Submitted by the expert of OICA

Informal document **GRPE-85-35**
85th GRPE, 11.-14. Jan 2022
agenda item 9.(a)

OICA comments on UN GTR No. 21

GRPE 85th meeting
11.-14. January 2022

Feedback on HEV System power Determination

Background:

- GTR 21 Determination of Electrified Vehicle Power (DEVP) was published on 18. January 2021 in the global registry
- Initial purpose for the GTR development was the need from GTR15 for provisions on downscaling and cycle classification for HEV
- In GRPE 77 In June 2018 was decided to develop a standalone GTR instead of an annex to GTR15
- In noise regulation, UN-R51, 3rd series of amendments, we see already references to GTR21:

2.8.3. For hybrid electric vehicles (HEV) [where at least one electric machine contributes to propulsion], or pure electric vehicles that have more than one propulsion energy converter

The maximum engine power is the "vehicle system power rating" according to the arithmetic sum of parallel propulsive engines on the vehicle or GTR 21, paragraph 6.9.1.(b) “sustained vehicle system power”.

New Terms of References of the EVE-IWG:

3. TERMS OF REFERENCE

The informal working group shall focus its work on the following activities:

1. The informal working group will initially develop the means and resources to address the issues before the EVE informal working group, including:

    a. Advancing the development of the new UN GTR on in-vehicle battery durability of electrified vehicles and subsequent phases of such GTR.

        i. The EVE IWG will also evaluate how to implement the in-vehicle battery durability UN GTR for heavy-duty vehicles.

    b. Staying apprised of the need to update and amend UN GTR No 21. and developing future candidate methods, as necessary.

    c. Supporting the work of the Group of Experts on Energy Efficiency (GEEE) related to the evaluation of upstream emissions of electrified vehicles.

5. TIMELINES

11. November 2021– June 2023
    a. Consideration of a candidate test method and further validation testing for UN GTR No. 21
    b. Consideration of family concept
    c. Consideration of other GTR amendments as necessary

- The Battery Durability GTR for LD vehicles was adopted.
- It is time to revisit GTR 21 now, since it could be used for Type approval soon

- OICA sees some limitations in the GTR21 that should be resolved soon according to the timeline

Validation testing

EVE-31-04e.xlsx

NOVC-HEV	(a) Architecture	(b) Propulsion sources at maximum power[1]	Examples exist?	Candidates	Models tested	Tested by
	Mild 48-Volt HEV	ICE only	Uncertain	?		
		ICE + Electric	Yes	?		
		Electric only	No	N/A	N/A	N/A
	BAS, CISG HEV (P0, P1)[2]	ICE only	Uncertain	?		
		ICE + Electric	Yes	various GM	2013 Malibu Eco	US EPA
		Electric only	No	N/A	N/A	N/A
	Parallel pre-gearbox HEV (P2)[3]	ICE only	Uncertain	?		
		ICE + Electric	Yes	various	1. Honda Fit HEV 2. Hyundai Ioniq 3. undisclosed Hyundai	Japan (2016) KATRI JRC
		Electric only	Uncertain	?		
	Parallel post-gearbox HEV (P3,P4)[4]	ICE only	Uncertain	?		
		ICE + Electric	Probably yes	?		
		Electric only	Uncertain	?		
	Power split HEV[5] (aka series-parallel)	ICE only	Uncertain	?		
		ICE + Electric	Yes	Toyota, some Honda	2015 Yaris hybrid	Japan (2016)
		Electric only	Uncertain	?		
	Pure series HEV[6]	ICE only	No	N/A	N/A	N/A
		ICE + Electric	No	N/A	N/A	N/A
		Electric only	Yes	Nissan e-POWER		
OVC-HEV	**(a) Architecture**	**(b) Propulsion sources at maximum power[1]**	**Examples exist?**	**Candidates**	**Models tested**	**Tested by**
	Parallel pre-gearbox PHEV (P2)[3]	ICE only	Uncertain	?		
		ICE + Electric	Yes	BMW	2018 BMW 530e	Canada ECCC
		Electric only	Uncertain	?		
	Parallel post-gearbox PHEV (P3,P4)[4]	ICE only	Uncertain	?		
		ICE + Electric	Yes	various	1. Mitsubishi Outlander 2. undisclosed Volvo	Japan (2016) JRC
		Electric only	Uncertain	?		
	Power split PHEV[5]	ICE only	Uncertain	?		
		ICE + Electric	Yes	Chevy Volt (CS mode)		
		Electric only	Yes	Chevy Volt (CD mode)	1. 2013 Volt Gen 1 2. 2016 Volt Gen 2	US EPA Canada ECCC
	Pure series PHEV[6]	ICE only	No	N/A	N/A	N/A
		ICE + Electric	No	N/A	N/A	N/A
		Electric only	Yes	BMW i3 Rex		
Pure electric	**(a) Architecture**	**(b) Propulsion sources at maximum power[1]**	**Examples exist?**	**Candidates**	**Models tested**	**Tested by**
	2+ motors	ICE only	No	N/A	N/A	N/A
		ICE + Electric	No	N/A	N/A	N/A
		Electric only	Yes	various Tesla	Tesla Model S AWD	Canada ECCC

EVE-31-04e Vehicle test matrix

- The test matrix should be revisited in order to check if all architectures are covered
- Some architetures are tested with only one (sometimes outdated) vehicle

- We have to discuss if more tests are neccessary and what needs to be validated.
- If we agree to carry out more tests, we need commitment from the stakeholders to support the validation program

GTR amendments and clarifications

- It was stated already from manufacturers in the past, that very powerful vehicles could be too demanding for the chassis dynos
- This could not be verified with the low to mid powered vehicles from the validation program. Only a small number of vehicles will be affected but the test procedure has to cover all configurations.

OICA wants to raise awareness on this issue:

6.8.6. Power test:

The maximum accelerator pedal command shall be given by either the pedal position or by vehicle communication network for a duration of at least 10 s.

The maximum accelerator command shall be given as rapidly as possible. If necessary in order **to elicit maximum power delivery**, it is permissible to vary the accelerator pedal command as recommended by the manufacturer prior to the maximum accelerator pedal command (for example, ask the manufacturer if it is necessary to achieve a kickdown state).

If the gearbox has driver-selectable gears, the gear shall be selected as recommended by the manufacturer for a typical driver to achieve maximum power. Gear shifting by means of special modes or actions that are not available to a typical driver are not permitted.

Our experience is that, when delivering the maximum power in the above mentioned conditions, it may happen that this power exceeds the specifications of the dyno used for the test (even for the best dyno currently on the market in terms of performance). Therefore, the current test procedure seems not applicable for high power hybrid vehicles.

OICA is discussing a proposal for an amendment of the test procedure that could solve this issue.

The proposal will be presented in the next EVE-IWG meeting for discussion.

GTR amendments and clarifications

- Other open issues should be identified and discussed quickly
- The development of a possible candidate test method is mentioned in the ToR

  We have to discuss if this is a priority and really needed
- A family concept would be required if GTR 21 will be used for type approval