

JAMA Comments

HDV GTR Breakout on c-rate meeting

27th October, 2023

JAMA comments,

As discussed at the 65th EVE IWG session, we need to set an appropriate constant C-rate. This meeting is set up for that purpose.

Then, when discussing C-rate, it is also necessary to clarify the test method. JAMA will now report on plans to conduct the following tests.

For the Method 1a test that can be conducted in Japan, we will check the reproducibility of discharge/charge and UBE/UBC in four different boundary conditions, which have not yet been verified, between indoor and low-temperature outdoor boundary conditions, and look for combinations that can be recommended.

JAMA will be able to report these results in March 2024.

We hope that it will support HDV GTR creation.

- 1) Actual driving test (evaluation of different boundary conditions)
- 2) Consideration of constant C-rate for Method 1a and Method 2
- 3) Comparison test plan for HIOKI current sensor measurement values and On-Board values

1) Actual driving test (evaluation of different boundary conditions)

Tests are going to be conducted using the following combinations of indoor and outdoor tests and four test patterns.
 (Two types of ambient temperature (2 patterns) and 4 patterns tests)

Indoor test;

Room temperature = 23°C constant. Cell Max temperature = room temperature +5°C or less

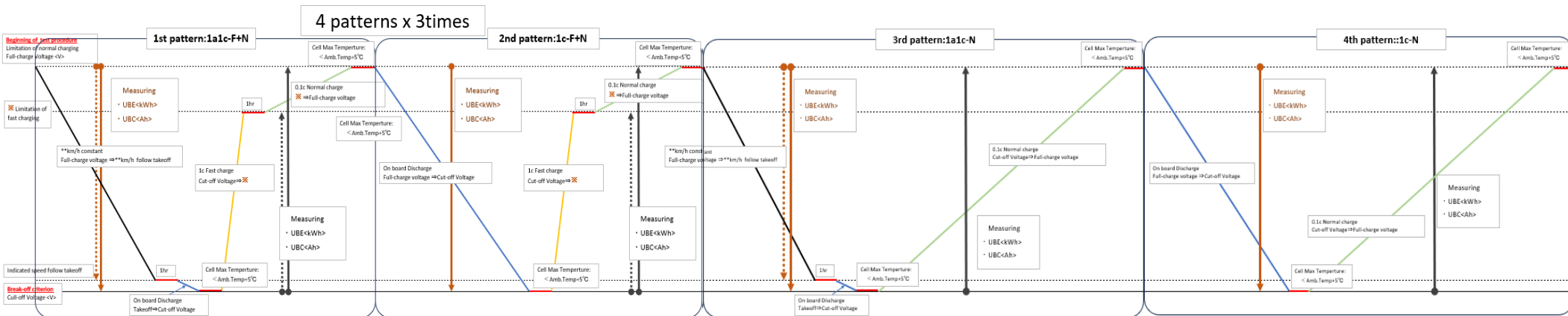
Outdoor test;

Outside temperature = normal temperature in December (cold region).

Cell Max temperature = outside temperature +5°C or less

There are four test patterns:

- (1) Discharge; constant vehicle speed running (C-rate 0.33) at Method1a + On-Board discharging at Method1c
- (2) Discharge; On-Board discharging at Method1c
- (3) Charging; C-rate 1 quick charging + AC normal charging
- (4) Charging; AC normal charging only



2) Consideration of constant C-rate for Method 1a and Method 2

At the 65th EVE meeting, in response to the constant C-rate (median was selected) proposed by JAMA, and EPA commented that a C-rate in the range of C/5 to C/3 would be reasonable.

JAMA verified this as follows,

1) Predicted vehicle battery capacity from GVW and driving route

Batt.Capacity kWh

Segment of veh.	GVW/GCW	City	Country	H/W
	2.5	34	57	-
	3.5	40	67	-
	5.5	48	80	-
	7.5	60	100	200
	11	80	133	267
	18	120	200	400
	25	160	267	533
	40	240	400	800
	60	300	500	1,000

2) Calculated the median based on WHVC

kW on WHVC-Median

Method 2 : Bidl Test	GVW/GCW	City	Country	H/W
	2.5	12	12	-
	3.5	14	14	-
	5.5	19	19	-
	7.5	25	25	25
	11	35	35	35
	18	50	50	50
	25	62	62	62
	40	87	87	87
	60	113	113	113

2) Consideration of constant C-rate for Method 1a and Method 2

3) Convert median output to C-rate

4) Calculate vehicle speed according to the GVW of the test vehicle from the output of C/3-C/5

C-rate on WHVC-Median

GVW/GCW	City	Country	H/W
2.5	0.35	0.21	-
3.5	0.36	0.22	-
5.5	0.40	0.24	-
7.5	0.41	0.25	0.12
11	0.43	0.26	0.13
18	0.41	0.25	0.12
25	0.39	0.23	0.12
40	0.36	0.22	0.11
60	0.38	0.23	0.11

C/3=0.33 C/4=0.25 C/5=0.2

kW on C/3-C/5 for Method 1a ■ ≤ 90kph

GVW/GCW	Veh.speed[kph]		
	40-50	60-70	80-90
2.5	11	14	-
3.5	13	17	-
5.5	16	20	-
7.5	20	25	40
11	26	33	53
18	40	50	80
25	53	67	107
40	79	100	160
60	99	125	200

kW on C/3-C/5 for Method 2 ■ ≤ 70

GVW/GCW	Veh.speed[kph]		
	40-50	60-70	80-90
2.5	11	0	-
3.5	13	17	-
5.5	16	20	-
7.5	20	25	40
11	26	33	53
18	40	50	80
25	53	67	107
40	79	100	160
60	99	125	200

5) vehicle verification of constant C-rate

JAMA think that it is possible to discharge using Method1a and Method2 at a constant output selected from C/3-C/5.

3) Comparison test plan for HIOKI current sensor measurement values and On-Board values

At the 64 & 65th EVE meeting, OICA member DT expressed doubts about voltage and current measurement at HIOKI.

JAMA checked the accuracy of voltage and current using a HIOKI measuring device and On-Board on a JAMA vehicle.



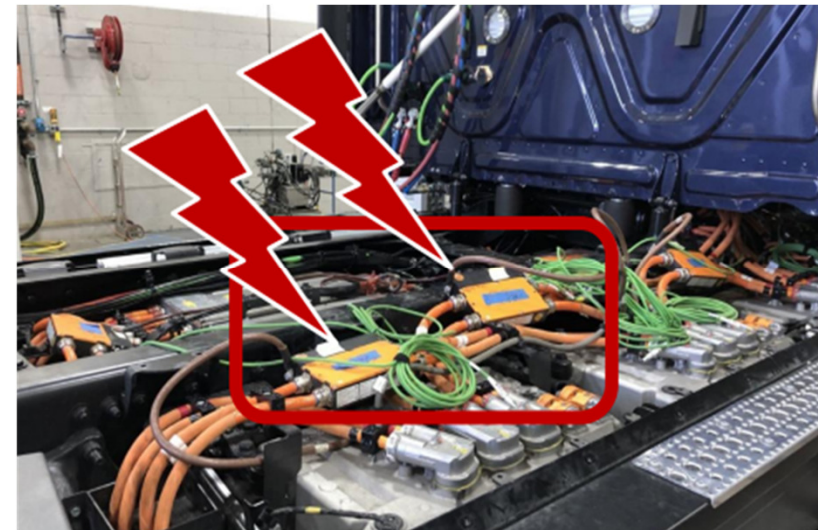
Capacity vs. energy

Capacity

- very low scatter of the measurement results
- No impact of payload / route
- Very high reproducibility
- Accurate ampere sensor on-board

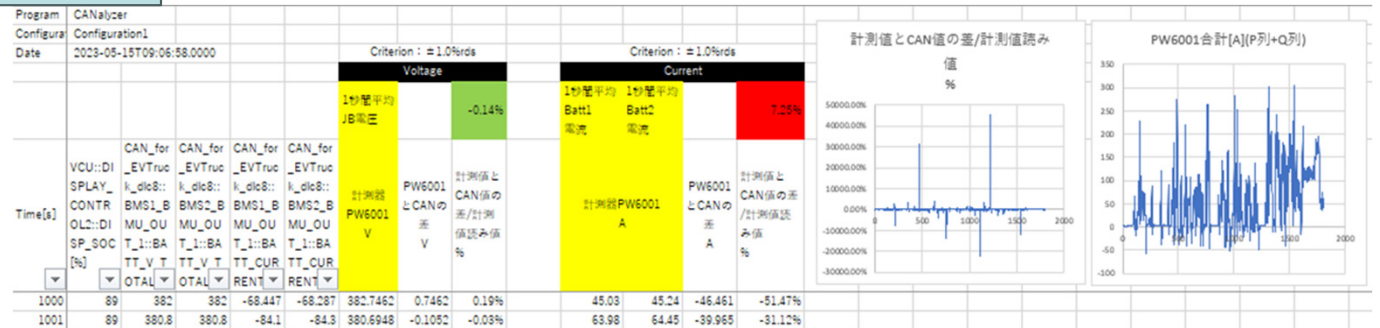
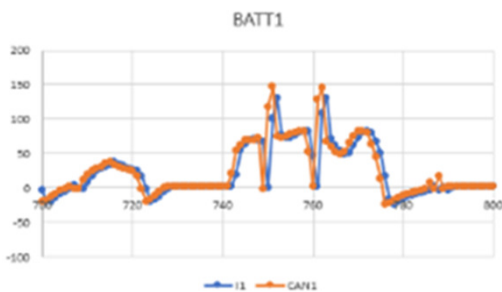
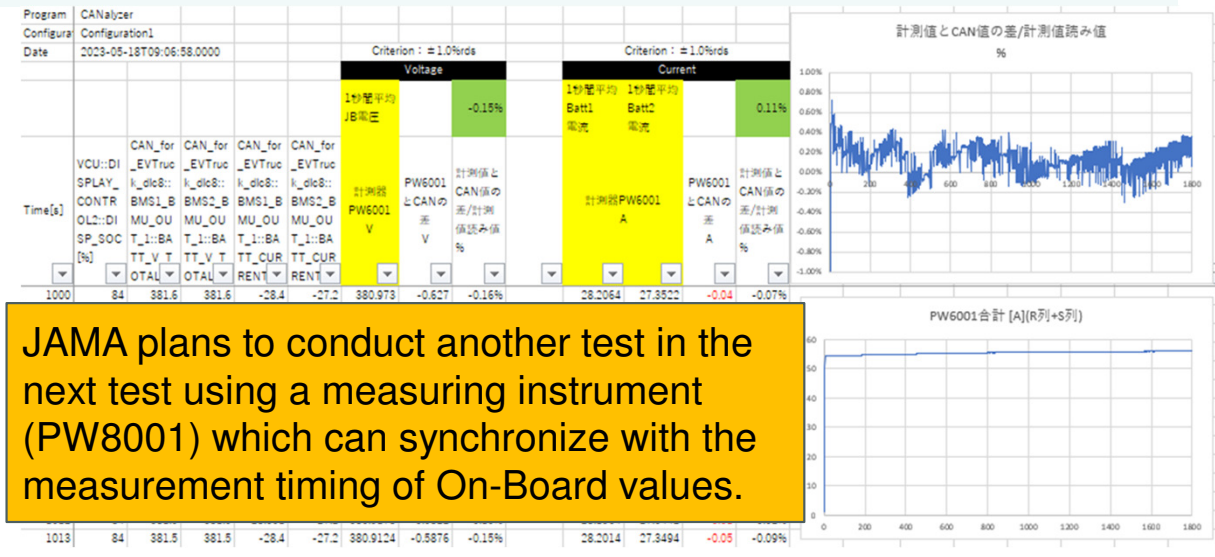
energy

- Still very low scatter of the measurement results within test 1-3 and 4-7 (e.g. compared to emission PEMS testing)
- „impossible“ to define SoH over lifetime without perfectly reproduceable route and load
- Non-accurate voltage sensor on-board leads to added measurement result deviation



3) Comparison test plan for HIOKI current sensor measurement values and On-Board values

Difference ratio(%) between HIOKI and On-Board current/voltage
 Constant C-rate test both within $\pm 1.0\%$
 Mode test Current average 7.25%
 Voltage average 0.14%
 HIOKI comment;
 Due to the timing differenc between the measuring instrument and the measurement of On-Board values. There is no effect from shielded HV cables.



Thank you.