

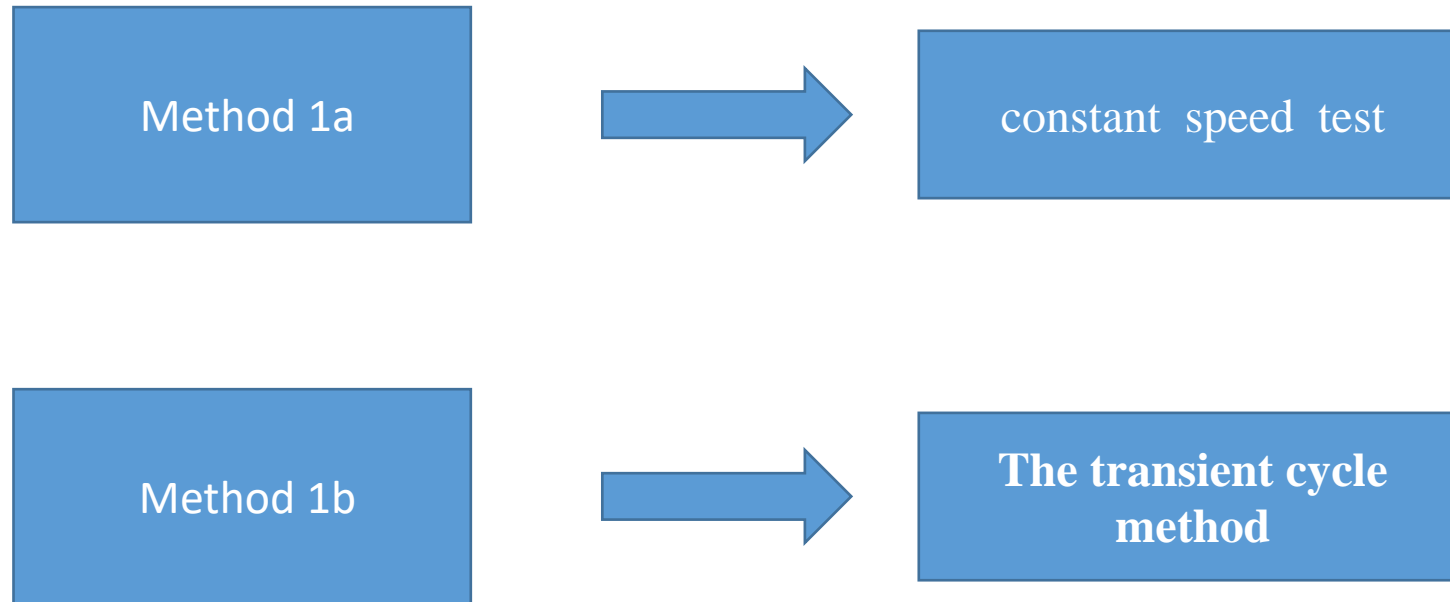
Test method by using HD chassis dynamometer

~Alternative method For UBE~

China, January 09, 2024

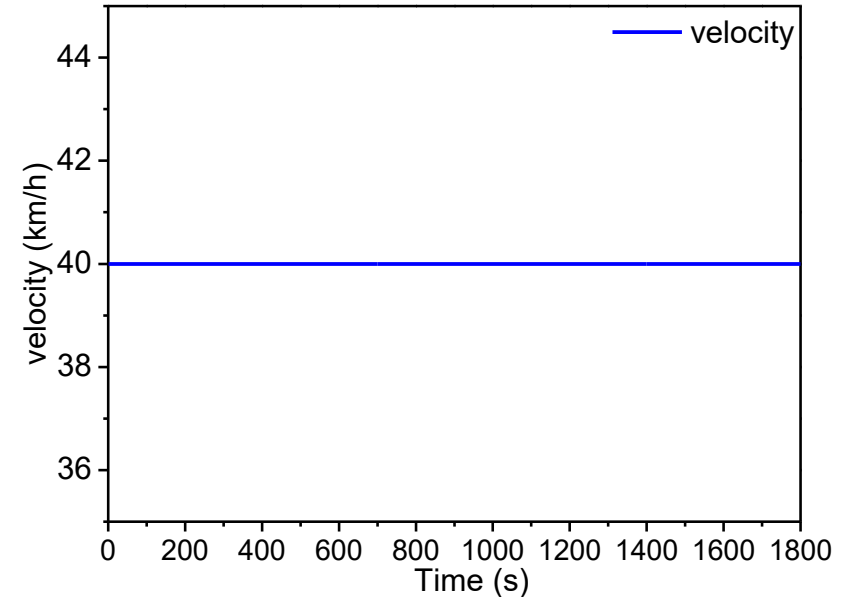
Test method by using HD chassis dynamometer

This method can realize constant speed test (1a) and transient condition test (1b). The tests can be carried out in the laboratory for easy control of environmental conditions. It can replace the scenarios of 1a and 1b.



The constant velocity method

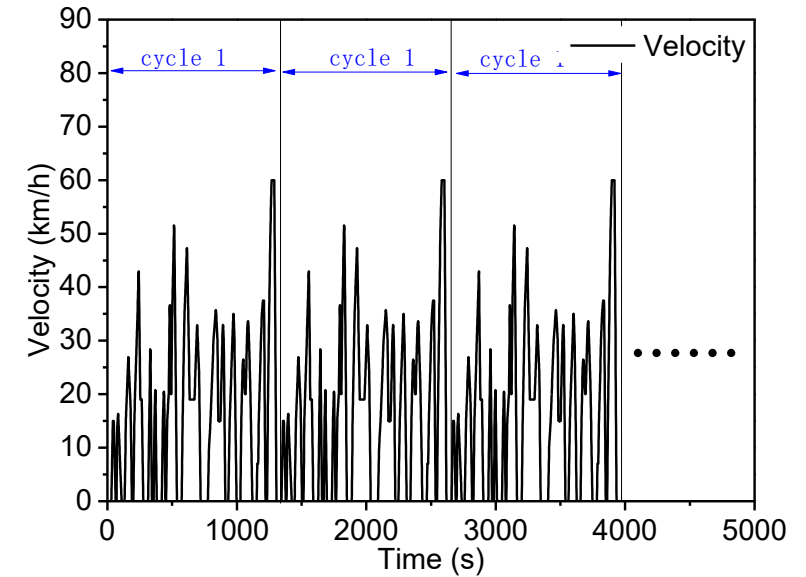
- ❑ The velocity shall be determined in agreement with the local authorities.
- ❑ During the experiment, the speed can be controlled manually or by cruise control system.
- ❑ The speed deviation should be controlled in the scope of ± 3 km/h.
- ❑ The test stop when the vehicle speed does not reach [set speed-4]km/h.



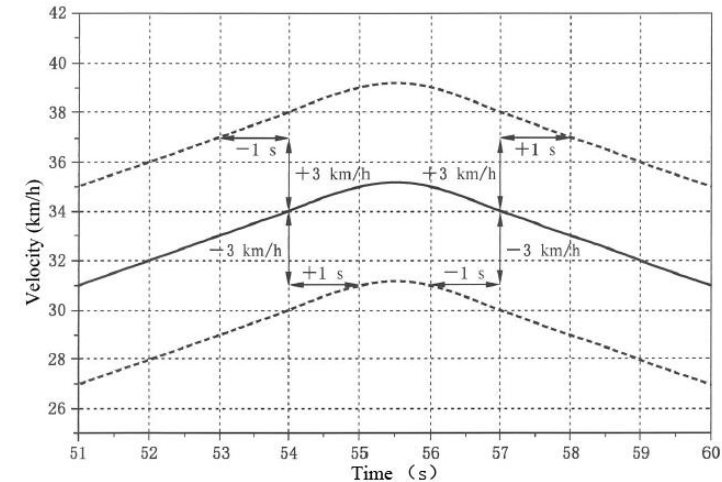
The constant cycle

The transient cycle method——conventional method using repeated cycles

- ❑ The cycle shall be determined in agreement with the local authorities.
- ❑ The test is carried out by conventional method using repeated cycles.
- ❑ During the test, The tolerance of each point speed should be $\pm 3\text{km/h}$.
- ❑ the time should be $\pm 1\text{s}$.
- ❑ the total deviation time of each cycle should not exceed 15s.



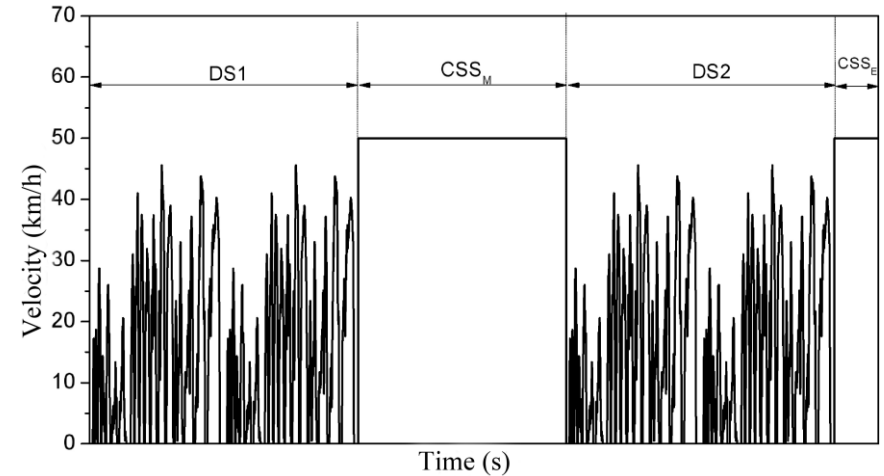
The repeated cycle



The tolerance

The transient cycle method——shortening method

- ❑ The velocity segment consists of two test cycle segments (DS1 and DS2) and two constant velocity segments (CSSM and CSSE).
- ❑ The constant speed section can be carried out at a higher speed to discharge as soon as possible and reduce the test time.
- ❑ For the cycle segments, the tolerance requirement should meet the requirements in the conventional method.
- ❑ For the constant velocity segments, the speed deviation should be controlled in the scope of ± 3 km/h.

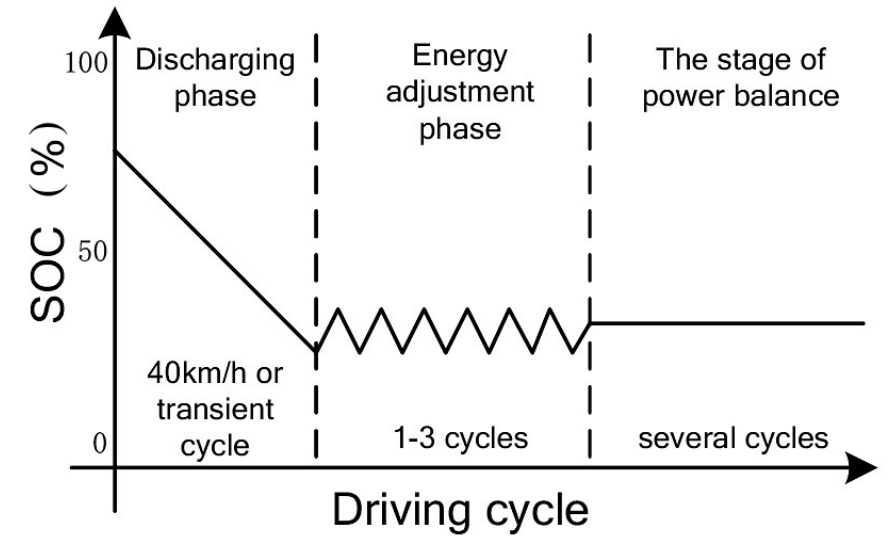


The test process of shortening method

- ❑ When the working condition test can not meet the tolerance requirements, the test is terminated.
- ❑ Another condition for termination is when the dashboard displays a low battery alarm.

The method for OVC-HEV

- ❑ the working process of OVC-HEV have three stages, Discharging phase, Energy adjustment phase and the stage of electric power balance. The UBE testing procedure should be phase 1 and phase2.
- ❑ The test start at 100% SOC. The end time of the test is the beginning time of the electric power balance stage.
- ❑ The conditions for determining the electric power balance stage can be determined according to the energy change of the battery in the test cycle. The recommended value shall be determined in agreement with the local authorities.



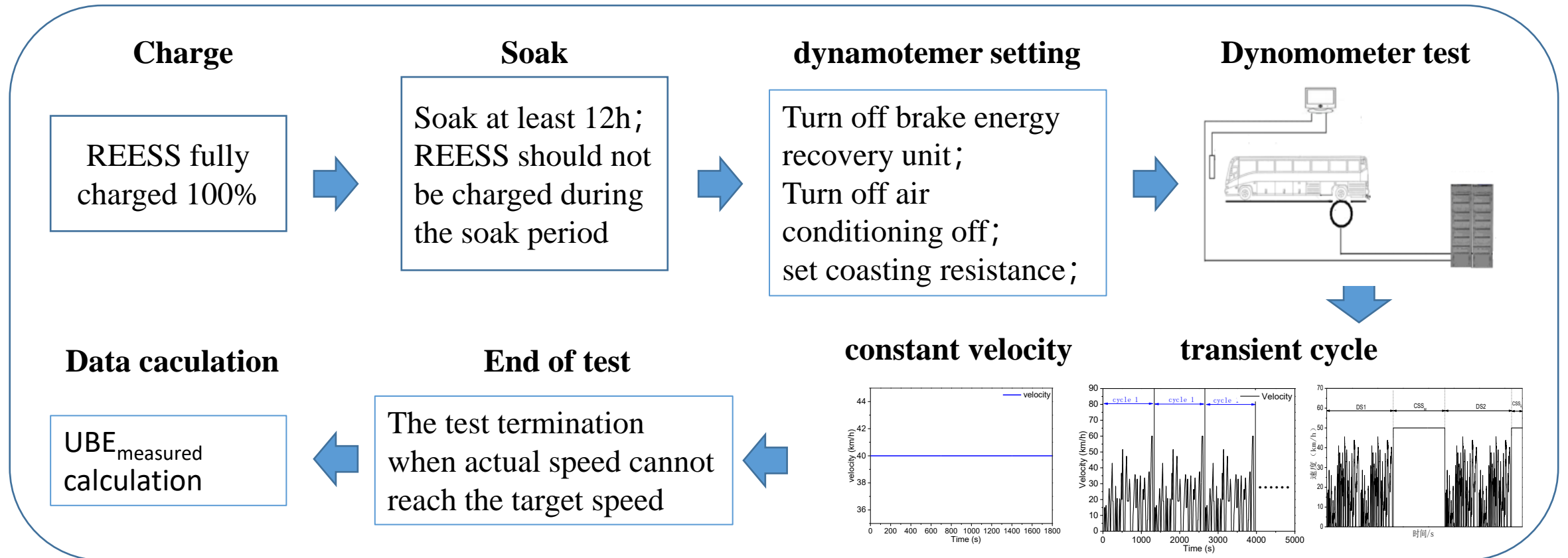
SOC variation of HD-OVC-HEV

China 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



China 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 calculation 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 calculation

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

Annotation

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

$UBE_{certified}$ — 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.