

Progress Status on HD UBE Measurement prepared by JAPAN

61st EVE IWG
25th & 26th April, 2023

Background

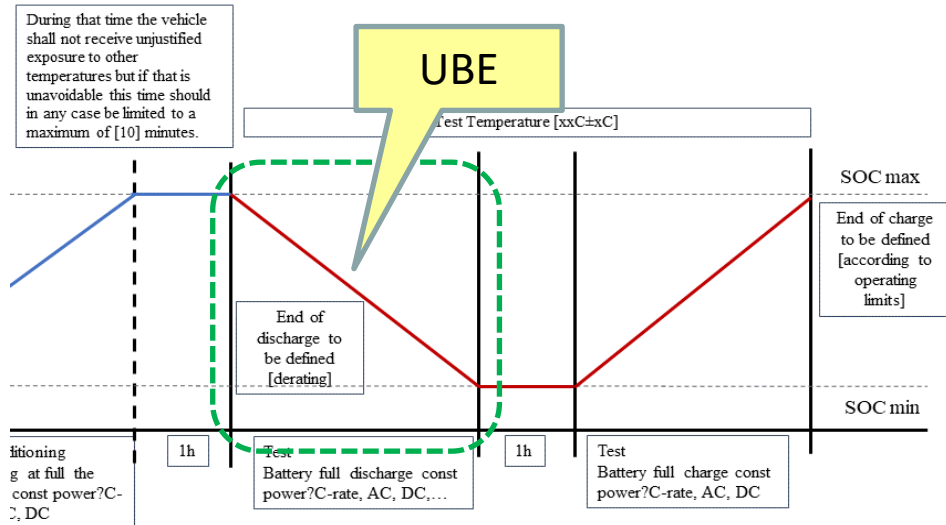
UBE test for Heavy-duty vehicles

【EVE-59】 10/Jan./2023

As a first step,
JRC execute the Charge / Discharge Test.



JPN also starts the physical tests to develop the test procedure for UBE determination < April/2023 ~ >



Informal document **GRPE-87-52**
87th GRPE, 10 January~13 January 2023
Agenda item 9

Heavy-duty Durability GTR

7

EVE-57-10-Rev1a

① Different possibilities for certification and in-service testing of HDV and LCV

Options Testing	Charge/Discharge test	Chassis-Dynamometer LCV segment ¹⁾ only	Battery System testbench	Any other...
Reference test	+ Simple/low effort - Limited power level Total vehicle coverage to be evaluated	+ No limitation of discharge power level + Chassis dynamometer already established for light duty (in GTR 22) - Additional test procedure for determination of reference value (during type approval)	+ Due to complexity and lack of accuracy when disassembling single packs or whole systems and reassembling with virtual vehicle control, OICA came to the conclusion to not consider it as a technical feasible procedure	However, industry continues to develop a universally valid test procedure.
In-Service test	+ Simple/low effort - Limited power level	+ No fundamental impact on customer vehicles + Vehicle/ Battery operated as customer experience - Need of chassis dynamometer for ISC testing		Our target is to present results during next IWG EVE.

1) No option for heavy duty due to feasibility and availability

- Summary of alternatives presented by OICA
- Each alternative has pluses and minuses
- Goals
 - Identical procedure for Reference Test and In-service Test
 - Leverage experience and existing capabilities of manufacturers and regulatory authorities

EVE IWG

Approach

【Focus】

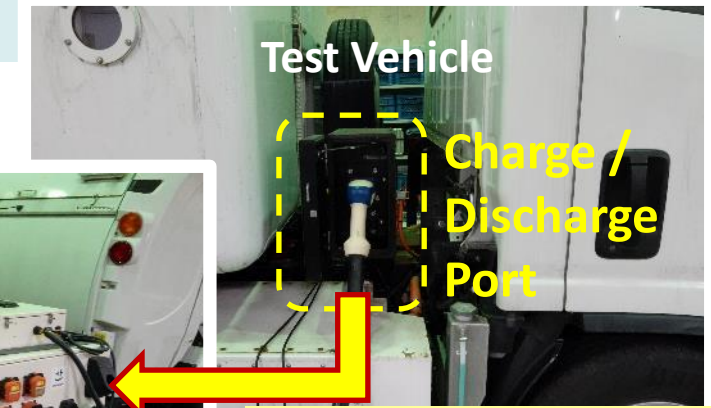
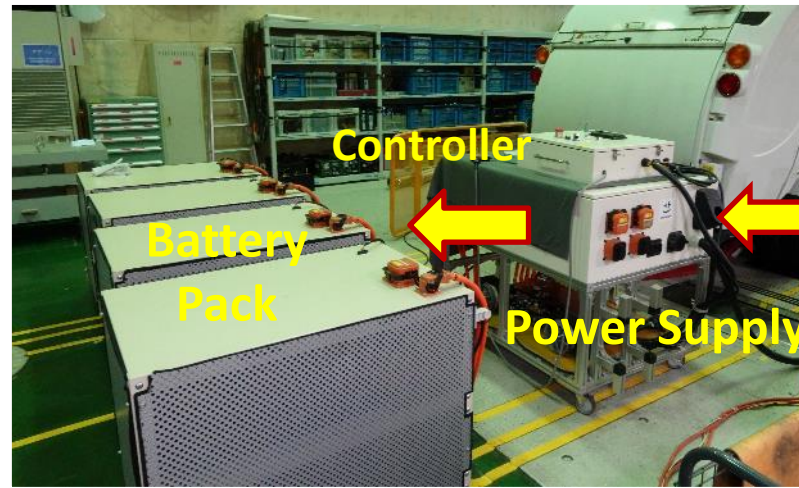
✓ JPN evaluates the gap (error) of its battery discharged energies (UBE) obtained under the two (2) different test procedures

- ① Chassis Dynamometer Test
- ② Charge / Discharge Test

① Chassis Dynamometer Test



② Charge / Discharge Test



By using V2X function

Power : One-way
(Vehicle → Power supply)

【Test Vehicle】

- EV Truck (GVW : 7,500kg)
- Battery Capacity : 48kWh (Lithium-ion battery)

【Test condition】

- Test Room Temperature : 25°C (setup)

Test Procedure

① Chassis Dynamometer Test (WHVC+Road Gradient) ←GTR No.4_ Section 9 (Annex9, 10)

- Obtain the discharge pattern data of battery power from SOC max to SOC min (Cycle Repetition).
- Measure the total amount of battery discharged energy

② Charge / Discharge Test

→ Measure total amount of battery discharged energy of the following conditions

(1) **Cycle Repetition** : The discharge pattern simulating the chassis dynamometer test ①

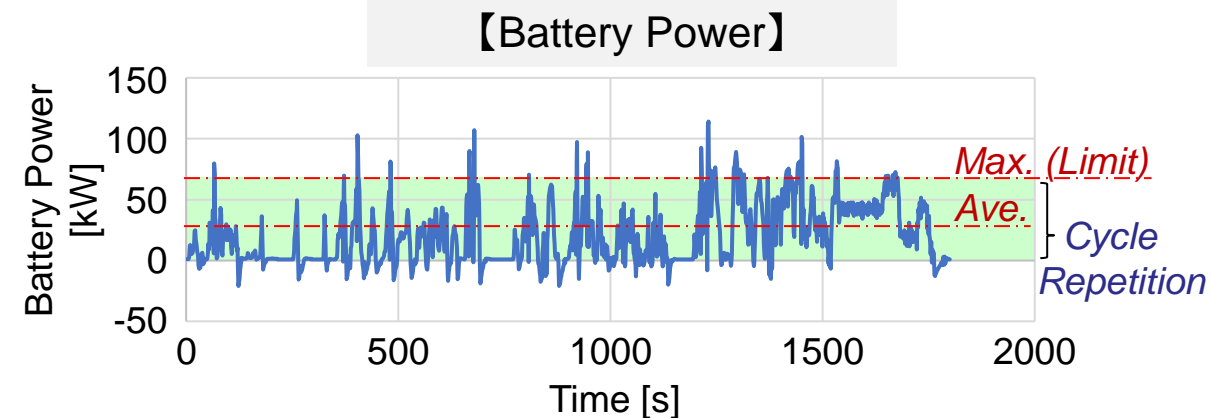
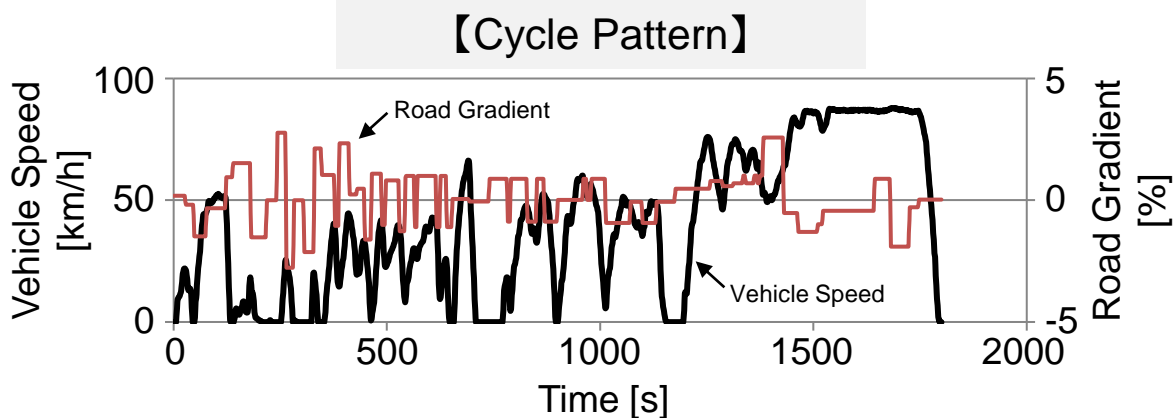
(2) **Constant Power** : Power (10.3kW) ∴ C-rate=0.2

(3) **Constant Power** : Cycle Average power (24.3kW) ∴ C-rate=0.5

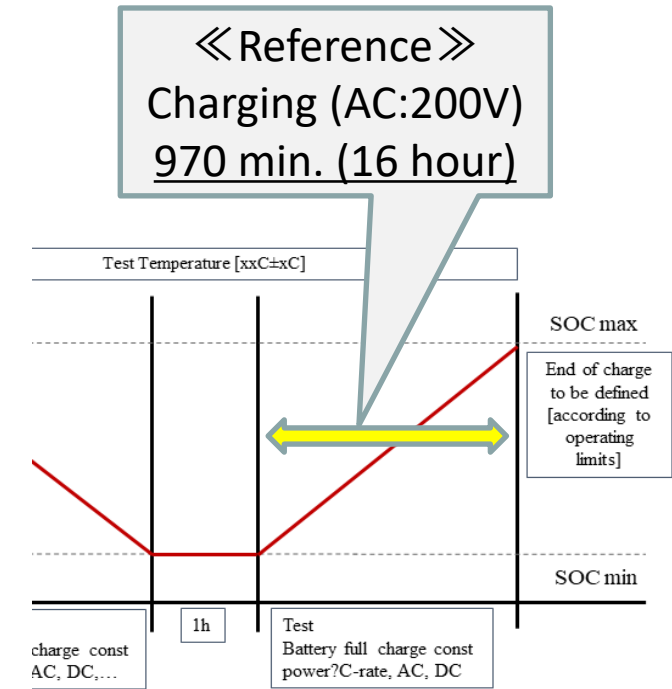
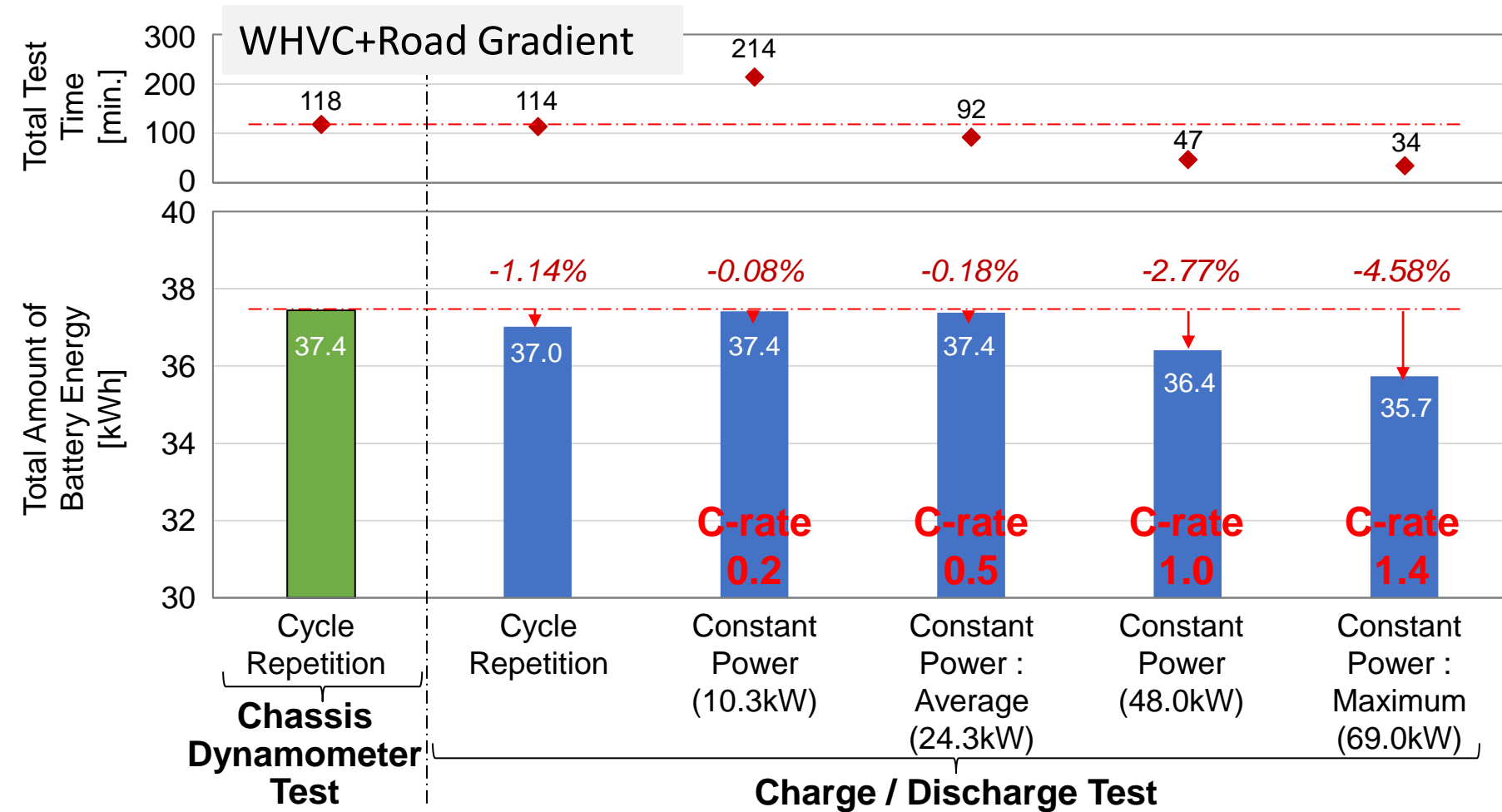
(4) **Constant Power** : Power (48.0kW) ∴ C-rate=1.0

(5) **Constant Power** : Cycle Maximum power (114kW) → V2X power limit (Max.=69kW) ∴ C-rate=1.4

$$\text{C-rate} = \frac{\text{Setup Power [kW]}}{\text{Battery Capacity(48kWh)}}$$



Result



Initial Observations and Next Actions

< Initial Observations >

- Charge/Discharge test (e.g. bidirectional charger) can be one of the solutions to determine HDVs UBE considering its complexity during in-service testing
- Discharge patterns need further study
 - ✓ Cycle Repetition : consider the necessity to simulate the regenerative energy
 - ✓ Constant Power : consider the necessity to set the upper limit of C-rate

< Next Actions >

- Evaluate the repeatability of each discharge pattern
- Evaluate the potential factors of test-to-test variability
- Develop the concrete test procedure
 - plan to report the latest progress during 62nd IWG meeting