HDV Battery Durability presentation

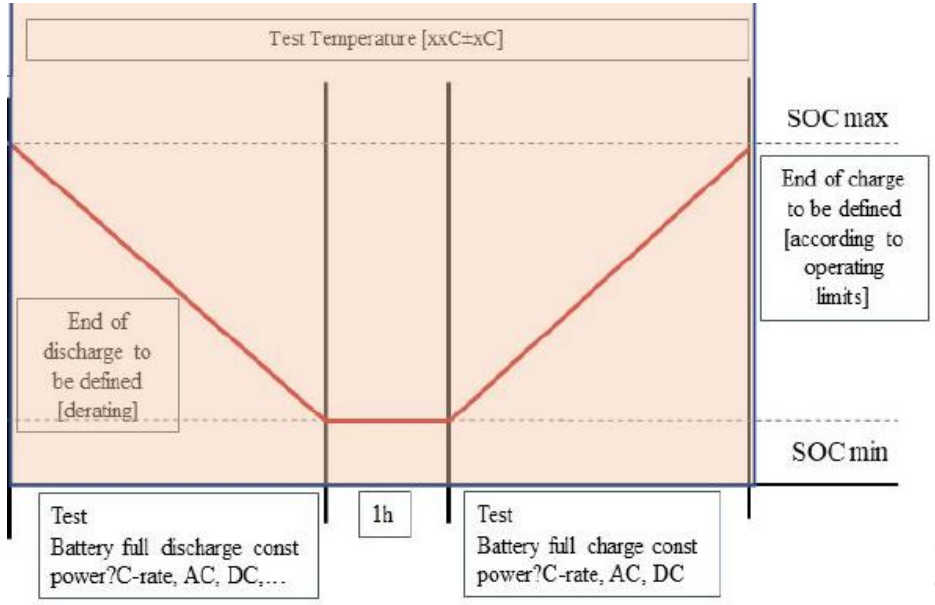
~ Operating Condition Method for UBE ~

62nd EVE Meeting
Geneva, May 30th, 2023

The instructions of UBE test method proposals

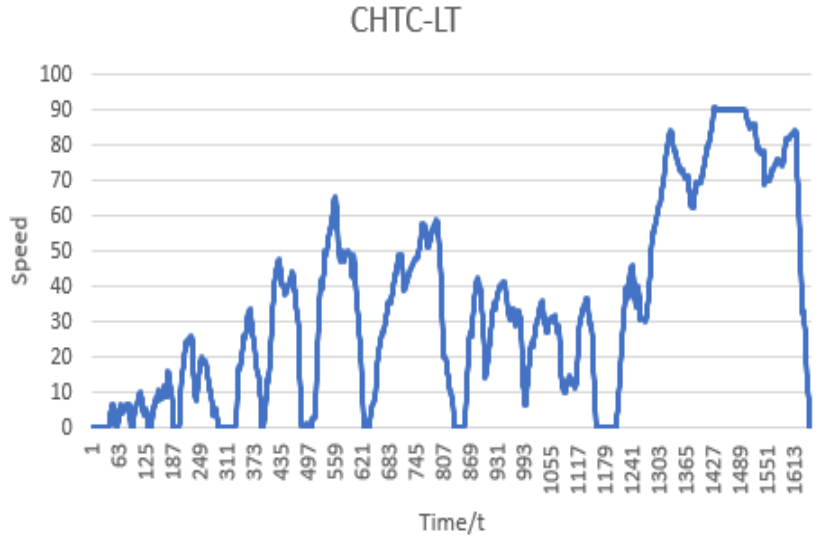
It is recommended to use the operating condition method instead of the constant current method for power battery system UBE testing.

Constant current method



Recommend

operating condition method (for example, CHTC-LT)

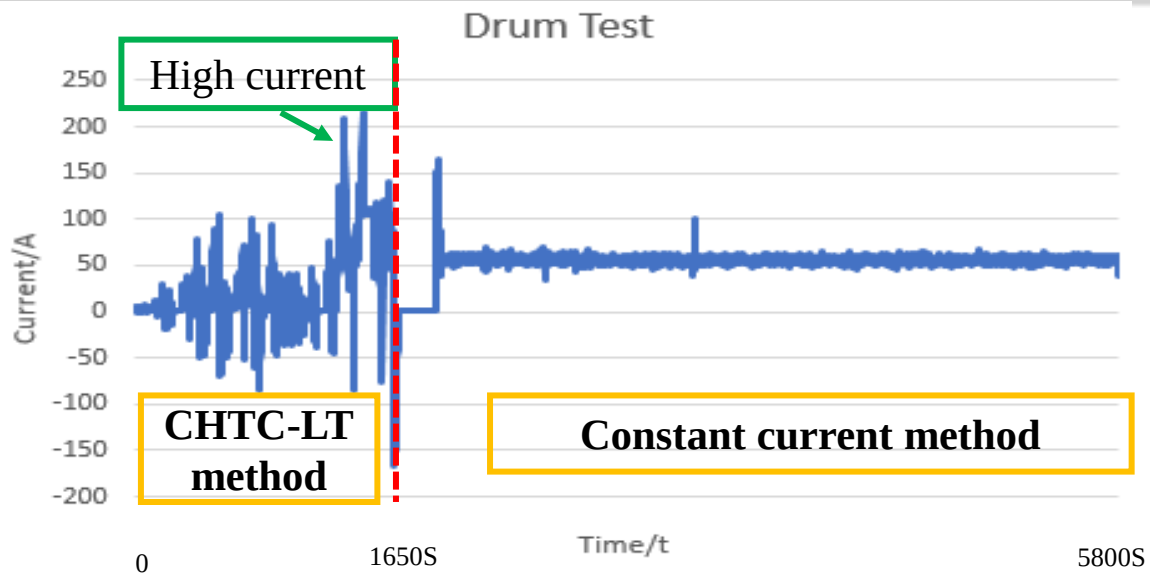


At least we should retain the chassis method for UBE

Constant current method: equivalent to the equal speed method, the discharge power/current value is constant. However, the vehicle cannot always travel at a uniform speed.

CHTC-LT working condition (China Heavy-duty Vehicle Test Cycle - Light Truck GVW ≤ 5500kg):
Divided into low speed, medium speed, high speed three speed intervals, the total duration of 1640s.
CHTC-LT is based on vehicle speed, which is closer to the actual vehicle operating conditions and better reflects the actual discharge power/current capacity of the power battery system.

The instructions of UBE test method proposals



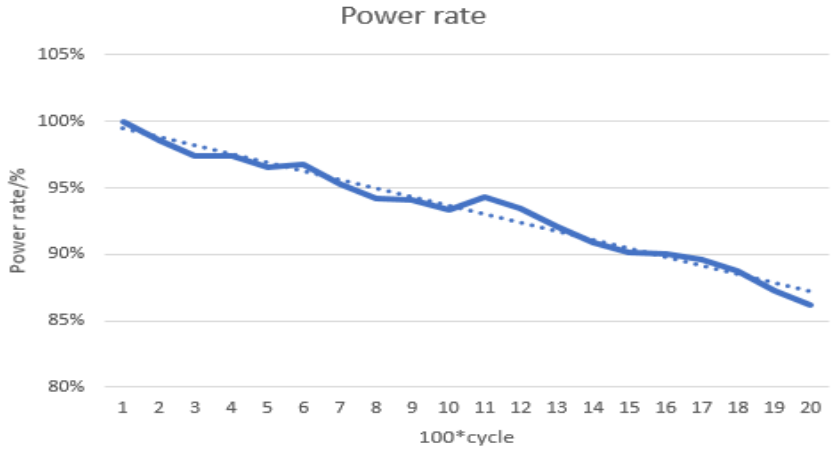
Comparison of test current value for 4.5t electric light truck CHTC-LT method and 70km/h vehicle speed (constant current method)
(The battery system is lithium iron phosphate 81.14kWh, 150Ah the vehicle is fully loaded (4.5t))

➢ Constant current method:
The constant current discharge capacity of the battery system does not decrease with the SOC and capacity decay, and the test results cannot reflect the actual usage state of the whole vehicle power/current.

➢ CHTC-LT method:
1. the battery system discharge power/current changes with the actual working condition, the maximum power/current is much larger than the constant current method;
2. the vehicle is discharged at low SOC (30%) with reduced power/current and limited acceleration or hill climbing ability;
3. the battery system capacity/power and power/current capability will continue to decrease when the vehicle is used up to EOL;
4. When low SOH, low SOC, acceleration or hill climbing generates high current, insufficient discharge power/current capacity will trigger the threshold (undervoltage) alarm, and CHTC-LT method can verify the discharge power/current capacity at that stage.

SoC/T	0.0	5.0	10.0	20.0	30.0
-35 ℃	0.0	0.0	0.0	0.0	15.0
-30 ℃	0.0	4.4	8.8	18.8	37.5
-25 ℃	0.0	9.4	18.8	37.5	75.0
-15℃	0.0	9.4	18.8	37.5	75.0
-10℃	0.0	28.1	56.3	93.8	180.0
-5℃	0.0	37.5	75.0	150.0	318.8
0℃	0.0	41.9	83.8	158.8	327.5
5℃	0.0	46.9	93.8	168.8	337.5
10℃	0.0	49.4	98.8	182.5	365.0
15℃	0.0	51.3	102.5	197.5	395.0
20℃	0.0	53.8	107.5	211.3	422.5
25℃	0.0	56.3	112.5	225.0	450.0
30℃	0.0	56.3	112.5	225.0	450.0
35℃	0.0	56.3	112.5	225.0	450.0
40℃	0.0	56.3	112.5	225.0	450.0
45℃	0.0	56.3	112.5	225.0	450.0
50℃	0.0	56.3	112.5	225.0	450.0
55 ℃	0.0	56.3	112.5	225.0	450.0
60 ℃	0.0	56.3	112.5	225.0	450.0
65 ℃	0.0	0.0	0.0	0.0	0.0

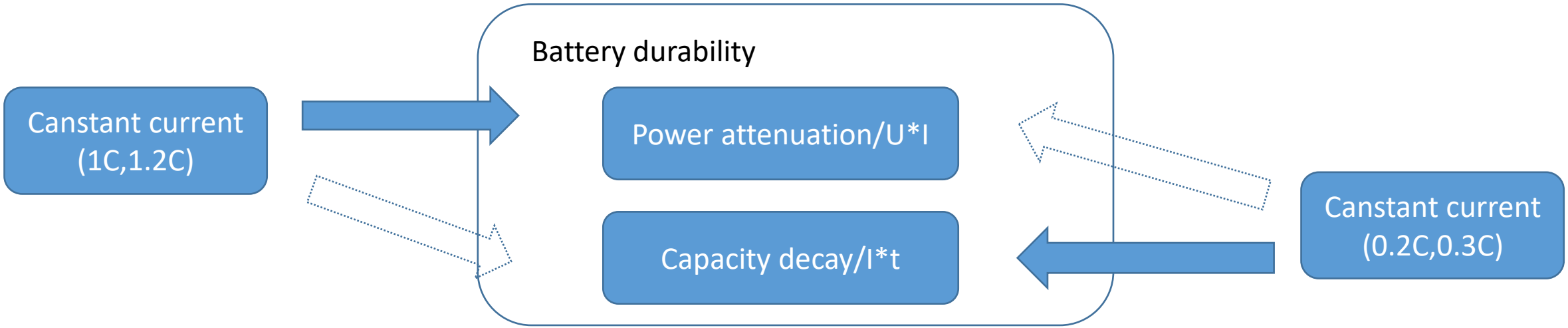
Discharge current MAP at different SOC :
When SOC is lower than 30%, the battery system discharge capacity decreases significantly.



Power attenuation: the discharge power capacity decreases with the increase of the frequency of charging/discharging cycle.

why we choose the the operating condition method

The purpose of GTR XXX for HDV is to regulate the in-vehicle battery decay, and verify that if the old vehicles meet or not. The in-vehicle battery decay includes the power attenuation and capacity decay. Either of them will influence the battery durability and consumer experience. So, we should verify the power attenuation and capacity decay together. However, the constant current method for UBE test can not verify these two attenuations together.



If we choose the canstant high current,the terminal for the old battery UBE test is result from the Power attenuation, we can't verify the capacity decay of in-vehicle battery.

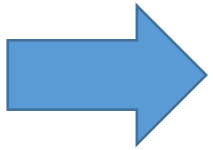
IF we choose the canstant low current, the terminal for the old battery UBE test is result from the capacity decay, we can't verify the power attenuation of in-vehicle battery.

why we choose the the operating condition method

The operating condition methode can well verify the power attenuation and capacity decay together.

operating condition method

variable current can take into account the power attenuation and capacity decay.



Battery durability

- Power attenuation/U*I
- Capacity decay/I*t