Submitted by the EVE informal working group

Informal document **GRPE-90-36**
90th GRPE, January 9-12, 2024
Agenda item 9.(b)

Electric Vehicles and the Environment (EVE IWG)

REPORT TO 90TH GRPE SESSION

Recent EVE Meetings

- Virtual meetings
  - 63rd EVE IWG – July 18-19, 2023
  - 64th EVE IWG – September 19-20, 2023
  - 66th EVE IWG – December 6-7, 2023

- In –person meetings
  - 65th EVE IWG – October 11-12, 2023, in Ottawa, Canada
  - 67th EVE IWG – January 9, 2024, concurrent with GRPE in Geneva, Switzerland

Current Work

- Hybrid power determination (GTR-21)
  - Continuing to develop the GTR based on the experiences of stakeholders
- In-vehicle battery durability (GTR-22) – Light-duty
  - Considering further development and refinement of GTR 22
- New GTR for in-vehicle battery durability – Heavy-duty
  - Building from GTR-22, shaping around unique circumstances of heavy-duty vehicles.

GTR-21 Amendments: Determination of Electrified Vehicle Power

- Efforts on GTR-21 were focused refining the text and test procedures
  - Consideration of CAN signals in place of direct measurement
    - Data analysis conducted
  - Appropriate accuracy requirements
    - Reviewed technical necessity of current values
  - Measurement alternatives for highly integrated systems
    - Considered the use of vehicle CAN signals in lieu of instrumented values
  - Considered alternative for system bench testing
  - Developed family concept
  - Continued considering need for Candidate Method
  - Continued considering need for power determination of heavy-duty and fuel-cell vehicles

GTR-21 Amendments: Determination of Electrified Vehicle Power

- Revisions to GTR-21:
  - Family concept added (section 7)
  - Additional TP1 method 6.1.3.1.2 (d) to accommodate highly integrated powertrain
    - Uses a power distribution ratio between two powertrain branches based on CAN signal
  - Use of a system bench is allowed in the case of vehicles that are too powerful to be tested on a chassis dynamometer (3.6 and 6.1)
  - Revisions to accuracy requirements
    - Soak area temperature revised to specify a tolerance around a set point and to accommodate Type 1 soak area target temperature (5.1.4)
    - Engine speed, fuel flow rate, atmospheric pressure allowed from onboard signal (5.2.1/6.1.2)
    - Accuracy of intake manifold pressure, dynamometer speed, time, accelerator pedal (5.2.1)
    - TP1 calculation revised to 5% tolerance for fuel flow rate and manifold pressure to align with COP requirement (6.9.2.1)
  - Deleted placeholder Annex 3 for candidate/equivalency method

GTR-22 Amendments: LDV Battery Durability

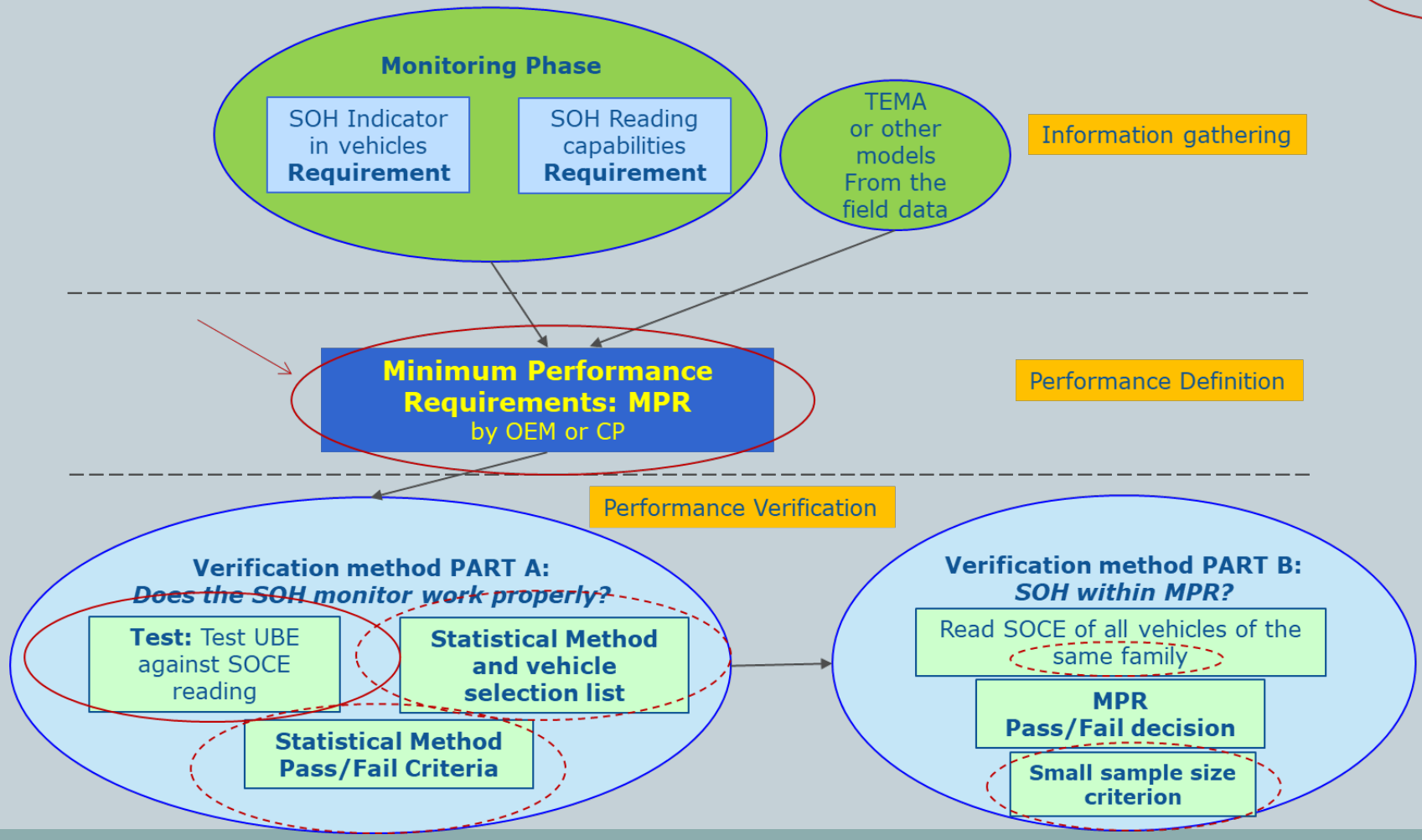
- GTR-22 amendments finalized in 2023
- Amendments of GTR-22
  - Battery durability requirements for electrified vehicles of category 2
  - Accounting for energy consumption not related to mobility in the calculation of Virtual Mileage, with focus on category-2 vehicles that may have ancillary, non-propulsion electrical loads
  - Part C Verification of reported virtual distance: V2X and/or non-traction purposes, if applicable
  - Update in the specific metrics and requirements of the Annex 2: Values to be read from vehicles
  - Minor revisions of Annex 3 Determination of Performance Parameter during Part A Test Procedure
- Continue 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

Heavy-duty Durability GTR

- Heavy-duty in-vehicle battery durability is currently 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
- The EVE IWG would like to request an approximate 6-month delay to our initial timelines
  - Submission of draft text at the 91st GRPE session as an informal document, for group feedback
    - May 2024 GRPE solution
  - Submission of draft text in the 91st GRPE session as a working document
    - October 2024 GRPE solution

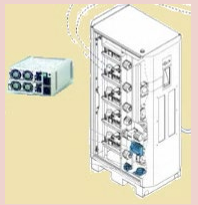
Heavy-duty Durability GTR

UN ECE GTR22 and HDV GTR



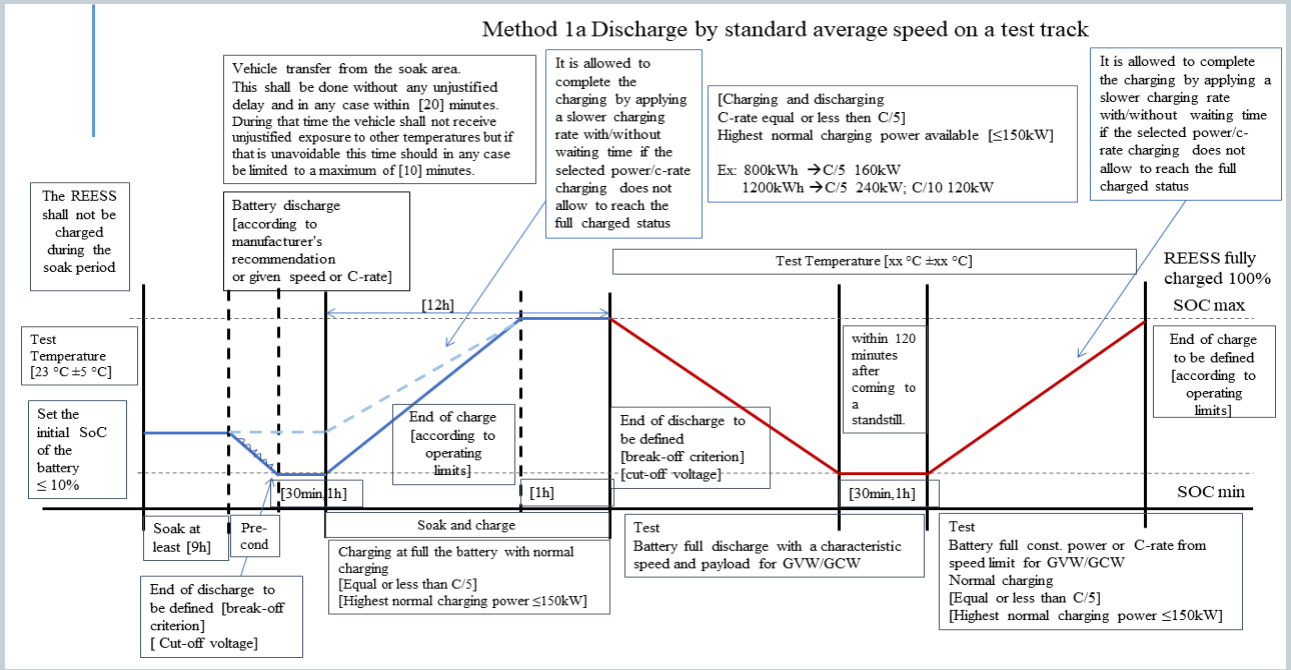
Heavy-duty Durability GTR

Test procedures under discussion

Methods for Checking Battery Durability Monitor for HDV			
Test Methods	HDV with no bidirectional charging system		HDV with bidirectional charging system
	Method 1a	**Method 1b**	**Method 2**
Description	Discharge by standard average speed with tolerances on test track And charge 	Discharge by driving on the road with average speed with higher tolerances And charge 	Virtual Round Trip Efficiency (VRTE) test Discharging and charging in a column or by a bidirectional power supply  
Alternative Method	**HDV Dyno testing with similar driving characteristics** constant speed test or transient condition test		

Heavy-duty Durability GTR

Boundary conditions of the test procedures under discussion



Test in Method 1a and 1b driving on test track or on-road with characteristic constant speeds (regional speed)

- different speed around regions
- but same methodology and test procedure

- Regional specific speeds and payload in agreement with authorities (GVW, GCW)
- With a C-rate in the range of [C/6 or less, C/2], as check, not to have unwanted battery behaviour
- Guideline for the harmonisation of the characteristic speed:

Range of speed per category per region
To leave open the speed for the test and prescribe only the target speed in the last part of the test for which a speed tolerance will be applied
The last part of the test starts when the SOC < [10%]
Speed tolerance in last test segment [± 5km/h;± 7km/h]
The acceleration/deceleration during vehicle speed change shall be smooth and accomplished within the range ±[0.5-1] km/h/sec
End of discharge: break-off criterion
Temperature not prescribed

Terms of Reference Renewal

- Requesting renewal for January 2024 – June 2027
- Leadership group
  - Chairmanship shared by European Commission and the United States
  - Vice-chairmanship shared by China and Japan
  - Secretary responsibilities by Canada
- Proposed future work includes
  - eHDV GTR development
  - Amendments to UN GTR No. 21
  - Amendments to UN GTR No. 22
  - Ongoing review of literature, policies and developing technologies
  - Investigating lessons learned from the adoption of UN GTRs
  - Coordination of environmental performance and technology considerations in the context of existing mandates of other IWGs

Current Timeline

- January 2024:
  - Renewal of the EVE IWG Terms of Reference
  - Submit working document to GRPE for UN GTR 21 amendments, for consideration
  - Submit working document to GRPE for UN GTR 22 amendments, for consideration
  - Offer status update of new eHDV battery durability GTR as an informal document, for further discussion.
- June 2024:
  - 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
- October 2024:
  - Submit working document of UN GTR on eHDV battery durability to GRPE for consideration
- March 2025:
  - Submit working document of UN GTR on eHDV battery durability to WP.29 AC.3 for vote, if authorized

Proposed Future EVE Meetings

- 68th EVE IWG – February 28-29, 2024 (virtual)
- 69th EVE IWG – April 16-17, 2024 (in-person – Seoul, South Korea)
- 70th EVE IWG – Fall 2024 (in-person – Tokyo, Japan)

Thank you!

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