Japan Position on OICA Comments @GRPE#85 on GTR 21

16. February.2022

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- Some architetures are tested with only one (sometimes outdated) vehicle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

JAPAN position

No need for new validation tests .

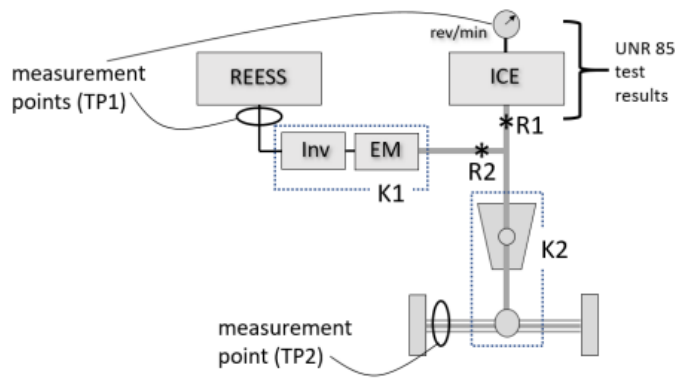
< Consideration>

Since the definition of the reference point (*1) in the GTR 21 indicated TP1 and TP2 should be equivalent in principle.

1) The difference between the results of TP1 and TP2 is due to the accuracy of K1 (inverter + motor efficiency) and K2 (transmission efficiency).
2) Validation test requires that test methods should be clearly defined, but there is no standardized measurement method of the transmission efficiency.
3) In the power split type of the HEV system with Planetary gears, K2 cannot be measured.

ECE/TRANS/180/Add.21
Annex 1

Figure 25
Example of power determination reference points R1 and R2 for a simple parallel architecture.



Note: measurement point for TP2 represents both axle shafts.

*1:
There was no concept of reference point at the time of the validation study, and a simple comparison of the results of TP1 and TP2 resulted in a significant difference.
As a result of analyzing the cause, it was found that the measurement accuracy of inverter/motor efficiency and transmission efficiency was a factor.
As a solution, TP1 and TP2 were defined to be equivalent by defining reference points R1 and R2.

(All Figures were transcribed from GTR 21.)

Figure 26
Example of power determination reference points R1 and R2REESS for a simple power split architecture.

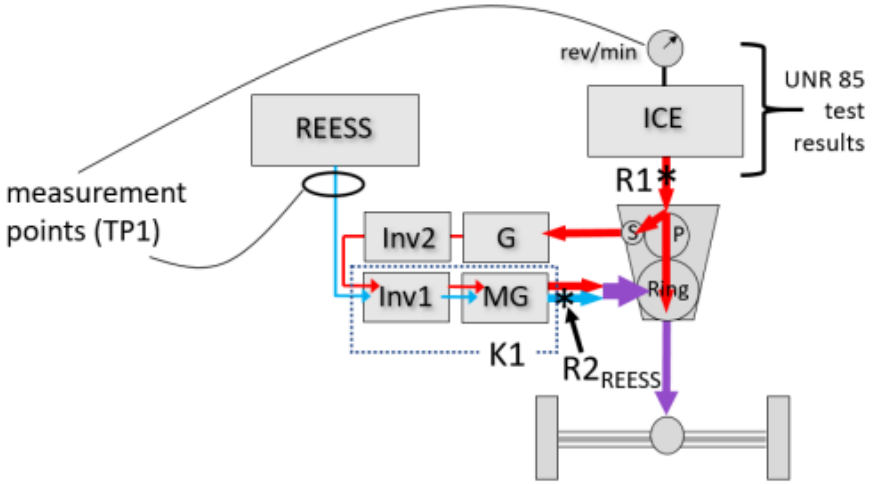


Figure 27
Example of power determination reference points for a pure series architecture

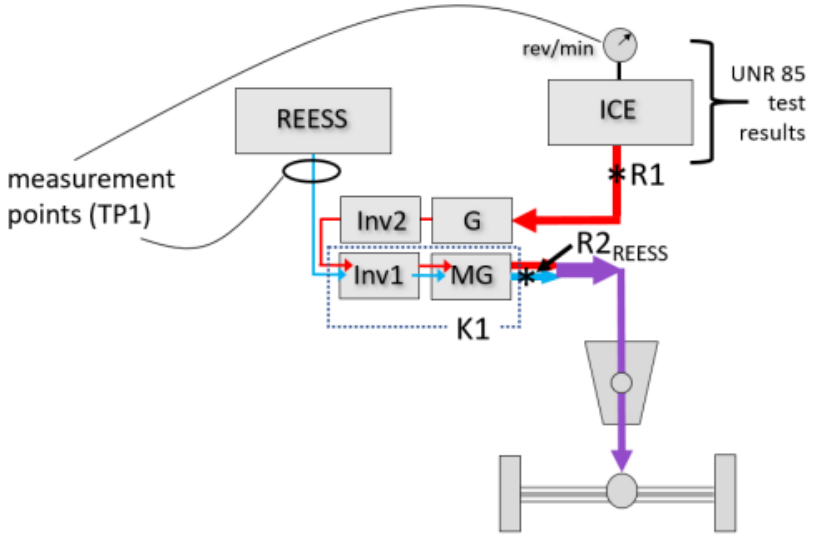
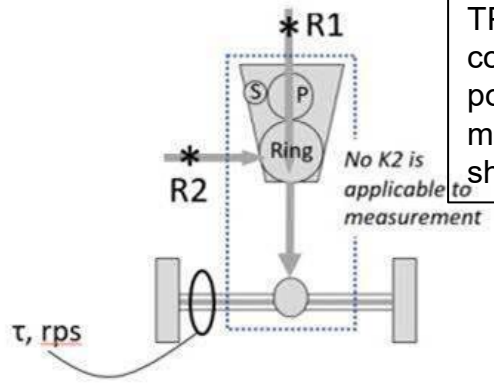


Figure 22
Example of TP2 not applicable to axle.
Power at R1, R2, or (R1+R2) cannot be resolved from the available measurement



TP2 is not applicable to an axle if torque contributions from more than one reference point are transmitted to the axle via different mechanical energy paths, for example, as shown in Figure 22

Reference points of a simple power-split HV or series HV is defined above.
Even for vehicles not in the matrix, if the HV system configuration is known, R1 and R2 can be clearly defined and no further validation tests are necessary.

Since K2 of power split HV with planetary gear cannot be measured, GTR21 indicated TP2 is not applicable and TP1 can be used. (Validation studies comparing TP1 and TP2 cannot be conducted.)

OICA comment

- It was stated already 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

One ACEA member raised again 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.

JAPAN Position

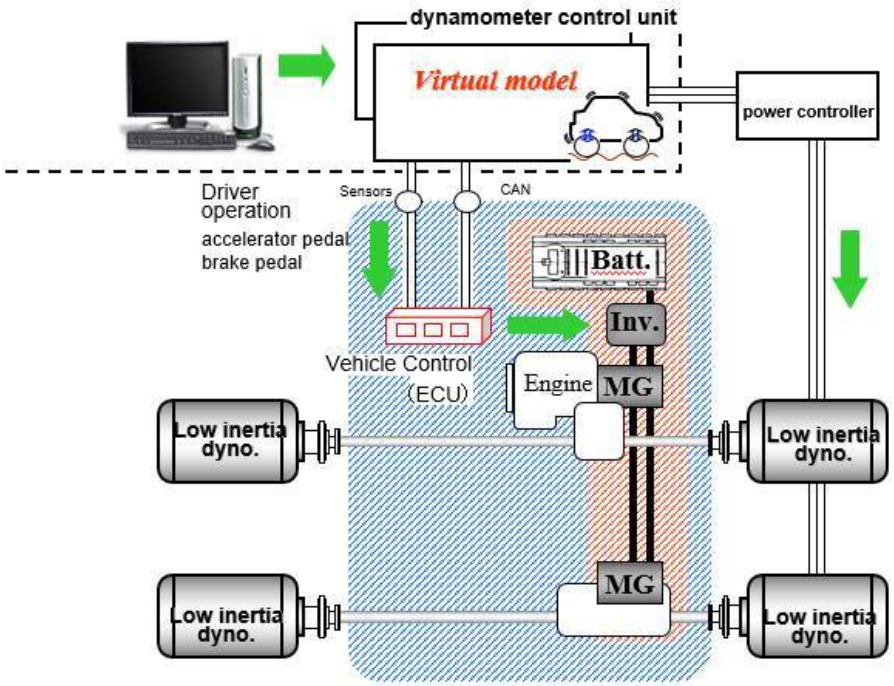
We propose to revise GTR21 so that both TP1 and TP2 can be carried out by not only chassis dynos or Hub dyno, but also “ System bench”.

< Consideration >

1.There is a possibility of products with very powerful HV (or BEV with multiple motors) that cannot be measured by normal chassis dynos because of reasons mentioned above.
2.TP1/TP2 can be measured by Hub Dyno, but Hub Dyno is expensive and has limited usage opportunities.
3.It is desirable that the system bench, which has been used in the development by each company, is an optionfor carrying out TP1 and TP2.

What is the HV system bench ?

HV System bench
(VRS : Virtual & Real simulator)



6. Test procedure

6.1. General

The following test procedures determine a vehicle system power rating for a hybrid electric vehicle, or for a pure electric vehicle with more than one propulsion energy converter.

Two test procedures are described herein.

Test procedure 1 (TP1) is based on measured electrical power, estimated ICE power, and estimated electrical conversion efficiency.

Test procedure 2 (TP2) is based on measured torque and speed at the drive shaft(s) or wheel hub(s) and estimated mechanical conversion efficiency.

TP1 and TP2 are intended to be technically equivalent methods for determining a vehicle system power rating from available measurements. TP1 and TP2 are distinguished by the specific instrumentation, measurements, other inputs, and calculations necessary to determine the vehicle system power rating.

Each powered axle that provides propulsion under the maximum power condition shall be tested by chassis dynamometer or hub dynamometer. Vehicles that are powered by two powered axles under the maximum power condition shall be tested by four-wheel-drive chassis dynamometer, or each powered axle shall be tested simultaneously by hub dynamometer.

Last paragraph might be modified as ;
Each powered axle that provides propulsion under the maximum power condition shall be tested by chassis dynamometer hub dynamometer **or system bench.**
Vehicles that are powered by two powered axles under the maximum power condition shall be tested by four-wheel-drive chassis dynamometer, or each powered axle shall be tested simultaneously by hub dynamometer **or system bench.**

OICA comment

- 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

JAPAN Position

We believe that measurement is possible with the current GTR 21 and that **there is no urgency to develop a candidate test method**. Candidate test method is considered to be a kind of simulation method, and although it would be useful to have it but not “MUST”.
We also believe that the verification of comparison with the current GTR 21 (reference method) is necessary.

We will support **a family concept** consideration if necessary.