November 17, 2009

Clerk of the Board
Air Resources Board
1001 I Street
Sacramento CA 95814

Subject: Plug-In Hybrid Electric Vehicles Test Procedure Amendments – 2nd 15-Day Notice

Dear Clerk of the Board:

The Alliance of Automobile Manufacturers is a trade association of 11 car and light truck manufacturers. We appreciate the opportunity to work with ARB staff to develop test procedures for plug-in hybrid electric vehicles. We compliment ARB staff for adopting many of the needed changes, especially during the post-hearing process. PHEVs are new and complex technology and we have learned more about them during the rulemaking process and will learn more going forward. As such we ask that ARB continue to work with manufacturers and make adjustments to the procedures as needed using the Manufacturers Advisory Correspondence process. Once we have accumulated more experience with both the vehicles and the procedures, ARB should conduct another rulemaking to improve and streamline the procedures.

We have organized our comments into 2 sections : Exhaust related comments and evaporative related comments. Within each section, each specific comment is categorized as to whether it is a high priority comment dealing with the ability to actually execute the proposed test procedures -- these are our most important comments. Also, the comments are identified if they are an entirely new issue not yet brought to ARBs' attention previously.

Again, we appreciate the work and cooperation by ARB staff. If you have any questions, please contact Steve Douglas at (916) 538-1197 or at sdouglas@autoalliance.org.

Sincerely,

[Giedrius Ambrozaitis for]

Steven P. Douglas
Senior Director, Environmental Affairs

Attachments

Section Category EVAP Related comments to ARB 2nd 15 Day Notice

General	New issue	Also since there are several testing options provided for the manufacturer, provide that: • ARB will test the vehicles the same manner as the manufacturer tested it with respect to options selected, including for **in-use and confirmatory testing**.
III.D.1.7.10 Evap	New Issue	This section adds the optional canister butane load for PHEV exhaust emissions testing and originally excluded sections III.D.1.7.1 through III.D.1.7.9. During the 1st 15-day comment period AAM indicated that sections III.D.1.7.3 and III.D.1.7.7 should not be excluded. Under further review the original ARB text was appropriate and should exclude sections III.D.1.7.1 through III.D.1.7.9.
III.D.1.9 and III.D.1.10 Evap	New issue	Clarification - to facilitate the use of the optional canister butane load for PHEV exhaust emissions testing outlined in section III.D.1.7.10, sections III.D.1.9 and 1.10 could be modified. For clarification purposes these sections could be modified to indicate these sections apply to both evaporative and non-integrated ORVR control canisters. This could be accomplished by changing "evaporative control canister" to one of the following: canister, the vehicle's canister, or the evaporative and/or ORVR control canister.
New section	New Issue	We request the option for manufacturers to use robot drivers for the 85% tank drivedown.
New section	New Issue	Increase the drive cycle tolerances to allow for greater and more frequent driver cycle violations during 85% drivedown and for the charge depleting test for an EREV

Section	Category	ARB 2nd 15 Day Notice – Alliance Comments
B.1 Definitions	Repeat comment (14Sep09)	The definitions for "Alternate Continuous Urban Test Schedule" and the "Alternate Continuous Highway Test Schedule" list a sequence of pairs of emissions test, with extended soaks (0 – 30 minutes) on the second test. The intent is to run as many UDDS's or HWY's in a row with the normal 10 minute soak for the UDDS, and likewise 15 second idles for the highway test. These extended soaks should be infrequent, and due to facility limitations. However the language in these definitions require the manufacturer to repeat the extended soak <u>after each pair</u>. Recommend wording be changed on both definitions to allow the insertion of these extended soaks as needed, (again) due to facility limitations, and not be required on a periodic (or pair) basis. Recommend 10-30 minute soaks for the UDDS and for the highway tests either a 0-30 minute soak or a 15 second idle
	Non-Executable & Repeat comment **(Nov09)**	**Nov09 (Non-Executable):** The extended soak time for the UDDS and HFEDS sequences was reduced from 10-30 minutes to 10-20 minutes. This needs to remain at **30** minutes maximum because some labs cannot meet the new 20 minute extended soak time allotment. (Again as above) recommend 10-30 minute soaks for the UDDS and for the highway tests either a 0-30 minute soak or a 15 second idle. The HWY test has an added 15 second key on "pause" which we assume is an idle. Also the same concern as 14Sep09 comment (above) w.r.t. the words "series", which implies "pairs.
B.1 Definitions	Repeat comment **(Nov09)**	Need a new definition for "Alternate Continuous US06 Test Schedule", which would complement the already defined "Continuous US06 Test Schedule" with the provision for extended soak periods (0-30 minutes) due to facility limitations. Recommend 0-30 minute soaks or a 1-2 minute idle
C.3.3 Zero Emission VMT PZEV Allowance	Repeat comment **(Nov09)**	Clarification on which utility factor will be used from J2841. Recommend change to the last sentence of this section as follows: "The Fleet Utility Factor (UF) based on the charge depleting actual range (Rcda) shall be determined according to SAE J2841 March 2009."
C.3.3.(a)	New comment	Section C.3.3 (a) Calculation of Zero Emission VMT Allowance. (page C-1) The original intent of C.3.3(a) was to establish a maximum VMT credit at 40mi R_{cda} and ERF_u=1, using the Fleet UF from SAEJ2841. The divisors have not been updated to reflect the updated UF from the March 2009 release of the standard. In order to harmonize the maximum VMT credit at R_{cda}=40 and ERF_u=1, and the VMT credit for R_{cda} > 40, the divisor

<table>
<tr><td></td><td></td><td>should be 28.80 for the equation for VMT credit with Rcda > 40, for all ERFu. This is consistent with F 11.13.

This harmonizes the VMT credits for all R_{cda} including 10 <= R_{cda} <= 40 and R_{cda} > 40, for all $EAER_{u40}$.

Bottom Row of the Table in C.3.3 (a):

<table><tr><td>Range</td><td>Zero-emission VMT Allowance</td></tr><tr><td>R_{cda} > 40 miles</td><td>$EAER_{u40}$ / 28.80</td></tr></table></td></tr>
<tr><td>E
HEV
Procedures</td><td>Repeat
comment
(Nov09)</td><td>General comment – no 20° or 50°F testing guidance</td></tr>
<tr><td>E.3.3 (b)
Recording
Requirements</td><td>Repeat
comment
(Nov09)</td><td>Exempt this DC energy measurement from manufacturers testing of in use customer vehicles or saleable vehicle testing due to the invasive nature of the measurement. Allow alternative methods to the measurement of net DC energy if approved in advance by the Executive Officer of the Air Resources Board.</td></tr>
<tr><td>E.3.3 (d)
Recording
Requirements</td><td>Repeat
comment
(Nov09)</td><td>Exempt this DC energy measurement from manufacturers testing of in use customer vehicles or saleable vehicle testing due to the invasive nature of the measurement. Allow alternative methods to the measurement of net DC energy if approved in advance by the Executive Officer of the Air Resources Board.</td></tr>
<tr><td>E.8.1.2.1</td><td>New Issue</td><td>Wording change which is conflicting – what if an HEV cannot be manually activated?

“The auxiliary power unit shall be manually activated at the beginning of and operated throughout the US06 preconditioning cycle. For <s>hybrid electric</s> vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level…”

This should be replaced with:

"For vehicles that allow manual activation of the auxiliary power unit, the auxiliary power unit shall be activated at the beginning of, and operated throughout, the US06 preconditioning cycle. Additionally for vehicles that allow manual activation, the battery state-of-charge shall be set at the lowest level that satisfies one of the following conditions: "</td></tr>
</table>

Section	Category	ARB 2nd 15 Day Notice – Alliance Comments
E.8.2.1	New Issue	Wording change which conflicts with E.8.2.6.2 (i) which allows up to three US06 emissions tests to meet SOC criteria. ***"The US06 cycle after the preconditioning cycle shall be used to calculate emissions and shall meet the state-of-charge net tolerances as calculated in section E.9"*** The intent is understood in context with E.8.2.6.2 (i). Perhaps delete the second "shall" phrase and replace with "if it meets"
E.8.4.1	New Issue	Wording change which conflicts with E.8.4.4.1 (i) which allows up to three SC03 emissions tests to meet SOC criteria. ***"The SC03 cycle after the preconditioning cycle shall be used to calculate emissions and shall meet the state-of-charge net tolerances as calculated in section E.9"*** The intent is understood in context with E.8.4.4.1 (i). Perhaps delete the second "shall" phrase and replace with "if it meets"
E.10 New section	**Non-Executable** Repeat comment **(Nov09)**	Additional Provisions, add the following clause • Manufacturers need to be allowed to launch the next drive cycle in a test sequence (example, end of CS HWY emissions test) while they are determining the SOC (including bag reads) for the previous drive cycle, then abort out of this new drive cycle if not required by the test procedure. It is not possible to read the sample bags in the 15 second idle between highway drive cycles nor the 1 – 2 minute idles between the US06 drive cycles
F. PHEV Procedures	Repeat Comments **(Nov09)**	General comments: 1. May need to raise the mileage limit on test vehicles due to the long test sequences (like CD range tests). 2. Very complex test procedures and new vehicle technology. There will be unforeseen issues as we implement the test procedures and learn about PHEV's. 3. Will need flexibility in the future such as relief on test validation criteria. Trying to run multiple CD UDDS, HWY or US06 test cycles and pass the myriad of validation criteria, relevant or not, on every test will be a major hurdle. Suggest looking at relaxed validation criteria (perhaps like that found in the heavy duty regulations Part 1065) where it won't impact the numbers generated. 4. When determining emissions for the UDDS CD range test, sections F5.5.1 and F.5.6.1 treats different types

		of Off-Vehicle Charge Capable Hybrid Electric Vehicles, namely PHEV's and EREV's, inconsistently. EREV's do not get credited with zero emissions (EV) modes. A more technically accurate approach would be to utilize Utility Factor equations as defined in SAE committees, which weight emissions based on the fraction of miles traveled in charge depleting and charge sustaining modes
F.3.1 Recording requirements	**Non-Executable** New Comment	The following phrase implies AC and DC recharging energy will be required for all tests even though figure G-2 only requires this recharging energy to be performed after (1) the UDDS CS test, and (2) possibly the HWY CD tests. Also for CD test sequences like the HWY & UDDS, this statement would require AC recharging energy after each cycle, which is not executable (would have to stop a CD test sequence after each cycle then recharge the battery). "…The following data shall be recorded for all ~~charge depleting range and exhaust~~ tests and for each individual test cycle therein…"
F.3.1 (b) Recording Requirements	Repeat Comment **(Nov09)**	Exempt this DC energy measurement from manufacturers testing of in use customer vehicles or saleable vehicle testing due to the invasive nature of the measurement. Allow alternative methods to the measurement of net DC energy if approved in advance by the Executive Officer of the Air Resources Board.
F. 3.1 (c) Recording Requirements	New comment	The following phrase implies AC recharging energy will be required for all tests even though figure G-2 only requires this recharging energy to be performed after (1) the UDDS CS test, and (2) possibly the HWY CD tests. "(c) AC energy required to fully charge the battery after a charge depleting or charge sustaining test from the point where electricity is introduced from the electric outlet to the battery charger;"
F. 3.1 (c) Recording Requirements	Repeat Comment	(c) Should record the AC wall energy while the charger is plugged in.
F. 3.1 (d) Recording Requirements	Repeat Comment **(Nov09)**	Exempt this DC energy measurement from manufacturers testing of in use customer vehicles or saleable vehicle testing due to the invasive nature of the measurement. Allow alternative methods to the measurement of net DC energy if approved in advance by the Executive Officer of the Air Resources Board.
F.3.1 (d) Recording Requirements	New Comment	The following phrase implies DC recharging energy will be required for all tests even though figure G-2 only requires this recharging energy to be performed after (1) the UDDS CS test, and (2) possibly the HWY CD tests. "(d) DC energy required to fully charge the battery after a charge depleting or charge sustaining test from the point where electricity is introduced from the battery charger to the battery; and"
F. 3.1 (d)	Repeat	Should record the AC wall energy while the charger is plugged in.

Recording Requirements	Comment	
F.3.5	New Comment	"Voltage and current shall be sampled at a minimum rate of 20 hz." AC voltage and current (**only**) should be sampled (but not necessarily recorded) at a higher frequency than 20hz (AC wall is at 60 hz) depending on the integration techniques of the instrumentation used. ARB should reference J1634 which specifies "bandwith of at least 10 times the maximum fundamental frequency". Recording frequency should remain at 20 hz.
F.5. Preconditioning	New Comment	General concern with references to the ARB evaporative procedures (in multiple locations of section F), that these evaporative procedure references are consistent with sections like F.5.1.
F.5.1.7	New Comment	Typo: "…To determine charging sustaining operation…", "charging" should be "charge". "For the charge depleting range test and the charge sustaining emission test, the preconditioning cycle shall be the UDDS." Figure G-2 does not show a preconditioning test before the UDDS CS test, assume this refers to the CS portion of the CD UDDS test. (Important) New requirement added to now run an emissions test during the preconditioning cycle. This is unnecessarily burdensome and should be replaced with a manufacturer's determination that the vehicle is indeed in CS operation. There is an allowance for alternate procedures to an actual emissions test. This should follow current cert procedure which does not require emissions data to prove that a preconditioning test was performed.
F.5.2.1	New Comment	Typo, insert "each" before "followed" *Overview*. The ***charge depleting range test*** dynamometer run shall consist of a series of charge depleting ***UDDSstests, after a second fuel drain and fill and a 12 to 36 hour soak period performed pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles." Each charge depleting test shall consist of one UDDS*** followed by a 10 minute ***key-off*** hot soak period until charge sustaining operation is achieved for two consecutive UDDSs.
F.5.2.1	New Comment	Inconsistent language. Figure G-2 shows a full AC recharge only after the UDDS **CS** test, however F.5.2.1 (below), F.5.4.2 (CD UDDS) & F.5.4.3 (CS UDDS) state that a full AC recharge shall be initiated after either the CS or CD UDDS. Unclear how to do this full AC recharge after the CD UDDS and then

		discharge the battery for the CS UDDS within the allotted soak time. *"Vehicle charging shall be initiated within three hour after either the charge depleting range test or the charge sustaining emission test pursuant to section F.5.4.2. During charging, all requirements in section F.3 must be met, and energy consumption shall be calculated pursuant to the requirements in section F.11.7."*
F.5.5.1	New comment	For clarity purposes, we recommend the following language change: "n = number of hot start UDDSs in Charge Depleting operation. **If there are no charge depleting hot start cycles**, then use the next hot start cycle (after the cold start cycle) in the test sequence for the purpose of determining hot start emissions. **The manufacturer may optionally extend the number of cycles so that at least 2 hot start cycles, in any mode (CD, CS or transition), are included, so that n=2."**
F.5.6.1	New comment	For clarity purposes, we recommend the following language change: "n = number of hot start UDDSs in Charge Depleting operation. **If there are no charge depleting hot start cycles**, then use the next hot start cycle (after the cold start cycle) in the test sequence for the purpose of determining hot start emissions. **The manufacturer may optionally extend the number of cycles so that at least 2 hot start cycles, in any mode (CD, CS or transition), are included, so that n=2."**
F.6.2. HFEDS	**Non Executable** & Repeat Comment	6.2.2.8 Gives guidance on when to end the multiple HFEDS test sequence, both CD and CS, but is inconsistent. The phrase "Up to two highway emission tests shall be allowed to satisfy the SOC criterion." Is inconsistent with both the revised CS HWY language and the existing CD HWY language, and this phrase would also be incorrect for CD HWY test sequences. Language in this section 6.2 should be changed.

Section	Category	ARB 2nd 15 Day Notice – Alliance Comments
F.7.1.2.1 US06	New Comment	Wording change which is conflicting – what if an HEV cannot be manually activated? **"**For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level allowed by the manufacturer. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the US06 preconditioning cycle" This should be replaced with: "**For vehicles that allow manual activation of the auxiliary power unit, the auxiliary power unit shall be manually activated at the beginning, and operated throughout, the US06 preconditioning cycle. Additionally, for vehicles that allow manual activation, the battery state-of-charge shall be set at the lowest level allowed by the manufacturer.** "
F.7.3.2.1 SC03	New comment	Wording change which is conflicting – what if an HEV cannot be manually activated? **"**For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level allowed by the manufacturer. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the US06 preconditioning cycle" This should be replaced with: "**For vehicles that allow manual activation of the auxiliary power unit, the auxiliary power unit shall be manually activated at the beginning, and operated throughout, the SC03 preconditioning cycle. Additionally, for vehicles that allow manual activation, the battery state-of-charge shall be set at the lowest level allowed by the manufacturer.** "
F.7.4.4.1 (ii) & (iii) SC03	New comment	This charge depleting clause contradicts specific guidance in F.7.3 (SC03) to run both of these tests in charge sustaining mode only. This language appears focused to HEV's, not PHEV's.
F.7.5 Electric Range	New Comment	Page 7 of 15 day notice definition of continuous US06 test schedule (only for PHEV US06 range test): using traction battery for accessory loads versus using an auxiliary battery for accessory loads:

Section	Category	ARB 2nd 15 Day Notice – Alliance Comments
Test		*" Key on not less than 1 minute and not greater than 2 minutes between each successive US06"* But for some vehicle designs, this means that 4-8% of energy is wasted during this idle (just to keep vehicle active at idle) which is not used for any forward driving purpose. The energy loss avoided can be used to extend the cycle. There is no need for this idle at all - the key should be allowed to be off.
F.8	New comment	"For 50°F and 20°F testing, vehicle charging, prior to emissions testing, shall be performed during the soak period at 50°F and 20°F, respectively" *We understand charging at 50°F test or 20°F test is needed only if CD mode is worst case for NMOG +NOx emissions. Thus, we would like to ask this language be clarified that charging only required for CD testing:* • *For example, "For 50ºF and 20ºF **CD Mode** testing…"*
F.8 20 °F UDDS	New Comment	The new cold 20 & 50 °F guidance (existing ARB procedures for 50 °F testing and CFR Part 86 subpart C procedures for 20 °F) contains the phrase *"…shall be conducted pursuant to section F.5…"*needs to be narrowed as to what parts of F5 are applicable. For example, parts of F.5. would not be applicable like loading the canister, 1% SOC, AC recharging energy measurement, 68-86 °F, etc. The intent of this phrase is to use applicable F.5 guidance like the running of CS and CD schedules. Also a concern over the word "temperature" in the sentence below. Could imply this is the only provision (20 °F) from CFR Pat 86 Subpart C, which is untrue (cold weather fuel being another). Order should be reversed, follow 40 CFR Subpart C test procedures with the test unique provisions of section F.5 (same comment above) and F.8 *"20 °F testing shall be conducted pursuant to section F.5 and shall include the temperature provisions in 40 CFR Part 86 Subpart C - Emission Regulations for 1994 and Later Model Year Gasoline-Fueled New Light-Duty Vehicles, New Light-Duty Trucks and New Medium-Duty Passenger Vehicles; Cold Temperature Test Procedures"*

Section	Category	ARB 2nd 15 Day Notice – Alliance Comments
F.9 Additional Provisions	Repeat Comments	To improve testing efficiency, and feasibility, suggest several Additional Provisions be provided as follows: • Allow manufacturers to run the charge depleting tests (UDDS, HWY, US06 AER range test) in a CD sequence to optimize the test process • Allow manufacturer to run an additional CS prep 12 – 36 hours before the required test. • F.9.7, In the case of a fuel fill allow the option to disconnect the canister during this fuel fill, do not do a canister load, and optionally can do a prep cycle (12 – 36 hours before the test). Also since there are several testing options provided for the manufacturer, provide that • ARB will test the vehicles the same manner as the manufacturer tested it with respect to options selected, including for in-use and confirmatory testing.
F. 11.3 Calculations	Repeat Comment **(Nov09)**	Y_h and D_h are not defined as to which HFEDS schedule they are derived from. Should be the same HFEDS as that used for NOx emissions compliance (“third”).
F. 11.5 Calculations	Repeat Comments	Highway tests have always been run as a hot start test. To account for frictional losses due to the CD cold start test, should correct the cold start CD highway for these losses. Recommend the ARB staff work with industry on just such a correction algorithm.
F.11.13 Calculations	New Comment	EFR_u should be ERF_u
G Test Sequence Figure	Repeat comment (Nov09)	Nov09 comment: New figure G-2 with many enhancements made. Still doesn’t have US06 AER, 50°F or 20°F cycles.