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## Vehicle sporadically fails to start or can no longer be started

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Topic number	LI54.10-P-054690
Version	3
Design group	54.10 Battery, voltage supply, voltage converter
Date	05-14-2014
Validity	Models 221.095 and 221.195 (Hybrid)
Reason for change	Capacitance limit increased from 800 $\mu$ F to 950 $\mu$ F

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### Complaint:

- Combustion engine sporadically fails to start.
- Combustion engine can only be restarted after a waiting period of approx. one hour.
- Combustion engine can no longer be started.
- Start/stop function is sporadically unavailable (READY displayed in yellow in instrument cluster).
- Fault code "current and stored" in electric motor control unit (SG-EM) (see control unit fault code).

### Cause:

Due to reduced capacitance of the high-voltage intermediate circuit capacitor in the power electronics (N129/1), the hybrid functions (e.g. start/stop, boost, regenerative braking) may be deactivated. If the capacitance of the high-voltage intermediate circuit capacitor is severely reduced (less than 950  $\mu$ F), engine start can be suppressed either occasionally/sporadically or permanently. Because of this, the 30A fuse of the HV battery (output to DC/DC converter) may also have blown.

### Remedy:

#### Requirement:

- Use a battery charger to ensure that the voltage supply of the vehicle's on-board electrical system battery is sufficient (greater than 12.5V)..

#### Work instructions:

1 Check fault memory in electric motor control unit (SG-EM) for phase errors.

If at least one of the following fault codes (FC) is present in the SG-EM control unit with status "stored" and/or "current and stored", the SG-EM control unit must be replaced and the test terminated (steps 2 to 5 should not now be performed):

- P0A5D00 The connection 'Phase U' of electrical machine A has a malfunction.
- P0A6000 The connection 'Phase V' of electrical machine A has a malfunction.
- P0A6300 The connection 'Phase W' of electrical machine A has a malfunction.

2 Check software (SW) in SG-EM control unit and update if necessary (ring flash: SG-BMS, SG-DDW and SG-EM).

If SW version 12.04.00 is present in the SG-EM control unit, continue with step 4. If older software is present, install the latest software.

To do this, select menu item "Control units – Drive – SG-EM electric motor control unit – Control unit adaptations – Control unit programming". After the software update, return to the control unit groups menu item.

### 3 Determine total capacitance in electric motor control unit SG-EM.

3.1 Create SG-EM control unit log. To do this, select menu item "Control units – Drive – SG-EM electric motor control unit – Control unit log" and create the control unit log. Then read off the value "Average value of total capacitance" in the SG-EM control unit log. If a value of 0 µF is shown, continue with step 3.2. If a value greater than 1µF is shown, continue with step 4.

3.2 Start combustion engine and switch off again (or circuit 15). Remove ignition key and leave removed for at least 2 minutes. During this period, do not operate any electrical consumers and leave all doors/flaps closed (wait for bus idle). DAS/XENTRY and battery charger remain connected. This procedure must be repeated six times! Then perform a "control unit reset" (to be found under "Actuations"). Afterwards create another SG-EM control unit log and read off the value "Average value of total capacitance" in the SG-EM control unit log.

### 4 Evaluate total capacitance (value "Average value of total capacitance") from SG-EM control unit log.

If the average value is less than 950 µF, the power electronics must be replaced.

### 5 Check 30A fuse of HV battery for proper operation (continuity test).

The test can be found in DAS/Xentry in the battery management system control unit (SG-BMS) at the following path: "Troubleshooting via complaints and symptoms" => "Initial startup of high-voltage on-board electrical system not possible. Voltage of high-voltage on-board electrical system at component N83/1 (DC/DC converter control unit) = 0 V."

If the 30A fuse is defective, the HV battery must be replaced.

Symptoms
Overall vehicle / Power supply / Battery/On-board electrical system / Battery function / Battery discharges
Power generation / Engine management / Engine start/stop / Does not start
Power generation / Engine management / Engine management indicator lamp / READY indicator / Does not illuminate

Control unit/fault code		
Control unit	Fault code	Fault text
SG-EM-Electric motor control unit (SGEM)	P0A1E00	Component N129/1 (Power electronics control unit) has a malfunction.
SG-EM-Electric motor control unit (SGEM)	P0A5D00	Connection 'Phase U' of electric machine A has a malfunction.
SG-EM-Electric motor control unit (SGEM)	P0A6000	Connection 'Phase V' of electric machine A has a malfunction.
SG-EM-Electric motor control unit (SGEM)	P0A6300	Connection 'Phase W' of electric machine A has a malfunction.
SG-EM-Electric motor control unit (SGEM)	P0C0C00	The power supply of the high-voltage on-board electrical system for inverter 'Electric machine A' has a short circuit to ground.
SG-EM-Electric motor control unit (SGEM)	P160A00	The capacitor of the power inverter has a malfunction.
SG-EM-Electric motor control unit (SGEM)	P160B00	There is a warning about the capacitor of the power inverter.

Parts							
Part number	ES1	ES2	Designation	Quantity	Note	EPC	Other ma-

							ke part
A 000 906 47 03			Rectifier	1	Electric motor control unit (SG-EM)	X	
A 221 343 11 00			LI-ION BATTERY	1	HV battery (SG-BMS)	X	

Work units				
Op. no.	Operation text	Time	Damage code	Note
54-1011	PERFORM DAS QUICK TEST AND ERASE FAULT CODE			
08-1200	REMOVE/INSTALL POWER ELECTRONICS WITH POWER DISTRIBUTOR, REPLACE IF NECESSARY		5441B 73	Damage code: 5441B (high-voltage intermediate circuit capacitor)
54-1014	PERFORM POWER DISCONNECT/INITIAL STARTUP OF HIGH-VOLTAGE ON-BOARD ELECTRICAL SYSTEM			
83-1762	EXTRACT REFRIGERANT, CHECK FOR LEAKS, REFILL			It is not necessary to replace the fluid reservoir for this repair.
54-1153	REPLACE HIGH-VOLTAGE BATTERY		5441B 73	Damage code: 5441B (high-voltage intermediate circuit capacitor) to be used, as consequential faults arise from a defective "high-voltage intermediate circuit capacitor".

WIS-References			
Document number	Title	Note	Allocation
AR08.10-P-0011SXH	Remove/install power electronics with power distributor		Remedy
AR54.10-P-1140SXH	Remove/install high-voltage battery		Remedy