Brief review of Phase 2 validation testing results to date

EVE 33 – Geneva – 13 January 2020

Purpose of Phase 2 validations

- Add additional vehicles to test matrix
- Determine whether revisions to the procedure have reduced the difference between result of TP1 and TP2
  - Use of torque and speed meters for TP2 instead of dyno rollers
  - Current and voltage collected by 20Hz instrumentation for TP1
  - Measures to reduce wheel slippage
  - Perform five repetitions and average the last four

Participants

- Environment and Climate Change Canada
  - 2018 BMW 530e (NOVC-HEV)
  - 2016 Chevrolet Volt (OVC-HEV)
  - 2018 Toyota Prius Prime (OVC-HEV)
- US EPA
  - Unanticipated problem with contract funding mechanism prevented EPA from being able to test any vehicles
  - ECCC tested a 2009 Saturn Vue as partial substitute (mild BAS NOVC-HEV)
- Joint Research Centre
  - Additional testing of vehicles similar to those of Phase 1
  - Additional analysis of Phase 1 results to shed light on issues raised in drafting group
  - Additional vehicles to be tested with hub dyno and torque-instrumented wheel

Status of ECCC testing

- Reports for BMW 530e and 2016 Volt are complete
  - These were made available for December 12 EVE teleconference
- Report for 2009 Saturn Vue is pending
- Data analysis is continuing for 2018 Prius Prime
  - Data analysis constrained by problem with data conversion from scan tool
  - Toyota Technical Center helped recover some of the data but not all
  - Late acquisition of R85 engine power curve (also with help of Toyota)
- Possible acquisition of R85 data for BMW530e may allow further analysis of that data
- All reports include important recommendations for improving the procedure (e.g. conditioning time, reducing slippage, variable usage of air conditioning compressor to cool electrical components)

Torque meters at ECCC presented difficulties

- Torque and speed instrumentation product used at ECCC showed various instances of unexpected variability, calibration drift, or outright malfunction for all vehicles tested
- Results for TP2 were computed but accuracy is questionable for these reasons
- Lesson:
  - Torque and speed metering technology may be a source of potential variation
  - If performing only TP2, would be hard to detect if this variation has occurred
- On the other hand:
  - Japan testing for ISO procedure did not encounter these difficulties
  - Procedure already has a requirement for torque and speed accuracy that labs must fulfill
- Options:
  - Assume that ECCC experience is an anomaly; rely on existing accuracy requirement
  - Require hub dynamometer for TP2
  - Reinstate use of dyno roller data, with specified procedure for adjusting tire losses

TP1 and TP2 comparison for ECCC is limited

- TP1 results limited by availability of R85 data for North America vehicles, and data conversion malfunction with proprietary scan tool
- TP1 was performed using substitute data sources such as CAN data or low-resolution sensors
- Strict comparison of these TP1 results with TP2 is not conclusive
  - Substitute calculation or data source is not the specified procedure
  - Accuracy of the substitute data is unproven
- There is still a possibility that ECCC Prius Prime, or JRC testing, will support a fully valid comparison of TP1 to TP2

Going forward

- Case for validity likely to rely on “good engineering judgment” basis
- Significant value added since starting with ISO 20762:
  - We have further shown that method of eliciting maximum power is reliable
  - We have accounted for relative applicability of TP1 and TP2 to diverse powertrain types
  - Strong theoretical basis for equivalence of TP1 and TP2 is now embodied in the procedure
  - Where equivalence cannot be fulfilled, TP1 or TP2 alone is specified
  - If measurements are accurate, TP1 and TP2 should be very similar
- Validation program cannot test for all potential loopholes, because a fully authentic type approval situation cannot be emulated
  - Will manufacturers always possess and provide accurate K factors?
  - Will manufacturers provide speed of maximum power?
  - Not every possible variation in architecture or calibration can possibly be tested
- Careful design of the procedure is important, but use of the procedure in practice is the ultimate test

Availability of draft procedure

- See EVE-33-05e
- Changes since EVE 32 Brussels are shown in markup
  - Minor revisions to Technical Rationale and Justification for clarity
  - Added text describing status of Phase 2 validation
  - Work of drafting group at EVE 32 Brussels drafting meeting
  - Additional work by drafting coordinator to implement other recommendations of drafting group
- Open issues substantially the same as in EVE-32-06e.xlsx
- Detailed examination and comment from all stakeholders and contracting parties is strongly encouraged