.	MGU HVAC Adapter	Continuity check: LV_GND to connector Stäubli connector housing	Continuity	
25.		U+V+W --> LV_GND	> 3 GOhm	
26.		LV_GND --> U+V+W	> 3 GOhm	
27.	MCU HVDC Adapter	Continuity check: LV_GND to connector shield surround (both)	Continuity	
28.		HV+ & HV- --> LV_GND	> 3 GOhm	
29.		LV_GND --> HV+ & HV-	> 3 GOhm	

30.		Continuity check: LV_GND to connector body	Continuity
31.	ESS MCU Adapter	HV+ & HV- --> LV_GND	> 3 GOhm
32.		LV_GND --> HV+ & HV-	> 3 GOhm
33.		Continuity check: LV_GND to connector body	Continuity
34.	ESS DCDC Adapter	HV+ & HV- --> LV_GND	> 3 GOhm
35.		LV_GND --> HV+ & HV-	> 3 GOhm
36.		Continuity check: LV_GND to connector body	Continuity
37.	DCDC ESS Adapter	HV+ & HV- --> LV_GND & HVILs	> 3 GOhm
38.		LV_GND & HVILs --> HV+ & HV-	> 3 GOhm
39.		Continuity check: LV_GND to connector body	Continuity
40.	ESS LV Hatch Adapter	HV+ & HV- --> LV_GND & HVILs	> 3 GOhm
41.		LV_GND & HVILs --> HV+ & HV-	> 3 GOhm
42.		Continuity check: LV_GND to connector body	Continuity
43.	HV5 ESS Adapter	HV+ & HV- --> LV_GND & HVILs	> 3 GOhm
44.		LV_GND & HVILs --> HV+ & HV-	> 3 GOhm

b) ESS

Check insulation resistance of ESS DCDC Output and ESS MCU Output.
Both outputs have a common HV+ and separate HV- contactors.
Nevertheless, check each HV+ Output!

No	Test Item	Description	Reference	Value
45.	ESS MCU	MCU HV+ & HV- --> LV_GND	> 3 GOhm	
46.		LV_GND --> MCU HV+ & HV-	> 3 GOhm	
47.	ESS DCDC	DCDC HV+ & HV- --> LV_GND	> 3 GOhm	
48.		LV_GND --> DCDC HV+ & HV-	> 3 GOhm	

c) MCU

Check insulation resistance of MCU DC input and AC output.

No	Test Item	Description	Reference	Value
49.	MCU HVDC	HV+ & HV- --> LV_GND	5.0 – 6.5 MOhm	
50.		LV_GND --> HV+ & HV-	5.0 – 6.5 MOhm	
51.	MCU HVAC	Phase U+V+W --> LV_GND + HVILs	5.0 – 6.5 MOhm	
52.		LV_GND + HVILs --> Phase U+V+W	5.0 – 6.5 MOhm	

d) DCDC

Check insulation resistance of the DCDC HV connection.

No	Test Item	Description	Reference	Value
53.	DCDC	HV+ & HV- --> LV_GND & HVILs	>1.5 GOhm	
54.		LV_GND + HVILs --> HV+ & HV-	>1.5 GOhm	

e) HV5

Check insulation resistance of the HV5 cable separately, prior to installation on the MCU.

No	Test Item	Description	Reference	Value
55.	HV5	HV+ & HV- --> LV_GND	>3 GOhm	
56.		LV_GND --> HV+ & HV-	>3 GOhm	

f) Body Protection Resistance Check

Connect ESS MCU and ESS DCDC measurement adapters.

Verify no HV on ESS DCDC & ESS MCU measurement adapters.

Connect the ESS HV Measuring Adapter (deadproof) loom to ESS.

Connect ESS on LV Hatch Measurement Adapter to the deadproof loom.

Measure resistance of ESS on LV Hatch Adapter to the corresponding MCU & ESS HV potentials.

No	Test Item	Description	Reference	Value
57.	HV Measuring Interface (deadproof) loom	HV+ DCDC	198 - 202 kOhm	
58.		HV- DCDC	198 - 202 kOhm	
59.		HV+ MCU	198 - 202 kOhm	
60.		HV- MCU	198 - 202 kOhm	

Assembled System Checks

Check for visible damage on all components. Components must not be used if they have any damage!

No	Test Item	Description	Reference	Value
61.	ESS Compartment Assembly	The ESS compartment is completely assembled according to the latest assembly instruction. Ensure the MSD is in the OFF Position!	Confirmed MSD off	
62.	Verification of no HV	Using the LV hatch panel measurement port and ESS LV Hatch HV Measurement box, verify no HV is present. Recommend to first check adapter insulation.	< 60 V	
63.	Stäubli HV AC cap	Make sure that the protective cap is attached on the Stäubli HV AC connector on the bulkhead.	cap installed	
64.	Bonding Resistance ESS	ESS PE stud <> PE interface on outer bulkhead	<10 mOhm	
65.	Bonding Resistance MCU	MCU <> Bulkhead PE	<10 mOhm	
66.	Bonding resistance DCDC	DCDC <> Bulkhead PE	<10 mOhm	
67.	Bonding resistance LV hatch	LV Hatch <> Bulkhead PE	<100 mOhm	

Functional Tests

For the functional tests, a charge device is required.

Ensure the ESS compartment is assembled according to the assembly instruction.

Ensure ESS & MGU-MCU coolant circuits have coolant installed and the systems are bled.

Ensure all HV and LV connectors are properly plugged.

Ensure ESS MSD in OFF Position, then switch ON charger.

Check for only plausible faults (related to ESS out of car) and a GREEN safety light on charger.

Switch the ESS MSD in ON Position.

The system will be operated in DCDC only mode. Only HV+ potential @MCU.

Operate the charge device according to the description in the manual.

a) Check Software and calibration level

No	Test Item	SW ver	Cal ver
68.	MCU		
69.	BMS		
70.	DCDC		
71.	Charger		

b) Activate the High Voltage System

Only proceed if the safety light status is solid green.

Otherwise proceed according to the Team and/or Sanctioning body's instructions for Red light handling.

No	Test Item	Description	Reference	Value
72.		<i>Safety light status</i>	<i>Solid Green</i>	

Activate the High Voltage System using the charge device by selecting a charge or discharge mode.

The HV System will be activated if the SOC delta between target SOC and real SOC is more than 2 %.

Wait 120 sec and check the Safety light status again.

Only proceed if the safety light status is solid green.

Otherwise, switch charge mode switch to Position 0 again, go through the 'ESS Compartment De-Commissioning Checklist' and check the ESS compartment setup.

No	Test Item	Description	Reference	Value
73.		<i>Safety light status after 120 s</i>	<i>Solid Green</i>	
74.		<i>Check DCDC Voltage.</i>	<i>HyCtrl_uDcDcHv</i>	<i>470 – 780 VDC</i>
75.		<i>Check MCU voltage.</i>	<i>HyCtrl_uMcuHV</i>	<i><60 VDC</i>
76.		<i>Check isolation resistance.</i>	<i>HyCtrl_resIsolation</i>	<i>> 4,000 kOhm</i> <i>< 6,000 kOhm</i>

No	Test Item	Description	Reference	Value
77.		Check on the charger display that the system error level is less than 8 (Inhibit Drive).	<Lvl 8	
78.		Check on the display that there is no ESS FR Level lower than FR6 active.	no FR1/2/3/4/5	

c) Deactivate the High Voltage System

Deactivate the High Voltage System by switching the charge mode selector switch to Position 0 - Off.

No	Test Item	Description	Reference	Value
79.		Check DCDC voltage.	HyCtrl_uDcDcHv <60 VDC	
80.		Check MCU voltage.	HyCtrl_uMcuHv <60 VDC	
81.		Check that the system error level is 1 (Info driver) or below.	<=1	
82.		Check that there is no ESS FR Level lower than FR6 active.	no FR1/2/3/4/5	

d) Charge

Confirm ESS Charging by selecting Charge Mode Switch Position 3. Charging completely up to 80 % target is not required.

Note: DCDC cooling be required in case of extended charging.

Repeat test items of 'Deactivate the High Voltage System'.

No	Test Item	Description	Reference	Value
83.		Charge mode operational	No errors	

e) Discharge

Confirm ESS Discharging by selecting Charge Mode Switch Position 1. Discharging completely down to 30 % target is not required.

Note: DCDC cooling be required in case of extended discharging.

Repeat test items of 'Deactivate the High Voltage System'.

No	Test Item	Description	Reference	Value
84.		Discharge mode operational	No errors	

Notes