

HDV Battery Durability presentation

~Another Test Measurement For UBE~

61st EVE Meeting
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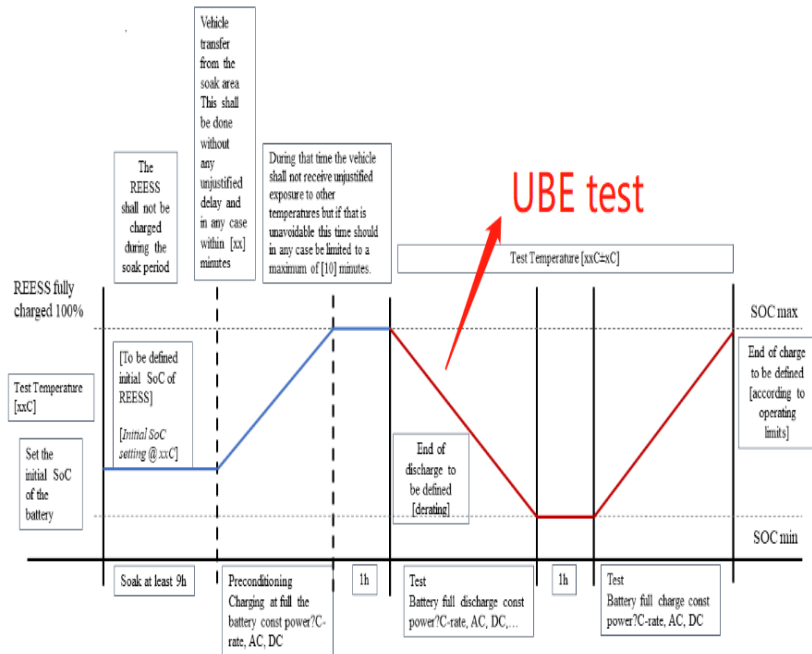
Another Test Measurement For UBE

Disadvantage of the UBE test with fixed discharge rate

- 1) Fixed discharge rate is not the real vehicle operation. The vehicle can not always run at a fixed speed. The energy from the fixed discharge rate doesn't reflect the available energy of the vehicle's battery.
- 2) To consider the battery's power attenuation, the energy from aging battery can not discharge as the new battery for many real cycles, such as the acceleration or climbing, the fixed discharge rate test can not verify the battery's power attenuation.
- 3) The UBE for new vehicle certification is relied on the real-cycle test. We should keep it for aging battery.

Suggestion of our proposals

We suggest that we should retain the real-cycle measurement for the heavy duty vehicle's UBE in the new GTR, and **We china would like to edit this part.**



Annex 3 the test procedure

Heavy-duty electric vehicle test in China

HD chassis dynamometer



HDV energy consumption test



Power analyzer



Heavy-duty four-wheel chassis dynamometer

- ✓ Inertia simulation range: 3500kg - 60000kg
- ✓ Maximum speed: 130km/h
- ✓ Wheelbase adjustment range: 3.2m~8.0m
- ✓ Vehicle drive type: 4×2; 4×4; 6×4; 6×6; 8×8
- ✓ Laboratory size: 30m×10m×8.5m

Power analyzer for electric vehicles measurement

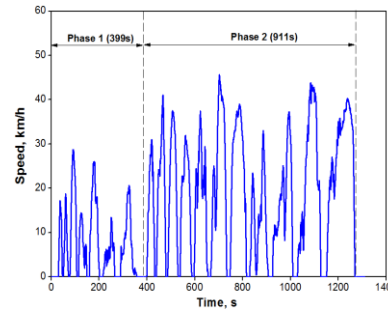
- ✓ Voltage measurement span: 15v-1500v
- ✓ Current measurement span: 0.1A-20 000A
- ✓ Power measurement range: 0.015W-39.6MW
- ✓ Frequency range: 0.5HZ-5kHZ
- ✓ Measurement parameter: Voltage, Current, Power, ect.

Heavy-duty commercial vehicle test cycle (CHTC)

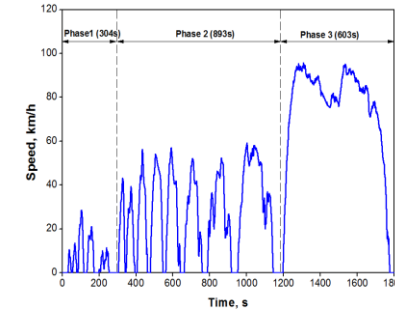
The CHTC includes six chassis dynamometer driving cycles for various types of heavy-duty commercial vehicles with GVW>3500 kg

- CHTC-B: heavy-duty commercial vehicle test cycle for **city buses**.
- CHTC-C: heavy-duty commercial vehicle test cycle for **inter-city coaches**.
- CHTC-LT: heavy-duty commercial vehicle test cycle for **light trucks** of GVW≤5500 kg.
- CHTC-HT: heavy-duty commercial vehicle test cycle for **heavy trucks** of GVW>5500 kg .
- CHTC-D: heavy-duty commercial vehicle test cycle for **dump trucks**.
- CHTC-TT: heavy-duty commercial vehicle test cycle for **tractor trailers**.

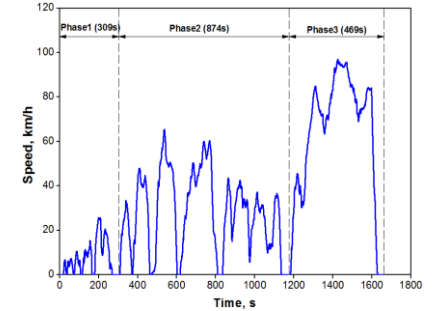
CHTC-B test cycle



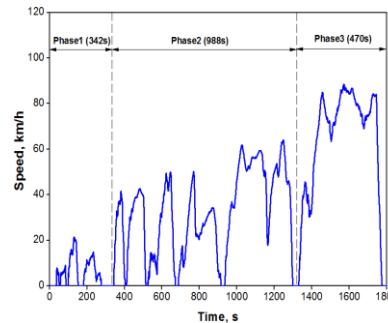
CHTC-C test cycle



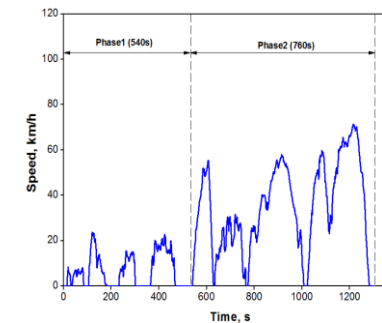
CHTC-LT test cycle



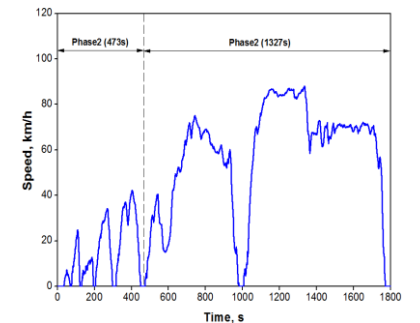
CHTC-HT test cycle



CHTC-D test cycle



CHTC-TT test cycle



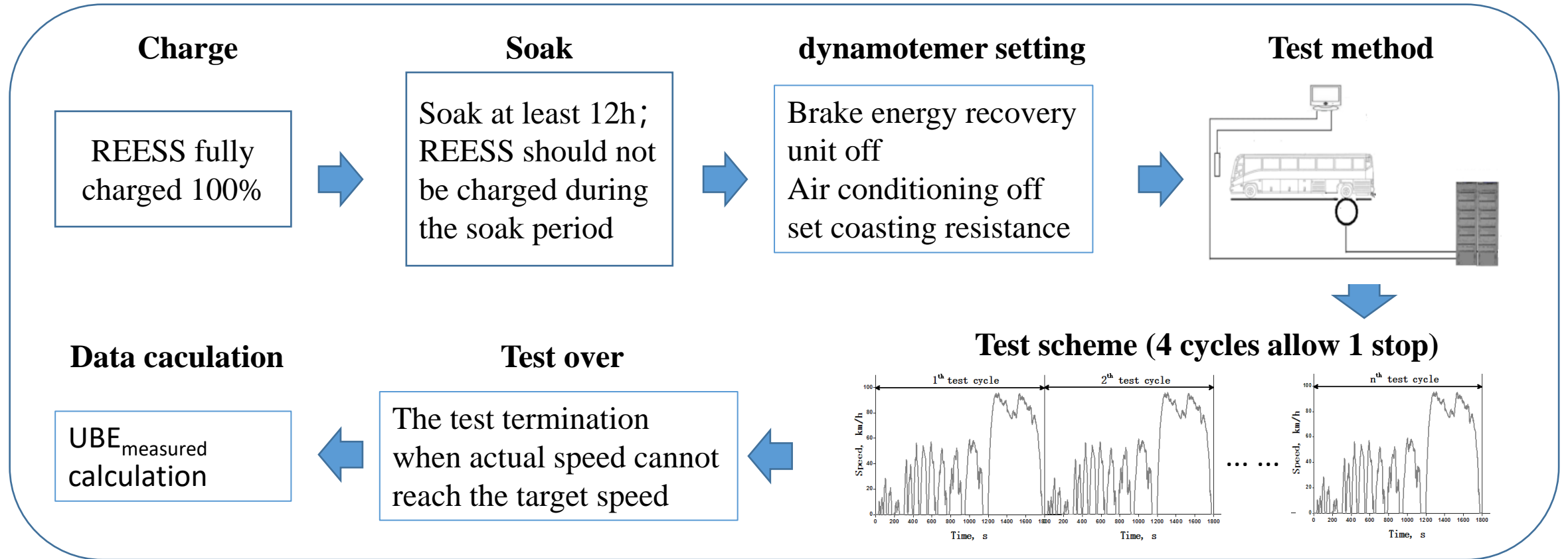
The test cycles are divided into phases of increasingly faster driving

Heavy-duty electric vehicle test methods (UBE)

The measurement method of the on-board battery UBE

China proposes to add cycles test method by using HD chassis dynamometer to measure UBE, which is used to calculate on-board battery SOCE , The test method is shown below.

UBE test flow chart



Heavy-duty electric vehicle energy calculate methods (UBE)

The calculation method of the on-board battery UBE

UBE is calculated by current and voltage signal collected by power analyzer.

UBE caculation flow

$$\Delta E_{REESS,k,j} = \frac{1}{3600} \times \int_{t_0}^{t_{end}} U(t)_{REESS,k,j} \times I(t)_{k,j} dt$$

$$\Delta E_{REESS,j} = \sum_{k=1}^m \Delta E_{REESS,k,j}$$

$$UBE = \Delta E_{REESS,j}$$

Annotation

k — REESS number.

j — Test cycle number.

m — REESS quantity.

SOCE caculation

$$SOCE = \frac{UBE_{measured}}{UBE_{certified}}$$

Annotation

$UBE_{measured}$ — means the UBE determined at the present point in the lifetime of the vehicle by the test procedure used for certification, according to the presentation.

$UBE_{certified}$ — refers to the UBE that was determined during the certification of the vehicle, according to the presentation.

Presentation summary

Summary

The above content is the energy consumption test method proposal of China's heavy pure electric vehicle, We sincerely suggest that EVE can consider adding UBE measurement method of the presentation, the reason is following:

- Test cycle method can measure the available battery energy UBE in accordance with the actual use of the vehicle compared to RTE. The SOCE can also reflect the attenuation degree of the vehicle battery more truly.
- The presentation method has rich testing experience and it is feasible and convenient.

Intentions

China working group is also very willing to undertake corresponding research work for this presentation or other projects from the In-vehicle Battery Durability for Electrified Heavy Duty Vehicles.

Finally, China working group welcomes EVE experts to China, meanwhile, we are pleasure to invite every expert to visit our heavy-duty vehicle laboratory.