

e-HDVs tests: open questions EVE IWG 68th

Open points of the draft HDV GTR:

- Proposal to merge Method 1a and Method 1b (OICA proposal EVE IWG 66) : to be discussed; in Japan method 1b is not applicable. If merged, only Method 1a will remain. OICA to verify internally the proposal. **To keep both** ✓
- Vehicle selection type approval and for Part A verification (Japan proposal EVE IWG 66): to be discussed
- Driver breaks: km vs time based: time based favourable ✓ JPN: should be confirmed no conflict with RDE requirement
- Run-in HD-PEV and HD-OVC-HEV: draft in the text ✓ JPN supports draft GTR description
- Break-off criterion: For HD-PEV, speed or power not kept any longer. ✓ For HD-OVC-HEV draft proposal in the text
- Cruise control use: possible to be used ✓ EU, Japan, ok to use it
- Verification and qualification of the on-board data (voltage) (OICA proposal): draft proposal in the text
- Steps of the test procedure (schemes and text in the draft GTR): updated schemes and text in the draft
- Temperature, road grading/slope, acceleration to the target speed,...Method 1a & 1b: to be discussed
- Alternative method: draft text added in the GTR
- Test repetitions: draft proposal in the text
- MPR and metric: to be discussed

e-HDVs test open questions: temperature ✓?

- Pre-conditioning, soak and charge to be carried out in a test room/soak area, [23 °C ±5; ± 7 °C] [25 °C ±7; ± 10 °C]
- If test room/soak area not available, not applicable..., allowed to use pre-warming of the battery in cold environment with internal designed functional systems with measurement of the energy
- from RDE moderate conditions (0 to 35 C)
- Not allowed the pre-warming of the battery with an external system

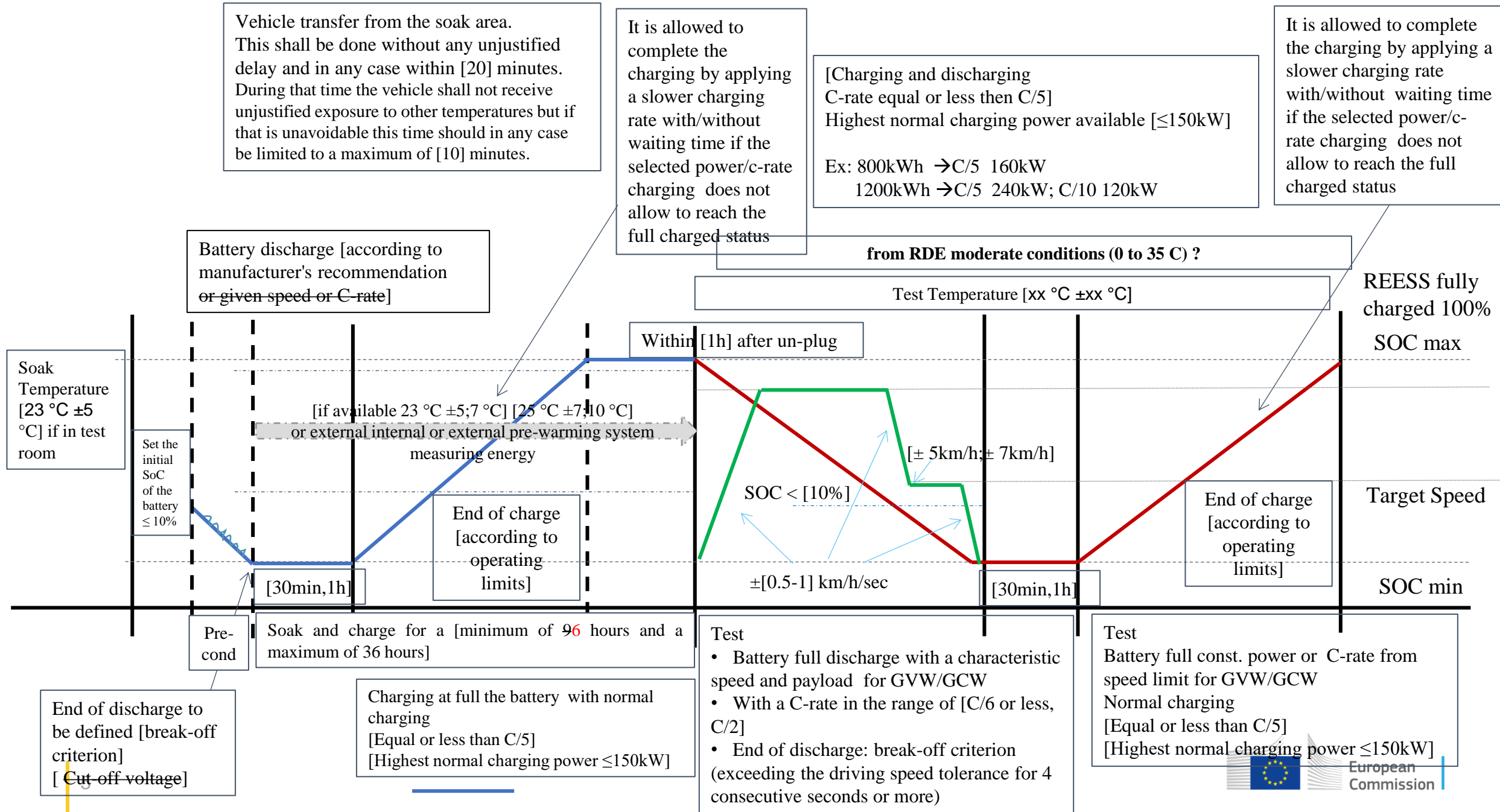
Japan: to improve practical test execution, propose RDE moderate conditions (0 ~ 35 C). based on technical justification, OK to expand the 5% tolerance in case of outside range from 18 ~ 30C.

e-HDVs test open questions: temperature



- ❑ Temperature Method 1a and Method 1b
- ❑ Soak, pre-conditioning and charge at 23°C: to add a sentence in case it is not applied?
 - To try to limit the effect of the temperature in the UBE measured in test 1a and 1b:
 - Higher variation in the UBE measurements at cold
 - UBE certified at cold smaller than UBE certified 23°C
 - To be avoided UBE certified at 23°C and UBE ISC at -5°C for instance
$$\text{SOCE} = (\text{UBE}_{\text{meas}})_{-5^{\circ}\text{C}} / (\text{UBE}_{\text{cert}})_{23^{\circ}\text{C}}$$
 - Comparison between different vehicles in the family tested at different temperatures (Part A, Part B) ?
$$(\text{UBE}_{\text{meas}} / \text{UBE}_{\text{cert}})_{23^{\circ}\text{C}} \text{ vs } (\text{UBE}_{\text{meas}} / \text{UBE}_{\text{cert}})_{0^{\circ}\text{C}}$$
- Tolerance on the UBE measured?
- ~~Corrective factor related to temperature?~~
- ~~To suggest a range of temperature values?~~

Method 1a Discharge by standard average speed on a test track ✓



e-HDV's tests open questions: acceleration, road grading/slope ✓

Japan:

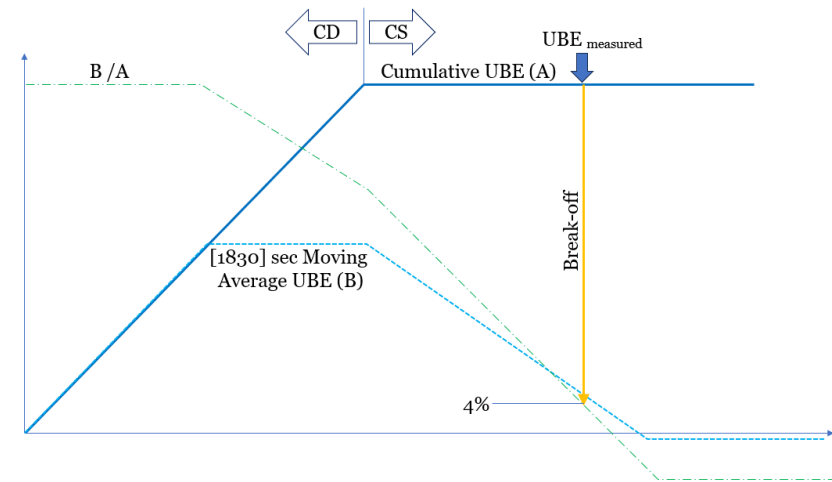
to improve practical test execution, propose to apply same conditions as RDE requirement means that “the cumulative elevation gain” shall be less than 1,200m / 100km

- Road grading/slope, accuracy on UBE to add? ~~Correction factor?~~
 - Effect of the acceleration to the target speed with road grading/slope
 - Effect on the last portion of the test: grading, payload, speed, power request ...
-
- Additional grade requirement in the last part of the test may be necessary to reduce test-to-test variability and to have a more stable SOC level near break-off point
 - To consider the effect of grade, payload and speed near the break-off point

e-HDV's tests open questions: Break-off criterion

Break-off criterion Method 1a, 1b:

- For HD-PEV speed or power not kept any longer ✓ **4 sec rule**
- For HD-OVC-HEV draft proposal in the text based on LDV-OVC-HEV



- [In case of HD-OVC-HEVs the charge depleting vehicle test operation mode shall be selected. The break-off criterion is reached when ...].

- [the vehicle cannot drive in pure electric mode for [4] consecutive seconds or more without recuperation from the engine operation]



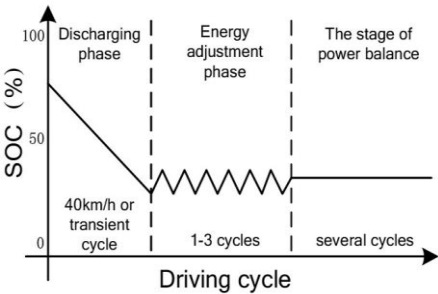
- [the $|\Delta E_{REESS,dt}|$ in the last xx dt of driving is equal to or less than xx per cent of the ~~total nominal energy capacity of the battery~~ **cumulative UBE**. The manufacturer shall provide evidence to the responsible authority after the test that this requirement is fulfilled.]

[For HD-OVC-HEV, the end of the charge-depleting test is considered to have been reached at the end of the energy adjustment phase when the break-off criteria is reached for the first time in the stage of power balance.]

← China proposal

Japan: at least 1500sec ?
 JE05 : 1830 sec
 WLTP 4 : 1800 sec
 WLTP 3 : 1477 sec

Japan: 4 per cent of cumulative UBE



e-HDVs tests open questions: Break-off criterion

□ Break-off criterion **Alternative method:**

- For HD-PEV speed or power not kept any longer ✓ **4 sec rule**
- For HD-OVC-HEV draft proposal in the text based on LDV-OVC-HEV
 - [the relative electric energy change, REEC in the last xx dt of driving, as defined in the following equation, is less than [4] or [5] percent.

$$REEC_{dt} = \frac{|\Delta E_{REESS,dt}|}{E_{cycle} \times \frac{1}{3600}}$$

E_{cycle} is the total energy demand E for the whole cycle ...]

- [the $|\Delta E_{REESS,dt}|$ in the last xx dt of driving is equal to or less than xx per cent of the ~~total nominal energy capacity of the battery~~ **cumulative UBE**. The manufacturer shall provide evidence to the responsible authority after the test that this requirement is fulfilled.]

same
criterion
as
Method
1a/1b?

e-HDVs tests open questions: Steps of the test procedure ✓

Method 1a Discharge by standard average speed on a test track

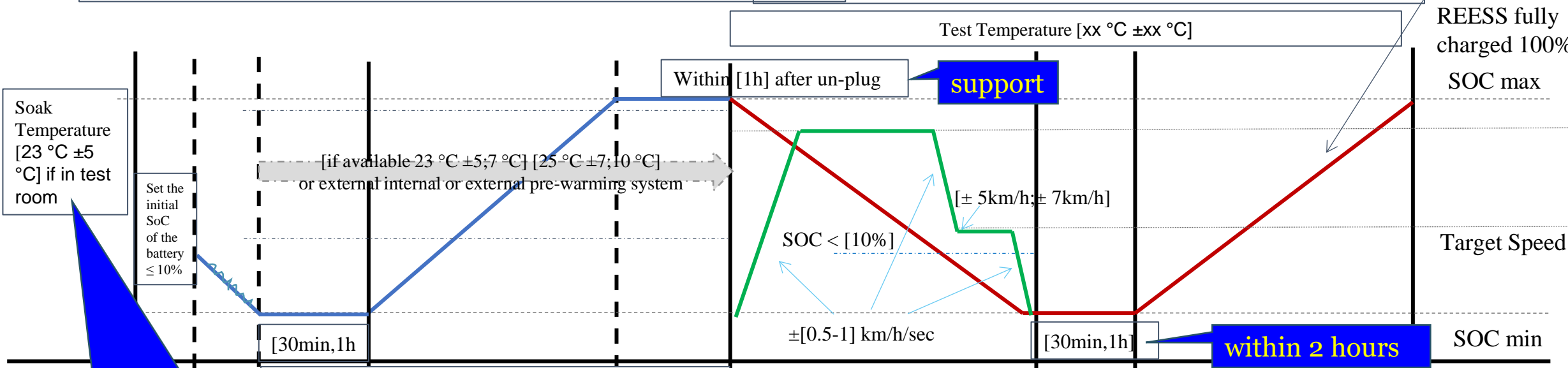
- Range of speed per category per region track
- To leave open the speed for the test and prescribe only the target speed in the last part of the test for which a speed tolerance will be applied
- The last part of the test starts when the SOC < [10%] (to be verified)
- Speed tolerance in last test segment [$\pm 5\text{km/h}; \pm 7\text{km/h}$]
- The acceleration/deceleration during vehicle speed change shall be smooth and accomplished within the range $\pm[0.5-1]\text{ km/h/sec}$
- End of discharge: break-off criterion
- Temperature provision due to cold temperature effect

[Charging and discharging
C-rate equal or less than C/5
Highest normal charging power available $\leq 150\text{kW}$

Ex: $800\text{kWh} \rightarrow \text{C/5 } 160\text{kW}$
 $1200\text{kWh} \rightarrow \text{C/5 } 240\text{kW}; \text{C/10 } 120\text{kW}$

It is allowed to complete the charging by applying a slower charging rate with/without waiting time if the selected power/c-rate charging does not allow to reach the full charged status

from RDE moderate conditions (0 to 35 C)?



Soak Temperature [23 °C ±5 °C] if in test room

Set the initial SoC of the battery $\leq 10\%$

[if available 23 °C ±5; 7 °C] [25 °C ±7; 10 °C] or external internal or external pre-warming system

Within [1h] after un-plug

support

Test Temperature [xx °C ±xx °C]

REESS fully charged 100% SOC max

Target Speed

SOC min

[30min, 1h]

SOC < [10%]

[± 5km/h; ± 7km/h]

±[0.5-1] km/h/sec

[30min, 1h]

within 2 hours

Japan: 23 or 25 +/-5 = 18 ~ 30 C as an option, wider temperature range is acceptable without any correction if manufacture allows.

6 to 36 hours

Test

- Battery full discharge with a characteristic speed and payload for GVW/GCW
- With a C-rate in the range of [C/6 or less, C/2]
- End of discharge: break-off criterion (exceeding the driving speed tolerance for 4 consecutive seconds or more)

Test

Battery full const. power or C-rate from speed limit for GVW/GCW

Normal charging [Equal or less than C/5]

Highest normal charging power $\leq 150\text{kW}$

not able to support



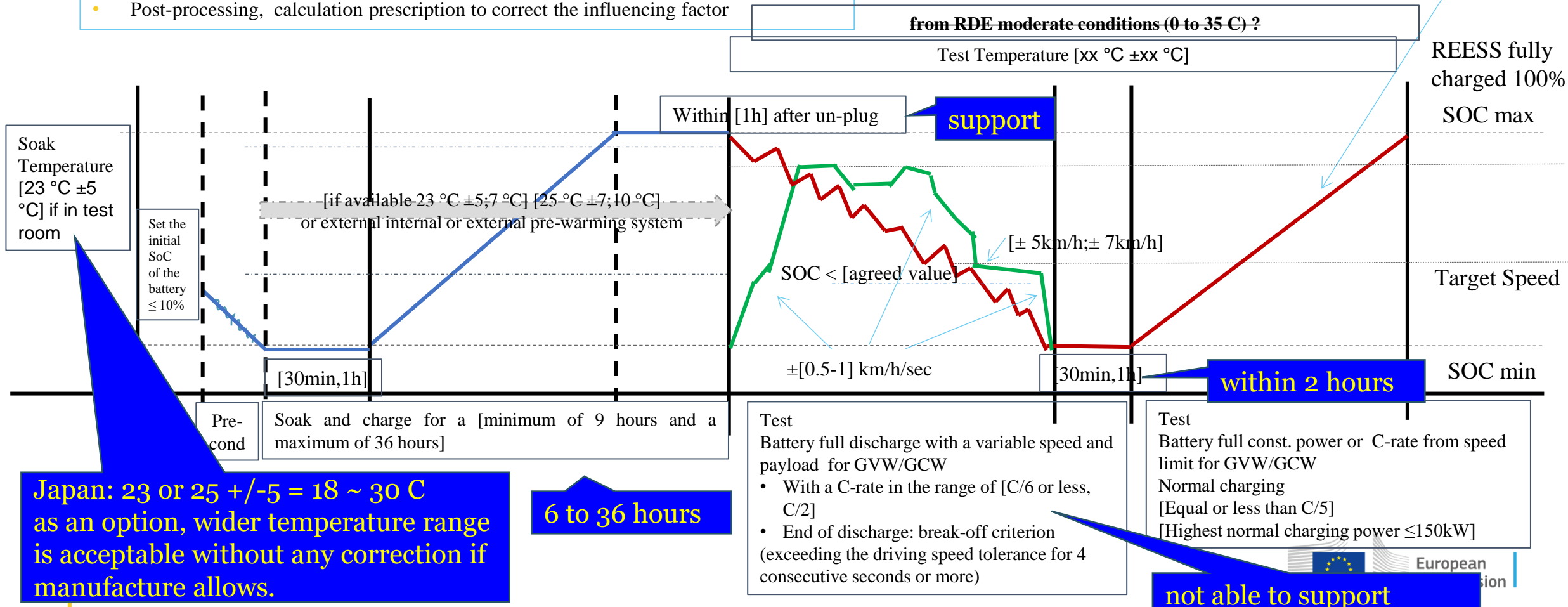
- Range of on-road speed per category per region
- To leave open the speed for the test
- The last part of the test starts with a given SOC level
- Some agreement with local regional authority for SOC minimum level and test
- Same route as type approval or different in accordance with regional authority
- If same routes is used, different provision on minimum SOC level and test
- Speed tolerance? in last test segment ?
- The acceleration/deceleration during speed change shall be as smooth as possible in relation to traffic conditions and safety of driving
- Post-processing, calculation prescription to correct the influencing factor

Method 1b Discharge by driving on the road with average speed

[Charging and discharging
C-rate equal or less than C/5
Highest normal charging power available $\leq 150\text{kW}$

Ex: $800\text{kWh} \rightarrow C/5 \ 160\text{kW}$
 $1200\text{kWh} \rightarrow C/5 \ 240\text{kW}; C/10 \ 120\text{kW}$

It is allowed to complete the charging by applying a slower charging rate with/without waiting time if the selected power/c-rate charging does not allow to reach the full charged status



Method 2 bidirectional charging system available

Japan: 23 or 25 +/- 5 = 18 ~ 30 C as an option, wider temperature range is acceptable without any correction if manufacture allows.

Vehicle transfer from the soak area. This shall be done without any unjustified delay and in any case within [20] minutes. During that time the vehicle shall not receive unjustified exposure to other temperatures but if that is unavoidable this time should in any case be limited to a maximum of [10] minutes.

It is allowed to complete the charging by applying a slower charging rate with/without waiting time if the selected power/c-rate charging does not allow to reach the full charged status

[Charging and discharging C-rate equal or less than C/5]
Highest normal charging power available [$\leq 150\text{kW}$]

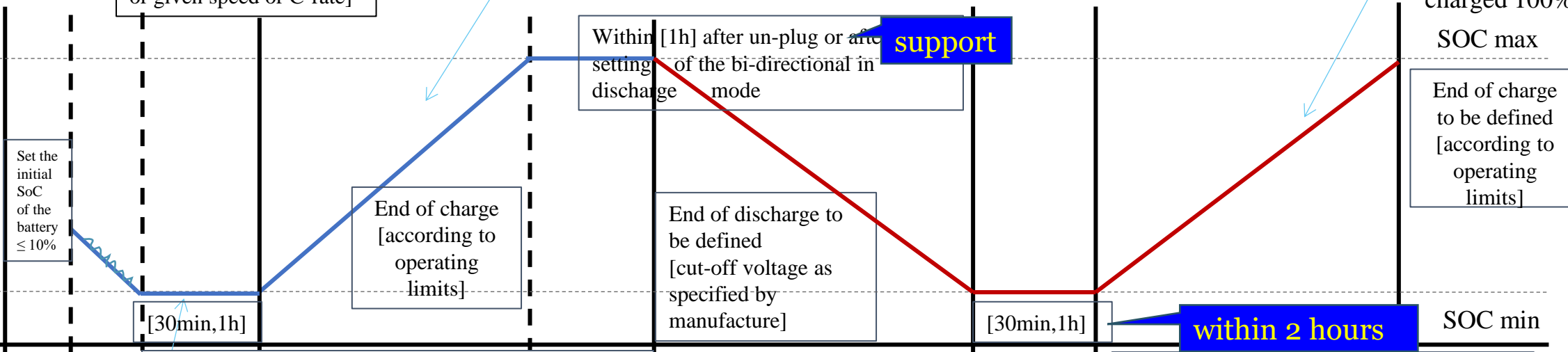
Ex: 800kWh \rightarrow C/5 160kW
1200kWh \rightarrow C/5 240kW; C/10 120kW

It is allowed to complete the charging by applying a slower charging rate with/without waiting time if the selected power/c-rate charging does not allow to reach the full charged status

within 0 ~ 35 C

Test Temperature [23 °C \pm 5 °C]

Test Temperature [23 °C \pm 5 °C]



Within [1h] after un-plug or after setting of the bi-directional in discharge mode

End of discharge to be defined [cut-off voltage as specified by manufacture]

End of charge to be defined [according to operating limits]

Pre- Soak and charge for a [minimum of 9 hours and a maximum of 36 hours]

Test Battery full discharge with constant power or constant C-rate from the characteristic speed for GVW/GCW

Test Battery full charge with constant power or constant C-rate from the characteristic speed for GVW/GCW
Normal charging [Equal or less than C/5]
[Highest normal charging power $\leq 150\text{kW}$]

follow manufacture recommendation

6 to 36 hours

within 2 hours

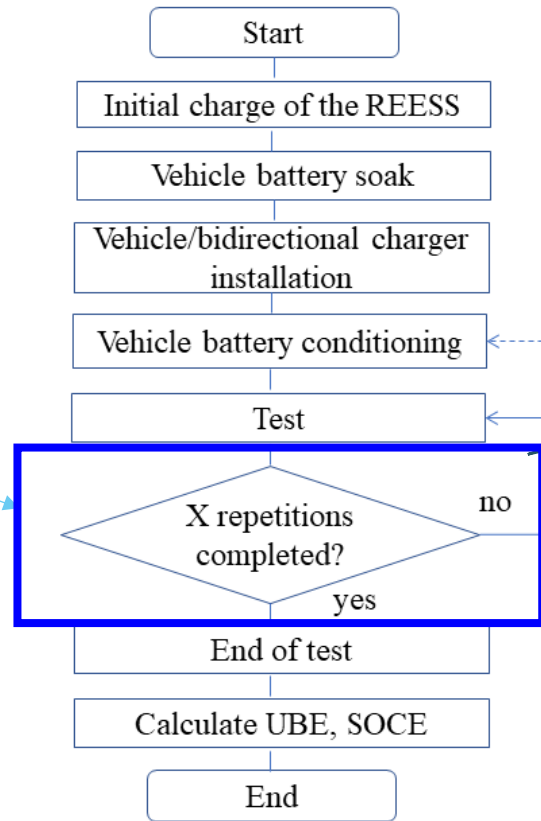
not able to support

End of discharge to be defined for bi-directional charging test [Cut-off voltage]

Charging at full the battery with normal charging [Equal or less than C/5]
[Highest normal charging power $\leq 150\text{kW}$]

e-HDV's tests open questions: test repetition

- Method 1a
- Method 1b
- Method 2
- Alternative Method



Japan: proposal to delete
Then two possible scenarios

#2

no repetition with
the additional
tolerance based on
ambient temperature

#1

no repetition without any
additional tolerance
(can be handled as a part
of statistical analysis
process)

EVE-68-08e

Repetition of RTE test criterion :
 1.000 ± 0.050 @Ah

OEM Declaration value ± 0.050 @kWh
for UBE_{certified}

e-HDVs tests open questions: REESS voltage measurement

- Verification and qualification of the on-board data (voltage) (OICA proposal)
- Draft text:
- Measurement of the voltage and current
- Possibility to use on-board-data

OK with this

- [As an alternative to the use of voltage measurement devices, use of on-board measurement data is permissible if the accuracy and frequency of these data is demonstrated to the responsible authority to meet the minimum requirements for accuracy and frequency described in [paragraph 2.2. of this annex].

and frequency

- [The on-board measurement data of the voltage can be used during the in-service testing only when the accuracy of on-board measurement data is confirmed during the Type Approval Test and a safe inspection point is made available for the direct measurement verification

- **Possibility to use on-board data during ISC but to retain the ability to measure the voltage**

- [~~External REESS voltage measurement (GTR No. 15)~~

- ~~The REESS voltage shall be measured with the equipment and accuracy requirements specified in paragraph x.x. of this annex. To measure the REESS voltage using external measuring equipment, the manufacturers shall support the responsible authority by providing REESS voltage measurement points and safety instructions.~~

- ~~Vehicle on-board REESS voltage data (GTR No. 15)~~

- ~~As an alternative to the external REESS voltage measurement specified in paragraph x.x. of this annex, the manufacturer may use the vehicle on-board REESS voltage measurement data. The accuracy of these data shall be demonstrated to the responsible authority.]~~

e-HDVs tests open questions: **Alternative method**

- Draft text added in the draft HDV GTR to be revised and completed

propose to allow the additional cycle as a CP option.
(please refer “15_13-03-2024-GTR HDV battery durability working draft GTR - v15_JPN.docx”)

e-HDVs tests open questions: **Metric and MPR**

- To be discussed
- JRC presentation as overview

e-HDVs tests open questions: Battery Replacement?

Thank you

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