59th EVE IWG Session – Hybrid

January 10th 2023

UN HDV Battery Durability Open Points:

OICA comments on JRC draft

Scope and application

Issue	Sub issue	Description of issue	Current resolution (provisional)	Status	Relevant text	Remarks	break out group needed
Scope and application	vehicle technologies	To agree and text update	GTR 22 drafted [HDEV, OVC-HDVs]	open	HDV GTR 1. & 2.	Japan EVE 55-03e No reason can be found to be different from LD application	
	weight		GTR 22 drafted [exceeding 3,855kg]	open	HDV GTR 2.	EU N2, N3, M2,M3 (2017/2400/EU;EU 2018/858)	
						OICA 58th EVE IWG: N1,N2,N3,M2,M3	
						US EPA weight classes 2b up to 8	

OICA comments:

- **Special purpose, off-road and all-wheel-drive vehicles** shall be **out** of scope due to their relatively small contribution of overall energy consumption over lifetime compared to on-road long-haul, regional delivery and urban delivery heavy duty operations.
- Hydraulically driven axles are not considered qualifying a vehicle being all-wheel drive.
- Furthermore, contracting parties shall decide on even more exclusions such as special axle formulas or additional axle numbers given especially in their markets (8x2, 8x6, 10x, …).
- Also importantly, vehicle classes comparable to European **class “O” (semitrailers & trailers**) which may be electrified too in future, shall be **in** scope.

Small Volume Manufacturers

Issue	Sub issue	Description of issue	Current resolution (provisional)	Status	Relevant text	Remarks	break out group needed
Small Volume Manufacturers		definition of "small volume" for HD		open	HDV GTR 2.	Japan EVE 55-03e per CP decision but no definition of "Small Volume Manufacturers"	

OICA comments:

- To be elaborated

Definitions

Issue	Sub issue	Description of issue	Current resolution (provisional)	Status	Relevant text	Remarks	break out group needed
Definitons	UBE	To review definitions in relation to test procedure	to be revised	open	HDV GTR 3.	For LDV reference to UBE depleting by driving WLTP, break off criterion. For HDV to be defined	
	BEV, OVC-HEV for HDVs		Definition from GTR 21	open	HDV GTR 3.	BEV, OVC-HEV for HDVs	
	Battery vs REESS			open	HDV GTR 3.	Battery or REESS reference to GTR 15	

OICA comments:

- *2.37. Rechargeable electrical energy storage system" (REESS):* feasible to make reference to R100 and / or GTR 20:
- *"Rechargeable Electrical Energy Storage System (REESS)" means the rechargeable energy storage system that provides electric energy for electrical propulsion. A battery whose primary use is to supply power for starting the engine and/or lighting and/or other vehicle auxiliaries' systems is not considered as a REESS. The REESS may include the necessary systems for physical support, thermal management, electronic controls and casing*

Battery performance requirements

Issue	Sub issue	Description of issue	Current resolution (provisional)	Status	Relevant text	Remarks	break out group needed
Battery performance requirements		Different MPR on battery energy capacity for different HDV categories and mission profiles		open	HDV GTR 5, 5.2	Different MPR on battery energy capacity for different HDV categories and mission profiles JRC EVE-58-08e OICA 58th EVE IWG	
	category			open		to be agreed	
	age/km/total cycle energy or number of full cycles			open		to be agreed	
	MPR			open		to be agreed	

OICA comments:

- In HDV operations, utilization use cases are dependent from drivetrain power and maximum permissible laden mass of the vehicle.
- Batteries will age differently, due to very different energy throughputs during lifetime
- **Therefore OICA proposes to differentiate the MPR between N2, N3, M2, M3**

Virtual Distance – V2X, …

Issue	Sub issue	Description of issue	Current resolution (provisional)	Status	Relevant text	Remarks	break out group needed
Virtual distance (V2X)	V2X	to be verified for HDVs	as per GTR 22 []	open	HDV GTR 5.2	to be discussed	

Necessary lifetime requirement for electric heavy duty vehicles, additional to age and range at and after main lifetime pursuant to EU-VII draft:

- if not to come, virtual mileage to be added as done with pascar
- virtual mileage has to be based on worst-case energy consumption - how to determine?
  - For HDV, V2X has to take PTO work into account
- big IT process to be build to track running vehicles energy consumption during stand still or PTO mode - accuracy not known, not sure if all events can be tracked
- For EU: virtual mileage based on Vecto per vehicle or as mean per HDBD family?
- What about US (GEM), Japan (fuel economy) and China (Stage-IV)
- Very complex process to be established
- Therefore energy MPR counter is useful to determine whether a vehicle is still valid for verification of Part A & B against compliance conditions

In-use verification

Issue	Sub issue	Description of issue	Current resolution (provisional)	Status	Relevant text	Remarks	break out group needed
In-use verification	Definition of families		as per GTR 22 []	open	HDV GTR 6.1	to be discussed	
	Part A verification of monitor			open	HDV GTR 6.1.1	OICA 58 EVE IWG to keep the same as LDV	
	Part B verification of battery Durabillity			open	HDV GTR 6.1.2	OICA 58 EVE IWG to revise the LDV one	

OICA comments:

- To be elaborated
- **Some comments on next slide**

In-use verification

In-use verification

44. To ensure the accuracy of the SOCE/~~SOCR~~ monitors and also ensure that MPR are being met it was necessary to introduce a two part in-use verification process, with Part A verifying the accuracy of the monitors and Part B verifying the battery durability against MPR.

45. Part A verification involves measurement of the UBE/~~electric range~~ under the applicable test procedure and determination of a measured SOCE/~~SOCR~~ by dividing by the respective values from certification. These measured values can then be compared to the on-board values from the SOCE/~~SOCR~~ monitors to ensure the accuracy is within a given

Trentzsch, Axel (001)
OICa supports the Part A & B approach for HDV, as stated during EVE IWG 09/2022.

Trentzsch, Axel (001) Gestern
Which has to be defined for HDV

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tolerance. For this purpose, the resolution of the on-board values from SOCE/~~SOCR~~ was set to 1 part in 100, and the required accuracy defined by a statistical process as described below.

46. A pass or fail decision on a sample of vehicles will be reached through a statistical process, which evaluates the average of the ratios of measured/on-board-indicated

Trentzsch, Axel (001)
Important to review for HDV completely.

In-use verification

48. Due to the accuracy of the SOCE/SOCR monitors being assured through verification in Part A, it is possible to verify the battery durability of a sample of vehicles within Part B through remote collection of the on-board SOCE/SOCR values, together with information on the age of the vehicles, ~~and the~~ distance travelled and energy utilized. Where a vehicle has been equipped with V2X capabilities, an equivalent virtual distance will be calculated using the V2X discharge energy and the certified energy consumption. This will be summed with the distance travelled to calculate the total distance. This approach avoids the need for further testing of vehicles within Part B and enables a simple route to the assessment of a large sample size of vehicles, thereby minimising the impact that outliers (e.g. vehicles that have been used abnormally) may have on the sample result.

Trentzsch, Axel (001)
Important MPR counter for HDV operations compared to pascar

Trentzsch, Axel (001)
Virtual distance is complex to evaluate for HDV. Also PTO operations to be taken into account. Better to introduce the energy utilization based MPR counter

51. To support this two part in-use verification process, whilst minimising the burden of increased testing for manufacturers within Part A, two family concepts were developed within the GTR. This includes the concept of a monitor family for use in Part A and a battery durability family for Part B. This is likely to reduce the need for additional testing where multiple battery durability families may have the same characteristics with respect to verification of the ~~SOCR/~~SOCE monitors. In addition, the Part A in-use verification for the vehicles in the same monitor family may be combined between different regions with the agreement of all Contracting Parties involved. This contributes not only to minimise the testing burden but also to increase the verification robustness. However, this concept shall not be applied for Part B since battery deterioration might be different in different regions due to different usage patterns and ambient conditions.

Trentzsch, Axel (001) Gestern
Also taking different vehicle categories / classes of contracting parties into account for HDV

In-use verification – Family Concept

6.1.2. For Part B: Verification of Battery Durability

Only vehicles that are substantially similar with respect to the following elements may be part of the same battery durability family:

1. ~~(a) Type of battery chemistry;~~
2. Battery Control Unit BCU (with relevant functions for battery monitoring, estimations, and controls)
    a. Or BMS
3. Operational strategy influencing the battery durability
4. At the request of the OEM, additional family criteria may be aligned with type approval authority

~~Type and number of electric machines, including net power, construction type (asynchronous/ synchronous, etc.), and any other characteristics having a non-negligible influence on battery durability;~~

~~(b) Type of battery (dimensions, type of cell, including format and chemistry, capacity (Ampere hour), nominal voltage, nominal power;~~

~~(c) Battery management system (BMS) (with regards to battery durability monitoring and estimations);~~

~~(d) Passive and active thermal management of the battery;~~

~~(e) Type of electric energy converter between the electric machine and battery, between the recharge plug in and battery, and any other characteristics having a non-negligible influence on battery durability;~~

~~(f) Operation strategy of all components influencing the battery durability;~~

~~(g) Declared maximum charging power.~~

Frequency of verifications

Issue	Sub issue	Description of issue	Current resolution (provisional)	Status	Relevant text	Remarks	break out group needed
Frequency of verifications	[until 5 or 8 years]	to be verified for HDVs	as per GTR 22 []	open	HDV GTR 6.3.1		
	[At the option of the Contracting Party, the verification of the monitors shall not be mandatory [if the annual sales of the monitor family are less than 5,000 vehicles in the market for the previous year.]	annual sales of monitor family	as per GTR 22 []	open	HDV GTR 6.3.1	to be discussed	

OICA comments:

- To be elaborated
- **Also dependent on vehicle availability on customer side**
- **During first years, little amount (compared to ICE fleet) will be available**

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

Issue	Sub issue	Description of issue	Current resolution (provisional)	Status	Relevant text	Remarks	break out group needed
Verification procedure	pre-check	Annex 1 vehicle survey	as per GTR 22 []	open	HDV GTR 6.3.2	Annex 1 see row 36 below	
	verification of SOCE monitor procedure	To be checked with the new test procedure SOCE=UBEmeasured/UBEcertified *100	as per GTR 22 []	open		UBEmeasured and UBE certified determined with the new test procedure	

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 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		

Statistical method – pass/fail

Issue	Sub issue	Description of issue	Current resolution (provisional)	Status	Relevant text	Remarks	break out group needed
Statistical Method for Pass/Fail decision for a sample of vehicles	Number of vehicles	[at least 3 and not more than 16]	[at least 3 and not more than 16]	open	HDV GTR 6.3.3	To be revised. Statistics, N tests, tolerance 5% …etc Different HDV categories and mission profiles?	
	statistics method	difference,i.e. calculation of xi	as per GTR 22 []	open	HDV GTR 6.3.3		
	A value	5%	as per GTR 22 []	open	HDV GTR 6.3.3		
	parameters $t_{P1,N}$, $t_{P2,N}$, $t_{F1,N}$, and t_{F2}	parameters in the table to be verified	as per GTR 22 []	open	HDV GTR 6.3.3		

A battery durability family shall fail if less than 90 per cent of monitor values read from the vehicle sample are above the MPR*i* or DPR*i*.

For the pruposes of this GTR, the first and second sub-paragraph shall apply X years after its implementation in contracting parties laws.s

- Or -

For the classes of this GTR, a monitoring phase of X years shall be given to collect in-vehicle data from first electric heavy duty vehicles in the market.

Trentzsch, Axel (001)
Monitoring Phase as agreed.

Part B: Verification of Battery Durability

Issue	Sub issue	Description of issue	Current resolution (provisional)	Status	Relevant text	Remarks	break out group needed
Part B: Verification of Battery Durability			as per GTR 22 []	open	HDV GTR 6.4		
	Data shall be collected yearly	[yearly]	as per GTR 22 []	open	HDV GTR 6.4.1	to be verified "yearly"	
	Frequency of verifications	statistically adequate sample of vehicles within the same battery durability family. ... [but in principle should not be less than 500].	as per GTR 22 []	open	HDV GTR 6.4.1	[but in principle should not be less than 500].	
	Pass/Fail Criteria for the battery durability family	A battery durability family shall pass if equal to or [more than 90] per cent of monitor values read from the vehicle sample are above the MPRi or DPRi.	as per GTR 22 []	open	HDV GTR 6.4.2	to be discussed. Different HDV categories and mission profiles	
	Corrective Measures for the Battery Durability Family	to be reviewed	as per GTR 22 []	open	HDV GTR 6.4.3		

OICA comments:

- To be elaborated

Process flow charts Part A, B

Issue	Sub issue	Description of issue	Current resolution (provisional)	Status	Relevant text	Remarks	break out group needed
Process flow charts for Part A and Part B		to be updated at the end	as per GTR 22 []	open	HDV GTR 6.5	to be updated at the end	

OICA comments:

- To be elaborated

Annex 1 Vehicle Survey

Issue	Sub issue	Description of issue	Current resolution (provisional)	Status	Relevant text	Remarks	break out group needed
Annex 1 Vehicle Survey		to be updated in relation to the test procedure	as per GTR 22 []	open	HDV GTR Annex 1	Japan EVE-55-03 Related to Part A procedure	

OICA comments:

- To be elaborated

Annex 2 Values to be read from vehicles

Issue	Sub issue	Description of issue	Current resolution (provisional)	Status	Relevant text	Remarks	break out group needed
Annex 2 Values to be read from vehicles	Values 1-10	same of LDV or different	as per GTR 22 []	open	HDV GTR Annex 2		
	Values 11-13	energy throughput, capacity througput, total time of use of the battery	as per GTR 22 []	open	HDV GTR Annex 2	EU battery regulation to be considered	

OICA comments:

- To be elaborated
- **Needs to be verified on vehicles**

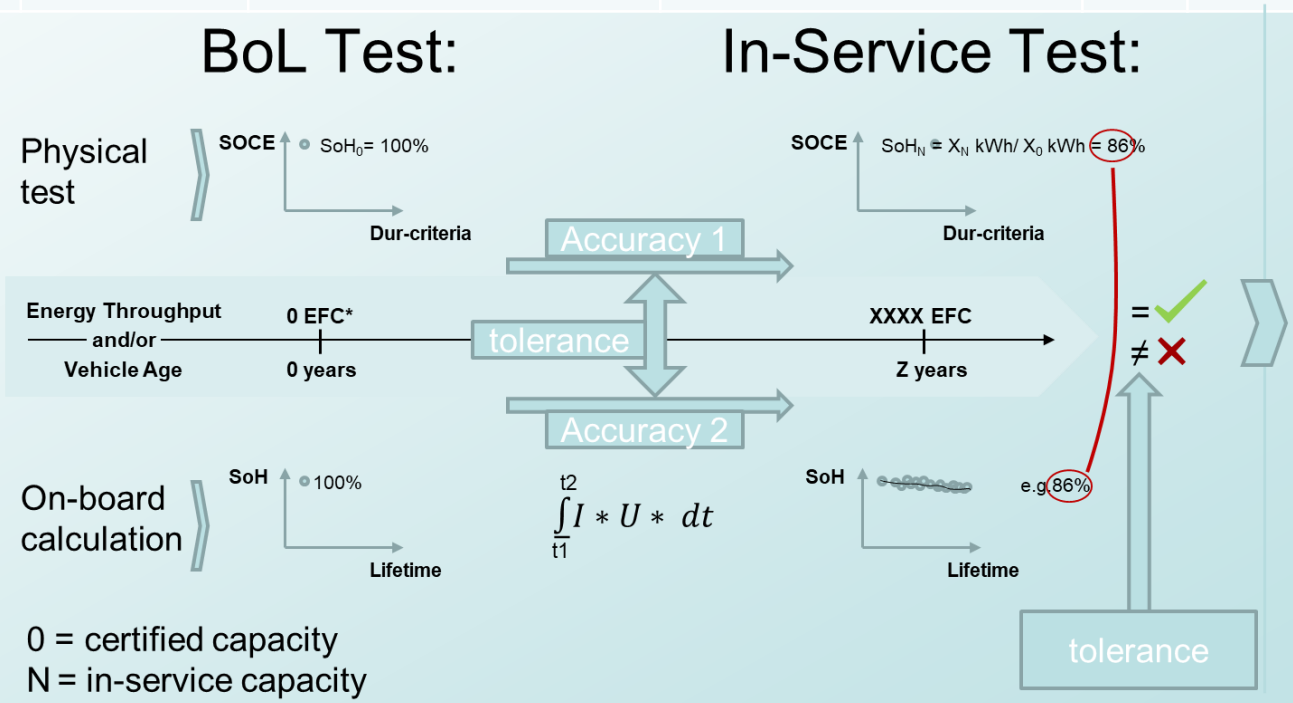
Annex 3 Test procedure and determination of performance parameters

Issue	Sub issue	Description of issue	Current resolution (provisional)	Status	Relevant text	Remarks	break out group needed
Annex 3 Test procedure and determination of performance parameters	New test procedure to be defined			open	HDV GTR Annex 3	Test boundary conditions to be defined: Power of charging/discharging, AC vs DC, temperature, SOC level and SOC swing… Test repetitions, accuracy, distribution OVC-HDV vs HEDV Families definition Battery energy, capacity … Temperature 15C, 25C OICA	
	Test instrumentation	2.1.1 Bidirect power suppli 2.1.2.Test r 2.1.3 coolir 2.1.4. Soak			TR Annex 3 - 2.1	OICA EVE IWG 58: To consider battery/vehicle not allowing bidirectional charging	
	Measurement	2.2.1 Measurement items and accuracy			2	operational metrics 3.8.1	
		2.2.2 Measurement frequency	[as per GTR 21 a charging too high frequency			10Hz and 20Hz for driving; for charging?10Hz or 0.033 Hz (every 30 s)?	
	Test procedure	General information Preparation of the test Test sequence		open	- 3	JRC EVE 54-05 test procedure OICA EVE-57-10e test procedure Draft figure in GTR HDV with the several steps	
	Required information	The manufacturer shall provide the following information required to conduct the test procedure.	The manufacturer shall provide the following information required to conduct the test procedure. [Boundary conditions that qualify vehicle for testing • Battery cell temperature normally distributed with average temperature at Y C and variance <Z • Average SoC normally distributed with average value Y*% and variance <Z* • Depth of discharge (DoD) : share of cycles	open	HDV GTR Annex 3 - 3.1.1	to define required information to conduct the test specify if a bidirecitonal charging mode should be activated	

Most time consuming for drafting group.
Parallel elaboration at OEMs facilities necessary / helpful.

Performance parameters

Issue	Sub issue	Description of issue	Current resolution (provisional)	Status	Relevant text	Remarks	break out group needed
Performance parameters	UBE certified and measured	to defined UBE measurement and calculation method		open	HDV GTR Annex 3 - 4	To check instrumentation of HDVs As an alternative to use of measurement devices, use of on-board measurement data to check method for both HEDV, OVC-HDV	



Comments

- UBE check via physical test
- SOCE compares kWh withdrawable from battery with value at BoL
- On board SoH monitor checking SoH during vehicle life
- Comparison of SOCE with SOCE status at BoL

Annex battery charging procedure

Issue	Sub issue	Description of issue	Current resolution (provisional)	Status	Relevant text	Remarks	break out group needed
Annex battery charging procedure		verify the need to define the charging/discharging procedure together with fully charged and fully depleted battery conditions	End of discharge is reached when [….]. Full charge is reached when […].	open	HDV GTR Annex 4	to define the charging and discharging procedure but also when the battery is fully charged or fully discharged. GTR 15 refers to driving break off criterion	

OICA comments:

- To be elaborated
- **Very sensitive point. Current decreases by battery management reaching low capacities. Any method proposals to be verified on test benches**
- **See also slide 9, verification procedure**

Further open points on JRC draft HDBD procedure

developed in 2 phases:

Phase 1:

(a) Deliver a first version of a UN GTR on in-vehicle battery durability to AC.3 by November 2021 with;

(i) Definition of and requirements for electrified vehicle battery performance criteria

(ii) Requirements for reading and/or displaying battery health information and usage data from the vehicle; and

(iii) A provisional in-service conformity test which will include generic usage criteria and a statistical method.

(iv) A certain certification reference procedure for HDV, to be able to evaluate compliance against

Phase 2:

(b) Develop a second version of the UN GTR on in-vehicle battery durability with the following:

(i) The development of a methodology to define Normal Usage Indices (NUI) based on data read from vehicles

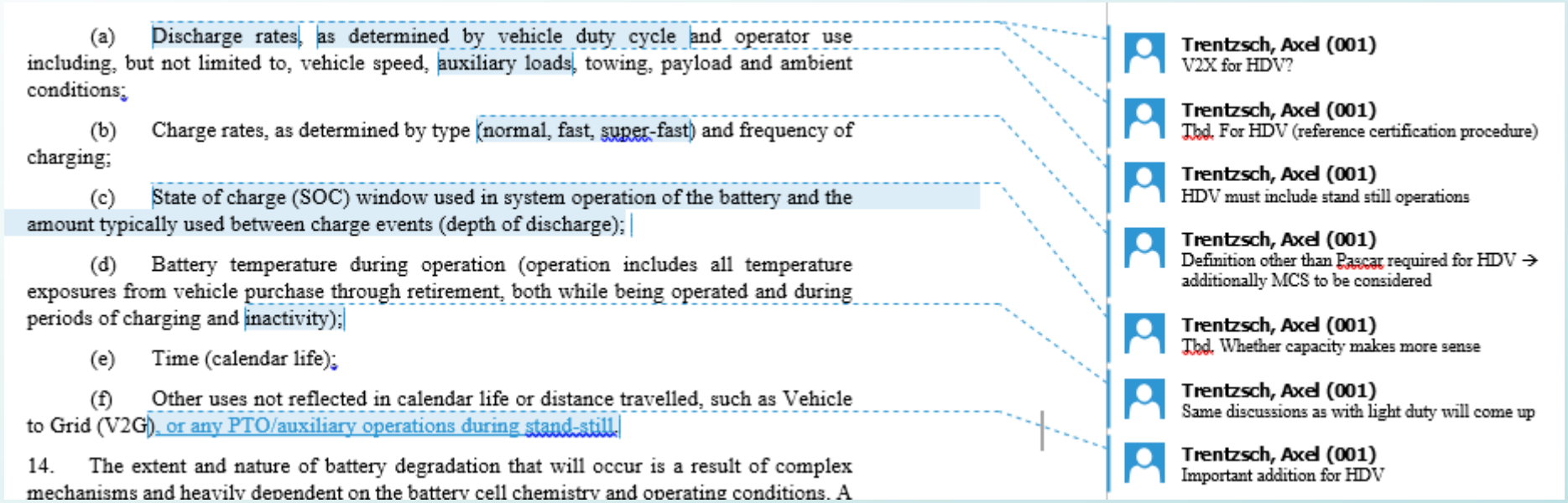
(ii) Refined performance criteria requirements for in-vehicle battery durability through assessment of further modelling and data collected from real vehicles and the use of NUIs

Trentzsch, Axel (001)
To be changed

Trentzsch, Axel (001)
For HDV no worldwide harmonized certification procedure is given. Needs to be evaluated.

Trentzsch, Axel (001)
Difficult for us to predict necessary HDV additions for Phase 2 now. Needs to be evaluated further.

Further open points on JRC draft HDBD procedure



(a) Discharge rates, as determined by vehicle duty cycle and operator use including, but not limited to, vehicle speed, auxiliary loads, towing, payload and ambient conditions;

(b) Charge rates, as determined by type (normal, fast, super-fast) and frequency of charging;

(c) State of charge (SOC) window used in system operation of the battery and the amount typically used between charge events (depth of discharge);

(d) Battery temperature during operation (operation includes all temperature exposures from vehicle purchase through retirement, both while being operated and during periods of charging and inactivity);

(e) Time (calendar life);

(f) Other uses not reflected in calendar life or distance travelled, such as Vehicle to Grid (V2G), or any PTO/auxiliary operations during stand-still.

14. The extent and nature of battery degradation that will occur is a result of complex mechanisms and heavily dependent on the battery cell chemistry and operating conditions. A

Trentzsch, Axel (001)
V2X for HDV?

Trentzsch, Axel (001)
Tbd. For HDV (reference certification procedure)

Trentzsch, Axel (001)
HDV must include stand still operations

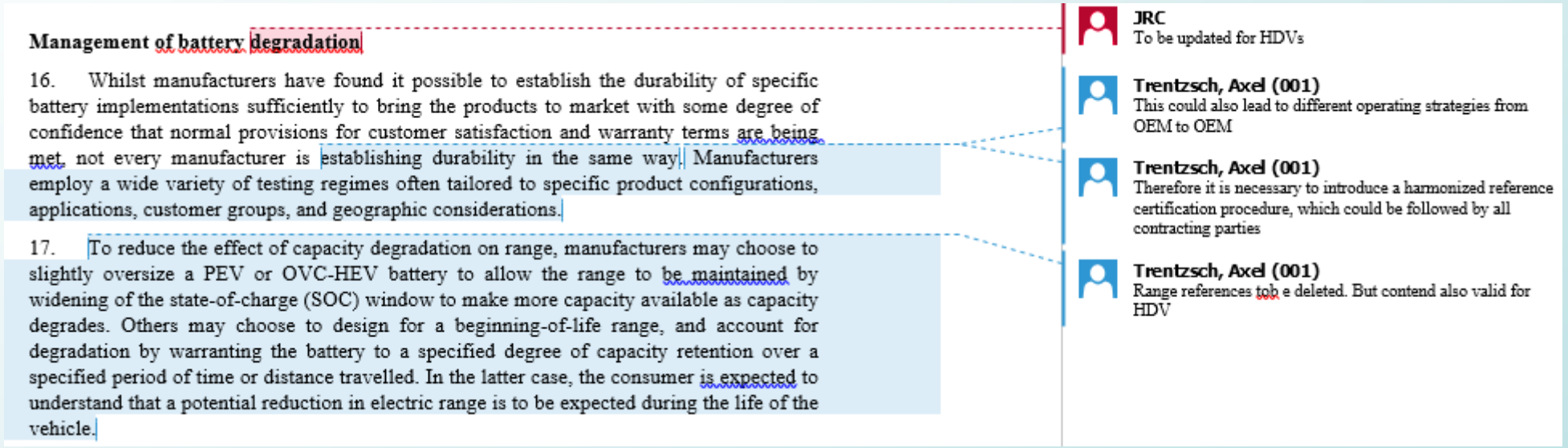
Trentzsch, Axel (001)
Definition other than Pascar required for HDV → additionally MCS to be considered

Trentzsch, Axel (001)
Tbd. Whether capacity makes more sense

Trentzsch, Axel (001)
Same discussions as with light duty will come up

Trentzsch, Axel (001)
Important addition for HDV

Further open points on JRC draft HDBD procedure

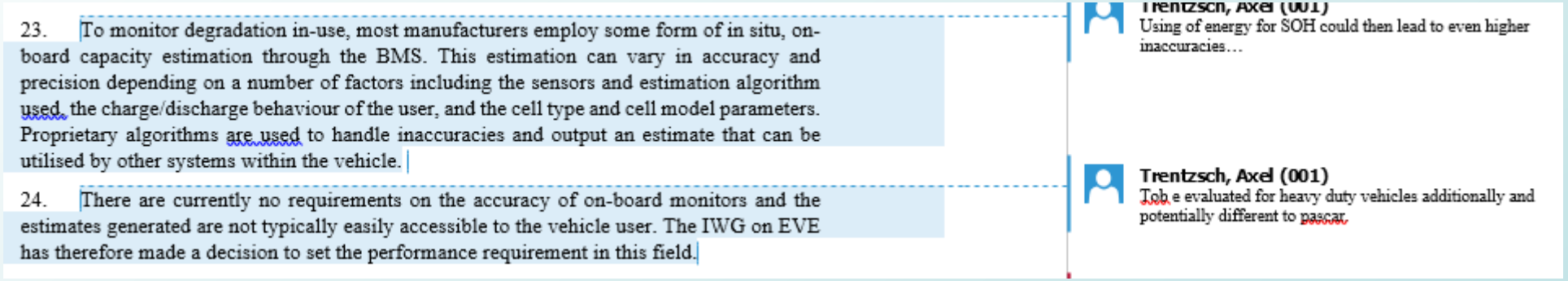


Management of battery degradation

16. Whilst manufacturers have found it possible to establish the durability of specific battery implementations sufficiently to bring the products to market with some degree of confidence that normal provisions for customer satisfaction and warranty terms are being met, not every manufacturer is establishing durability in the same way. Manufacturers employ a wide variety of testing regimes often tailored to specific product configurations, applications, customer groups, and geographic considerations.

17. To reduce the effect of capacity degradation on range, manufacturers may choose to slightly oversize a PEV or OVC-HEV battery to allow the range to be maintained by widening of the state-of-charge (SOC) window to make more capacity available as capacity degrades. Others may choose to design for a beginning-of-life range, and account for degradation by warranting the battery to a specified degree of capacity retention over a specified period of time or distance travelled. In the latter case, the consumer is expected to understand that a potential reduction in electric range is to be expected during the life of the vehicle.

Further open points on JRC draft HDBD procedure



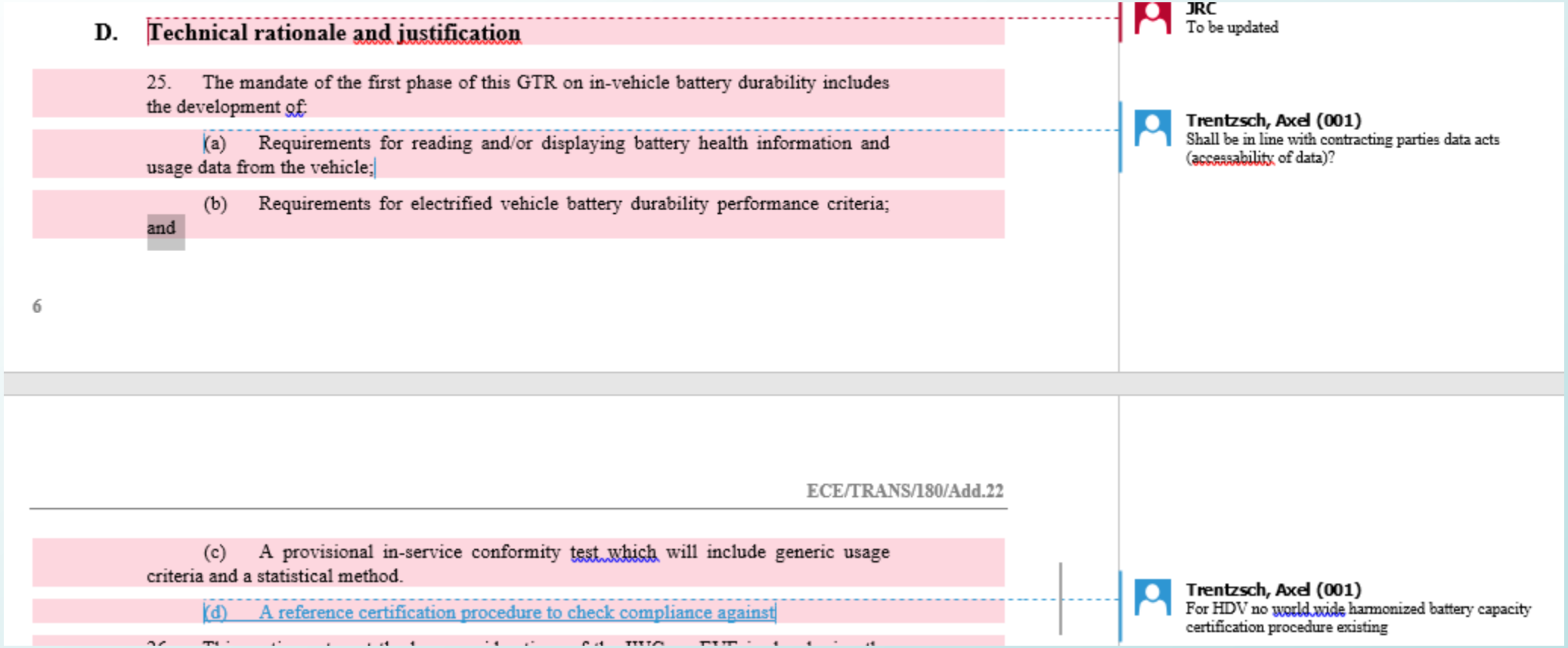
23. To monitor degradation in-use, most manufacturers employ some form of in situ, on-board capacity estimation through the BMS. This estimation can vary in accuracy and precision depending on a number of factors including the sensors and estimation algorithm used, the charge/discharge behaviour of the user, and the cell type and cell model parameters. Proprietary algorithms are used to handle inaccuracies and output an estimate that can be utilised by other systems within the vehicle.

24. There are currently no requirements on the accuracy of on-board monitors and the estimates generated are not typically easily accessible to the vehicle user. The IWG on EVE has therefore made a decision to set the performance requirement in this field.

Trentzsch, Axel (001)
Using of energy for SOH could then lead to even higher inaccuracies…

Trentzsch, Axel (001)
Tob e evaluated for heavy duty vehicles additionally and potentially different to pascar.

Further open points on JRC draft HDBD procedure



D. Technical rationale and justification

25. The mandate of the first phase of this GTR on in-vehicle battery durability includes the development of:

(a) Requirements for reading and/or displaying battery health information and usage data from the vehicle;

(b) Requirements for electrified vehicle battery durability performance criteria; and

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JRC
To be updated

Trentzsch, Axel (001)
Shall be in line with contracting parties data acts (accessability of data)?

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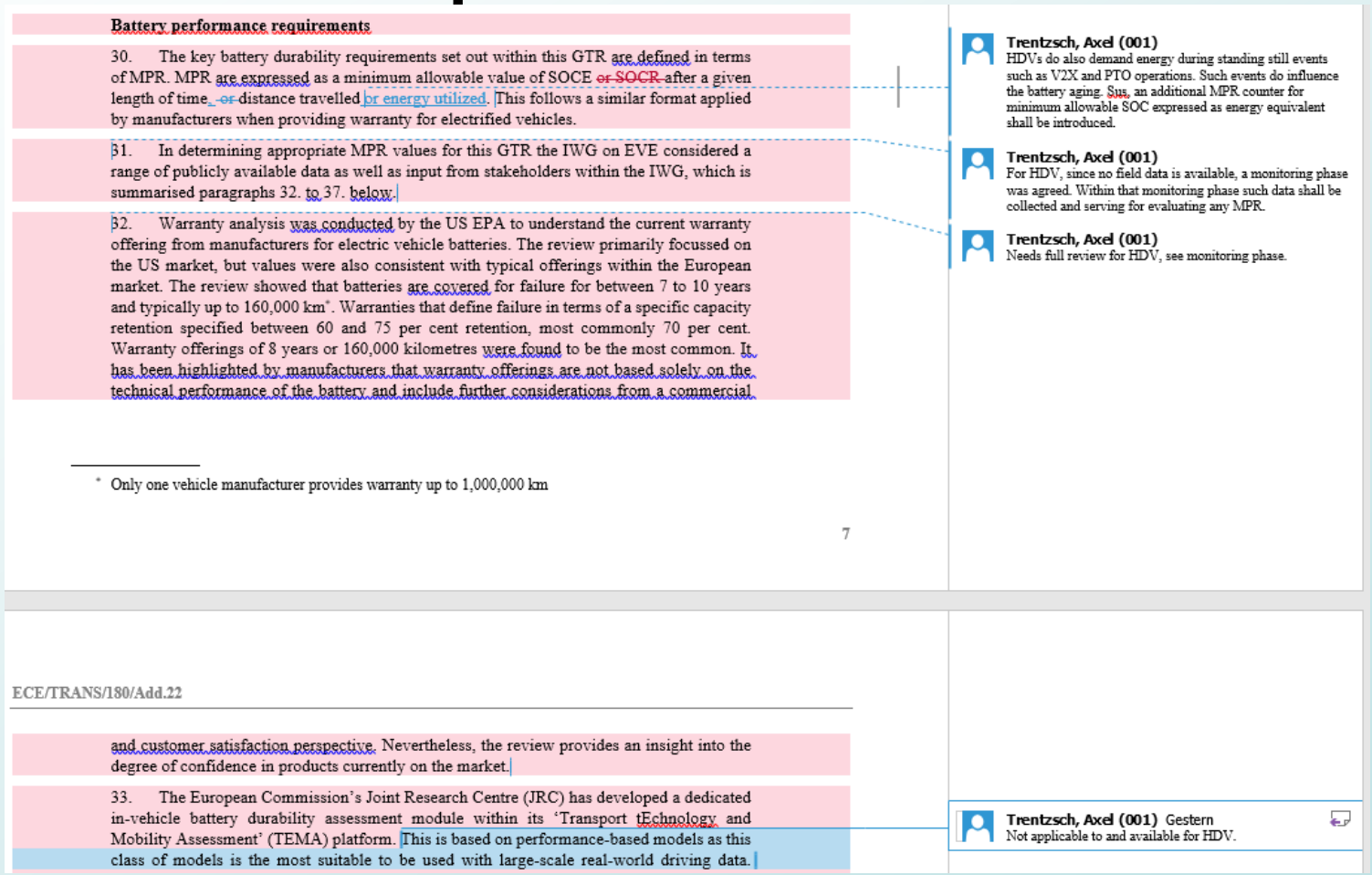
(c) A provisional in-service conformity test which will include generic usage criteria and a statistical method.

(d) A reference certification procedure to check compliance against

Trentzsch, Axel (001)
For HDV no world wide harmonized battery capacity certification procedure existing

Further open points on JRC draft HDBD procedure



Battery performance requirements

30. The key battery durability requirements set out within this GTR are defined in terms of MPR. MPR are expressed as a minimum allowable value of SOCE ~~or SOCR~~ after a given length of time, ~~or~~ distance travelled or energy utilized. This follows a similar format applied by manufacturers when providing warranty for electrified vehicles.

31. In determining appropriate MPR values for this GTR the IWG on EVE considered a range of publicly available data as well as input from stakeholders within the IWG, which is summarised paragraphs 32. to 37. below.

32. Warranty analysis was conducted by the US EPA to understand the current warranty offering from manufacturers for electric vehicle batteries. The review primarily focussed on the US market, but values were also consistent with typical offerings within the European market. The review showed that batteries are covered for failure for between 7 to 10 years and typically up to 160,000 km*. Warranties that define failure in terms of a specific capacity retention specified between 60 and 75 per cent retention, most commonly 70 per cent. Warranty offerings of 8 years or 160,000 kilometres were found to be the most common. It has been highlighted by manufacturers that warranty offerings are not based solely on the technical performance of the battery and include further considerations from a commercial

* Only one vehicle manufacturer provides warranty up to 1,000,000 km

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Trentzsch, Axel (001)
HDVs do also demand energy during standing still events such as V2X and PTO operations. Such events do influence the battery aging. Sus, an additional MPR counter for minimum allowable SOC expressed as energy equivalent shall be introduced.

Trentzsch, Axel (001)
For HDV, since no field data is available, a monitoring phase was agreed. Within that monitoring phase such data shall be collected and serving for evaluating any MPR.

Trentzsch, Axel (001)
Needs full review for HDV, see monitoring phase.

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and customer satisfaction perspective. Nevertheless, the review provides an insight into the degree of confidence in products currently on the market.

33. The European Commission's Joint Research Centre (JRC) has developed a dedicated in-vehicle battery durability assessment module within its 'Transport tEchnology and Mobility Assessment' (TEMA) platform. This is based on performance-based models as this class of models is the most suitable to be used with large-scale real-world driving data.

Trentzsch, Axel (001) Gestern
Not applicable to and available for HDV.

Definitions

~~3.9. *"State of certified energy"* (SOCE) means the measured or on board UBE performance at a specific point in its lifetime, expressed as a percentage of the certified usable battery energy.~~

Trentzsch, Axel (001)
Not to exclude

3.23. *"Maximum charging power"* means the highest available charging power for the considered Part B family.

3.24. *"Non off-vehicle charging hybrid electric vehicle"* (NOVC-HEV) means an OVC-HEV vehicle as defined in […].

3.25. *"PTO-operation"* means any energy throughput during stand still of the vehicle for operational purposes.

exclusively electric machines as propulsion energy converters and exclusively rechargeable electric energy storage systems as propulsion energy storage systems.

Trentzsch, Axel (001)
To be removed from family criteria from our current point of view

Trentzsch, Axel (001)
Tbd. More precicely

Annex 2

Annex 2

Values to be read from vehicles:

1. On board SOCE value
2. ~~On board SOCR value~~
3. Odometer (in km)
4. Date of manufacture of the vehicle
5. Total distance (sum of the distance driven and the virtual distance) [km], if applicable

Trentzsch, Axel (001)
The definition of date of manufacture should be "date of issuing the vehicle documentation by the manufacturer" or so – based on the contracting parties' definitions