Submitted by the EVE informal working group

Informal document **GRPE-89-36**
89th GRPE, 31 May – 02 June 2023
Agenda item 9.

Electric Vehicles and the Environment (EVE IWG)

REPORT TO 89TH GRPE SESSION

Recent EVE Meetings

- Virtual meetings
  - 60th EVE IWG March 24 and 27, 2023
- In –person meetings
  - 61st EVE IWG – April 25-26, 2023, in Ann Arbor, U.S.A.
  - 62nd EVE IWG – May 30, 2023, concurrent with GRPE

"Go Blue!"

Current Work

- Hybrid power determination (GTR-21)
  - EVE continuing to develop the GTR based on the experiences of stakeholders
- In-vehicle battery durability (GTR-22) – Light-duty
  - Consider further development and refinement of GTR 22
- New GTR for in-vehicle battery durability – Heavy-duty
  - Seeking authorization at 190th WP.29 session
  - Building from GTR-22, shaping around unique circumstances of heavy-duty vehicles.

GTR-21 Development: Hybrid Power Determination

- Efforts on GTR-21 are focused refining the text and test procedures
  - Consideration of CAN signals in place of direct measurement
    - Data analysis ongoing
  - Appropriate accuracy requirements
    - Reviewing the source of current values
  - Measurement alternatives for highly integrated systems
    - Considering the use of vehicle CAN signals in lieu of instrumented values
    - China provided additional test data this week
  - Considering alternative for system bench testing
  - Develop family concept
    - Proposal from Japan reflected in the current draft update
  - Need for Candidate Method – still on hold, may not be required

GTR-22 Development: LDV Battery Durability

- GTR-22 was finalized in 2022
- Gaining experience with the GTR
  - Included in the implementation of Euro 7
  - Included in the US EPA's LMDV Multipollutant Standards for 2027+ MY proposed rulemaking
- EVE is focused on several issues
  - Temperature data requirements and consideration of CARB requirements
  - Accounting for energy consumption not related to mobility, with focus on category-2 vehicles that may have ancillary, non-propulsion electrical loads
    - Verification procedure is required and open issue
  - Category-2 minimum performance requirements

GTR-22 Development: LDV Battery Durability

- MPR for Category 2 vehicles
  - OICA presented slides at EVE 61 on energy throughput in order to show options for the MPR
  - Main challenges for the energy throughput remain the determination of thresholds for the MPR and energy throughput verification
  - The European Commission made a proposal to change the V2X concept
    - All Energy not used for traction is accounted for in the virtual mileage
  - The group agreed to the proposal and the GTR-22 draft has been revised accordingly

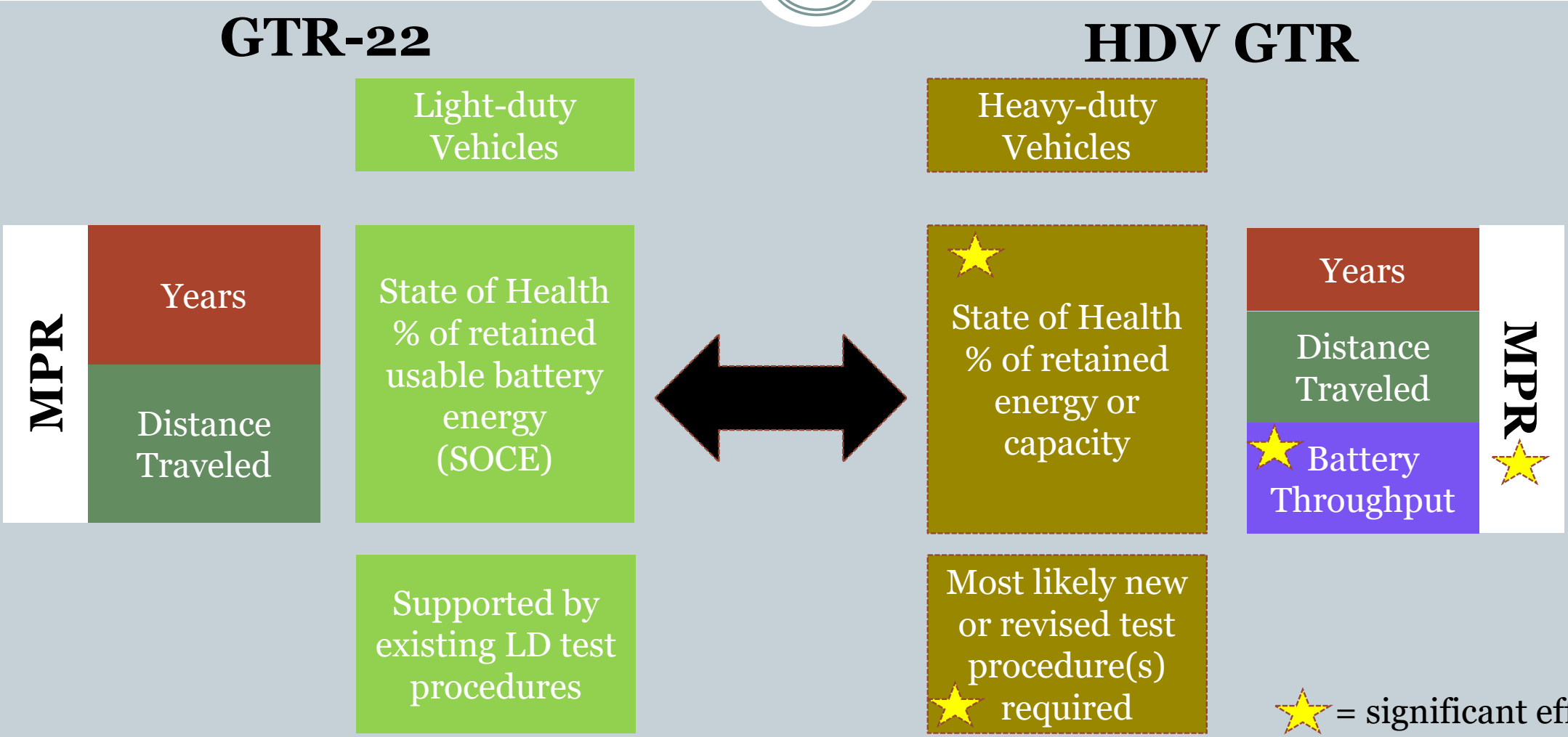
3.25. "Total discharge energy for non-traction purposes" means the total amount of energy in Wh discharged from the battery for purposes other than traction to support the particular use case of a Category-2 vehicle and do not include air conditioning/heating for the cabin or other uses already present in categories 1-1 and 1-2.

$$\textbf{\textit{Virtual distance}}\ (km) = \left(\frac{\text{total discharge energy during V2X and for non} - \text{traction purposes}^{\dagger}\ [Wh]}{\text{worst case certified energy consumption of PART B family [Wh/km]}}\right)$$

Heavy-duty Durability GTR

- Heavy-duty in-vehicle battery durability is now the most significant work being performed by the EVE IWG
- While the overall framework of GTR-22 is helpful, there is limited technical similarity
  - Light-duty test procedures with respect to electrified vehicles are more mature
  - Light-duty vehicle activity is relatively homogenous
  - Heavy-duty vehicle activity and energy demands can vary significantly between applications (e.g. PTO, non-traction loading)
- Potential common elements: SoH monitor, test procedure for verifying the monitor, initial battery condition, in-use assessments and minimum performance requirements

LDV vs HDV Durability Comparison



Heavy-duty Durability GTR

EVE-57-10-Rev1a

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

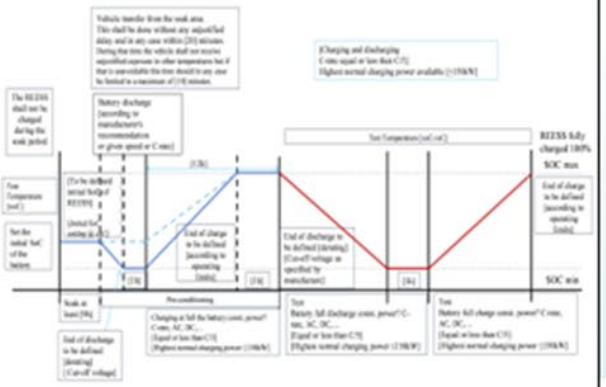
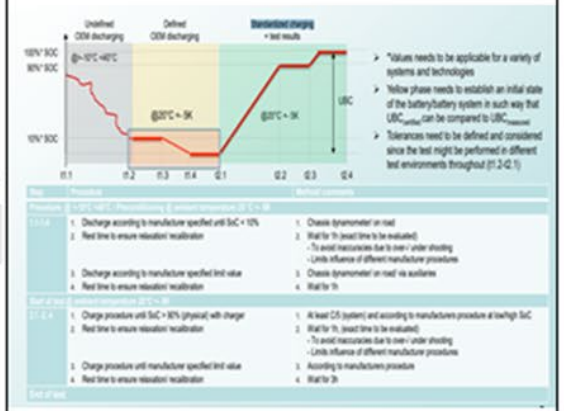
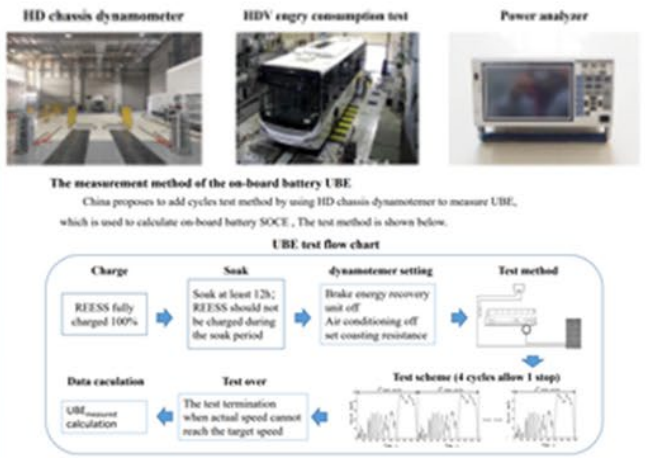
Testing \ Options	Charge/Discharge test	Chassis-Dynamometer LCV segment[1] only	Battery System testbench	Any other…
Reference test	+ Simple/low effort - Limited power level Total vehicle coverage to be evaluated	+ No limitation of discharge power level + Chassis dyno already established for light duty (in GTR 22) - Additional test procedure for determination of reference value (during type approval)	• Due to complexity and lack of accuracy when dissembling single packs or whole systems and reassamble 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. Our target is to present results during next IWG EVE.
In-Service test	+ Simple/low effort - Limited power level	+ No fundamental impact on customer vehicles + Vehicle/ Battery operated as customer experience - Need of chassis dyno for ISC testing		

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

Heavy-duty Durability GTR

Test procedures under discussion

Proposed test procedures		
Round Trip Efficiency (RTE) test (full discharge – full charge cycle)	**Standardised charging**	**Cycles test method by using HD chassis dynamometer**
		
EVE- 61- 21e	EVE-61-20e	EVE-61-18e

Current Timeline

- June 2023:
  - Propose, to WP.29 AC.3, the development of new UN GTR on in-vehicle battery performance and durability of electrified heavy-duty vehicles (eHDV)
- May 2021 - June 2023:
  - Support the Group of Experts on Energy Efficiency on the method for stating energy consumption from upstream emissions of electrified vehicles
- June 2021 – June 2023:
  - Consider candidate test method, family concept and further validation testing for UN GTR 21
  - Continue information gathering on possible modifications to the UN GTR 22 on in-vehicle battery durability
  - Consider other GTR amendments, as necessary
- January 2024:
  - Provide status update and draft UN GTR on eHDV battery performance and durability as an informal document, for further discussion and recommendation
  - Provide update on the future framework for UN GTR on eHDV battery performance and durability
  - Submit working document to GRPE for UN GTR 21 amendments, for consideration
  - Submit working document to GRPE for UN GTR 22 amendments, for consideration
- June 2024:
  - Submit working document of UN GTR on eHDV battery durability to GRPE for consideration
  - Submit working document amendments for UN GTR 21 to WP.29 AC.3 for vote, if authorized
  - Submit working document amendments for UN GTR 22 to WP.29 AC.3 for vote, if authorized
- November 2024:
  - Submit working document of UN GTR on eHDV battery durability to WP.29 for vote, if authorized

Proposed Future EVE Meetings

- 63rd EVE IWG – July 18-19, 2023 (virtual)
- 64th EVE IWG – September 19-20, 2023 (virtual)
- 65th EVE IWG – October 11-12, 2023 (in-person – Ottawa, Canada)

Thank you!

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