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June 24, 2015

TTC-15050

Clerk of the Board  
Air Resources Board  
1001 I Street  
Sacramento, California 95814

**Subject: Toyota Comments on Amendments to the LEV III Hybrid Electric Vehicle Test Procedures ("Second 15-Day Notice" of 9-Jun-2015)**

Dear Air Resources Board;

Toyota appreciates the thoroughness with which the Air Resources Board has reviewed and updated the LEV III regulations, and their open communication with the automotive industry to develop test procedures in good faith.

We kindly submit several comments to the proposed amendments to the CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2018 AND SUBSEQUENT MODEL ZERO-EMISSION VEHICLES AND HYBRID ELECTRIC VEHICLES, IN THE PASSENGER CAR, LIGHT-DUTY TRUCK AND MEDIUM-DUTY VEHICLE CLASSES, which are explained in the following pages.

Sincerely,

for Kevin D. Webber  
General Manager  
Vehicle Regulation & Certification Engineering

## 1. G.5.3.18.2 Additional End-of-Test Criterion

The text of the additional criterion states: *The SOC at the end of the hot-start UDDS cycle is higher than the SOC at the beginning of the cold-start UDDS cycle.*

We propose that this also be interpreted to mean that the net energy change of the battery (in Amp-hr) is positive; in other words, more energy has gone into the battery during the test than has come out.

The other instances of this additional criterion occurring in the document should be interpreted in the same way.

## 2. G.5.4.2 Urban Charge-Depleting Emissions Test

### a) G.5.4.2 Urban Charge-Depleting Test "Warm-Up" Extra Cycle

5.4.2 states: *If the engine starts operating toward the end of the cold-start UDDS cycle such that the vehicle does not achieve full warm-up conditions prior to the subsequent hot-start UDDS cycle, an additional hot-start UDDS cycle may be performed following the first hot-start UDDS cycle and be included in the hot-start mass summations....*

We feel that conducting two hot-start UDDS cycles is essential for accurate emission testing.

Also, since the term "fully warm" is not defined in this document, there is no clear way to determine whether or not a third cycle may be run.

Therefore, we recommend that this "fully warm" requirement be removed, and a third cycle be allowed according to the manufacturer's discretion.

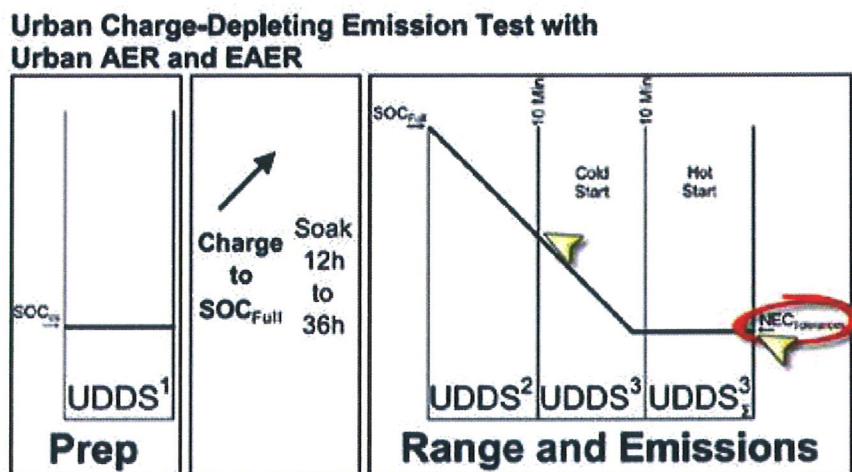
### b) G.5.4.2.17 Primary End-of-Test Criterion

G.5.4.2.17 describes the primary end-of-test criterion as  $\leq 1\%$  Net Energy Change from the beginning of the first cycle to the end of the second cycle.

5.4.2.17 Amend subparagraph (d)(3): End-of-Test Criteria. A valid test shall satisfy the SOC Net Energy Change Tolerances in section G.10. For PHEVs that use a battery as an energy storage device,  $(\text{Amp-hr}_{\text{soc}})$  is the stored charge at the beginning of the cold-start UDDS cycle and  $(\text{Amp-hr}_{\text{soc}})$  is the stored battery charge at the end of the next hot-start UDDS cycle immediately following the cold-start UDDS cycle. The final stored battery charge,  $(\text{Amp-hr}_{\text{soc}})$ , shall not exceed either  $(\text{Amp-hr}_{\text{soc}})_{\text{max}}$  or  $(\text{Amp-hr}_{\text{soc}})_{\text{min}}$  for a valid test.

This start and end point is a carryover from HEV testing and cannot possibly be fulfilled in a charge-depleting test unless the engine turns on immediately at the beginning of the first cycle.

As shown by the two arrows indicating initial and final Amp-hr, even the example test shown in Section I Figure 4 does not fulfill this primary criterion. Additionally, the end point being identified as “NEC<sub>Tolerances</sub>”, as opposed to “NEC<sub>Options</sub>”, indicates that no additional end-of-test criteria may be used to validate this test.



**Figure 4**

NEC<sub>Tolerances</sub>: Net Energy Change Tolerances required

NEC<sub>Option</sub>: NEC Tolerances apply; however, option available to validate test when SOC final > SOC initial.

Given that this test allows more than two cycles, the primary end-of-test criterion also ignores any cycles driven after the first two.

We propose that the primary end-of-test criterion be changed to apply over the last cycle or set of cycles, as described in p. A-50 paragraph 8 for compliance and in-use testing. This also follows the spirit of the end-of-test criteria described for charge-depleting tests in SAE J1711 sections 3.9 and 3.9.1, shown here:

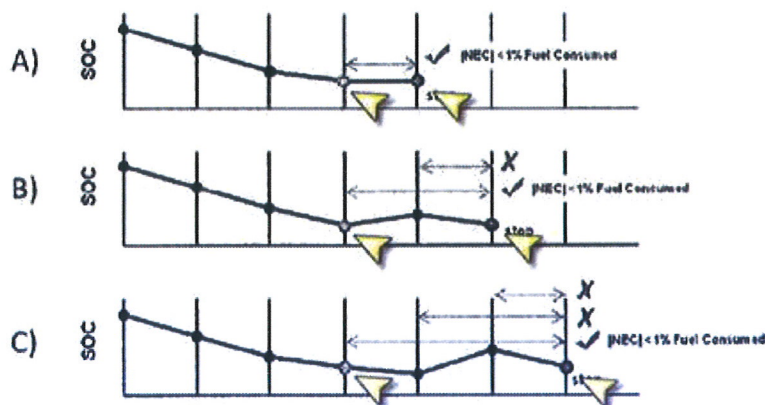


FIGURE 4 - SEVERAL SCENARIOS OF EOT CRITERION

**SAE J1711 3.9 EOT**

### **3. Section F – FC and HEV Emissions Test**

Great care was taken to develop the additional end-of-test criteria for charge-sustaining PHEV tests.

We propose that these additional criteria also be applied to hybrid emissions tests in Section F.