

Accumulator Inspection			
Car Number			
University			
ESF state			
<b>REQUIRED RESOURCES</b>			
No.	Checkpoint	Checkbox	Comment
-	All accumulator containers to be used during the event		
-	Accumulator Container Hand Cart		
-	Charger		
-	Tools needed for (dis-)assembly of Accumulator Container		
-	Laptop and cables to display data of the AMS		
-	Print-out of Rule Request (if applicable)		
-	An ESO must attend		
-	Pictures of accumulator internals, if necessary		
-	Datasheets for used wiring, insulation materials, tractive system components and container material with needed values highlighted <b>NOT ON A CELL PHONE</b>		
-	Samples of all wire types used inside the accumulator container		
-	Samples of all used accumulator container material		
-	Power Supply for AIL test		
<b>SAFETY BRIEFING</b>			
No.	Checkpoint	Checkbox	Comment
-	No jewellery, no rings		
-	No cell phone		
-	No watch / no necklace		
-	No sources of distraction		
-	Do not wear synthetic clothes		
-	Wear safety glasses		
-	Wear safety gloves (if necessary)		
<b>BASIC SET OF HV-PROOF TOOLS</b>			
No.	Checkpoint	Checkbox	Comment
1	Insulated cable shear		
2	Insulated screw drivers		
3	Insulated spanners, if applicable		
4	Multimeter with protected probe tips		
5	Two 4mm banana plug test leads (1000V CAT III)		
<b>SAFETY EQUIPMENT</b>			
No.	Checkpoint	Checkbox	Comment
6	Face shield		
7	Safety glasses (minimum three)		
8	HV Insulating gloves (minimum two pairs)		
9	HV insulating blankets (two) (min 1m <sup>2</sup> ) with label or serial number and datasheet		
<b>SELF DEVELOPED PCBs</b>			
No.	Checkpoint	Checkbox	Comment
▶	Ask for fully assembled spare PCB of self developed PCBs inside accumulator container		
10	Sufficient spacing regarding system voltage and implementation		
11	Sufficient insulation and temperature rating of coating if used, datasheet available		
12	Coating process according to datasheet		



39	Cell tabs must not be mechanically loaded		
40	No cells are damaged or can be damaged by the segment structures		
41	Cells securely fastened towards all 3 directions		
42	All parts carrying cells and loads are made of UL94-V0 or equivalent certified materials		
43	Every temperature sensor placed on negative terminal of monitored cell or in <10mm distance on busbar		
44	Galvanic Separation included inside the Accumulator Management System		
45	Internal vertical walls have to be rigidly fastened to the container		
46	Internal vertical walls have a minimum height of 75% of the external walls		
47	Internal vertical walls divide the accumulator in sections of maximum 12 kg		
▶	Present all Accumulator container materials		
▶	Compare samples with Accumulator container		
48	Samples and Accumulator container are of equal quality		
<b>ASSEMBLY</b>			
No.	Checkpoint	Checkbox	Comment
49	All components and parts of the TSAC need to be properly fixed		
50	All used fasteners must be secured by the use of positive locking except they are non-conductive and non-structural		
51	TS potentials are insulated against inner wall of accumulator container if container made from conductive material		
52	No soldering in high current path		
53	Every container contains at least one appropriately sized and rated fuse		
▶	Check datasheet of fuse, main wires and cells and compare to ESF		
54	Every container contains at least two appropriately sized and rated isolation relays		
55	Pre-charge relay is of mechanical type with appropriate voltage rating		
56	Isolation relays and fuses are separated from all other components by a barrier according UL94-V0, FAR25 or equivalent		
57	Holes in container only for wiring harness, ventilation, cooling or fasteners if mechanical properties are not influenced		
58	External openings not pointing towards hand cart operator		
59	Check opening in TS enclosures, try to reach TS potentials with insulated test probe (100mm length, 6mm diameter)		
60	If fully closed, an equalizing valve must be implemented		
61	Spare accumulators of same size, weight and type		
<b>WIRING</b>			
No.	Checkpoint	Checkbox	Comment
62	All TS wires have proper overcurrent protection		
63	No other wires than TS wires are orange		
64	Securely anchored to withstand at least 200N, if outside of enclosure		
65	Located out of the way of possible snagging or damage		
66	TS and LV wires separated (not valid for Interlock)		
67	Every wire used in the Accumulator container (TS and LV) is rated for maximum TS voltage		
68	TS wires are marked with gauge, temperature rating >85°C and voltage rating		
69	Positive locking mechanism or if no positive locking possible, automotive certified components		
▶	Check if insulated tools needed for the assembly of certified components are available		
70	Insulation is not only insulating tape or rubber-like paint		
<b>INDICATOR LIGHT OR VOLTMETER</b>			
No.	Checkpoint	Checkbox	Comment
71	Red Indicator light or voltmeter installed		
72	Marked with "Voltage Indicator"		
73	Visible while disconnecting the battery connector		
74	Hard wired electronics, supplied by TS		
▶	Connect power supply with 60VDC to accumulator TS connector with proper plugs, <b>no measuring probes</b>		
75	Indicator light on or voltmeter showing present TS voltage		

76	Visible in bright sunlight		
<b>ACCUMULATOR MANAGEMENT SYSTEM</b>			
No.	Checkpoint	Checkbox	Comment
77	AMS is located in the TSAC		
78	A minimum of 30% of cells are monitored with temperature sensors		
	▶ Disconnect any AMS internal connector		
79	The AMS must open the shutdown circuit within 1s		
	▶ Disconnect AMS current sensor		
80	The AMS must open the shutdown circuit within 0.5s		
	▶ Ask the team to connect their laptop to the AMS		
	▶ Connect charger to battery/batteries, start charging process		
81	Cell voltages can be displayed		
82	Cell temperatures can be displayed		
83	Temperature and voltage limit according to ESF		
84	Plausible accumulator current can be displayed		
	▶ Disconnect one SINGLE voltage sense wire, if any wires used		
85	The AMS must open the shutdown circuit within 0.5 s		
	▶ Disconnect one SINGLE temperature sense wire, if any wires used		
86	The AMS must open the shutdown circuit within 1 s		
<b>CHARGER SHUTDOWN CIRCUIT</b>			
No.	Checkpoint	Checkbox	Comment
87	IMD is integrated into the charging system		
	▶ Connect charger to battery/batteries, start charging process		
88	Voltage indicator shows that HV is present		
	▶ Press shutdown button		
89	AIRs open		
90	Battery indicator shows voltage <60V		
	▶ Start charging, unplug TSAC connector		
91	AIRs open		
92	Charger disabled, no voltage at charger connector, measure on TSMP		
<b>INSULATION MONITORING DEVICE</b>			
No.	Checkpoint	Checkbox	Comment
93	IMD connected to vehicle side of the AIRs		
	▶ Determine $R_{test} = (\max \text{ TS voltage} * 250 \Omega/V) - \text{BPR}$		
	▶ Activate charger output, connect RTest between TS+ and LV GND		
94	Shutdown circuits opens within 30 s		
95	TS voltage decreases below 60VDC within 5 s after shutdown circuit opens		
96	Reactivation of charger output is not possible		
	▶ Push the reset button, if any		
97	Reactivation of charger output is not possible		
	▶ Remove RTest. Wait 40 s until IMD resets status output		
98	Reactivation of charger output is not possible		
	▶ Activate TS, connect RTest between TS- and LV GND		
99	Shutdown circuits opens within 30 s		
100	One IMD GND line is connected to the TSAC and the other to the charger housing with a direct wire		
101	... is available during charging		
102	... is red and visible in bright sunlight		
<b>HAND CART</b>			

No.	Checkpoint	Checkbox	Comment
103	Hand cart has four wheels		
104	Hand cart has maximal dimensions of 1200mm x 800mm		
105	Hand cart has always on type brake system		
106	The accumulator must be mechanically fixed to the handcart while on the handcart		
107	The accumulator must be protected from vibrations and shocks		
108	Firewall (same width as hand cart, from lowest point to 30 cm above TSAC/handle) must protect operator		
109	Label according to EV5.3.8 (checked points 27-28) still visible while on handcart		
<b>SEALING OF COMPONENTS</b>			
No.	Checkpoint	Checkbox	Comment
110	Seal accumulator container(s)		
111	Seal charger		
112	Additional part:		
113	Additional part:		
<b>OTHER COMMENTS</b>			