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Electronic submission to: http://www.arb.ca.gov/lispub/comm/bclist.php

Dear California Air Resources Board (CARB):

American Honda Motor Company, Inc. (Honda) appreciates the opportunity to provide comments on CARB's Second Notice of Public Availability of Modified Text regarding Plug-In Hybrid Electric Vehicle Test Procedure Amendments published on November 2, 2009.

Honda is submitting comments for the following sections, please see the attached for detail explanations and proposals.

ATTACHMENT 1

§ 1962.1. Zero-Emission Vehicle Standards for 2009 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.

Section (c)(3)(A) Calculation of Zero-Emission VMT Allowance

ATTACHMENT 2

Section F.5.4.3 Urban Charge Depleting Range Test.

If the proposal in Section F.5.4.3 described above is accepted by CARB, then Sections **F.5.5.1 and F.5.6.1** for Gaseous and Particulate emissions, respectively, shall also be revised to reflect this change.

Section F.9.6 When determining the SOC tolerance during testing, the current drive cycle may be aborted if the SOC tolerance is met for previous drive cycle.

Sections F.5, F.6, and F.7

Vehicles with more than one mode of operation of the auxiliary power unit (e.g., economy mode, performance mode, etc.) for a given charge depleting or charge sustaining test cycle must be tested in the mode(s) which represents ~~maximum~~ the worst case emissions ~~of operation~~ of the auxiliary power unit. Confirmatory testing may also be performed in any mode of operation to ensure compliance with emission standards.

Section E.3.1.2(a) and E.3.2.2(a) Determination of Urban AER for Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles.

(a) The urban all-electric range for a fuel cell vehicle and a hybrid fuel cell vehicle shall be determined in accordance with SAE J2572. As an option, a manufacturer may elect to determine the urban all-electric range for a fuel cell vehicle or a hybrid fuel cell vehicle in accordance with section E.3.1.1 above.

Section F.11.9

11.9 The Charge Depleting Actual Range, R_{cda}, shall be defined as the range at which the state-of-charge is first equal to the average state-of-charge of the one or two UDDSs used to end the Urban Charge Depleting Test. This range must be ~~accurate~~ reported to the nearest 0.1 miles. For an illustration of R_{cda} see section H.

Please feel free to contact me at 734-222-5965 if you have any questions regarding the comments. Thank you very much.

Best regards,

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1. Zero-Emission VMT Allowance calculation

	15-Day Notice	2nd 15-Day Notice
Content **Section (c)(3)(A) Calculation of Zero-Emission VMT Allowance**	§ 1962.1. Zero-Emission Vehicle Standards for 2009 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles. Section (c)(3)(A) Calculation of Zero-Emission VMT Allowance *Range* / *Zero-emission VMT Allowance*: EAER$_u$ < 10 miles — 0.0 EAER$_u$ ~~>=~~ ≧ 10 miles and R_{cda} =10 miles to 40 miles — EAER$_u$ x (1 – UF~~R~~$_{Rcda}$)/11.028 R_{cda} > 40 miles — EAER$_{u40}$/29.63	*Range* / *Zero-emission VMT Allowance*: EAER$_u$ < 10 miles — 0.0 EAER$_u$ ~~>=~~ ≧ 10 miles and R_{cda} =10 miles to 40 miles — EAER$_u$ x (1 – UF$_{Rcda}$)/11.028 R_{cda} > 40 miles — EAER$_{u40}$/29.63 [no revision in left column]
Honda comment	As American Honda pointed out in the January 19, 2009 written comment to CARB prior to the January 23, 2009 Board Hearing, the "Rcda >40 miles" in the left column of the Zero-Emission VMT Allowance Table should be replaced with "EAERu > 40" miles and delete "Rcda=10 miles to 40 miles" to maintain consistency as shown below: *Range* / *Zero-emission VMT Allowance*: EAER$_u$ < 10 miles — 0.0 EAER$_u$ ~~>=~~ ≧ 10 miles and ~~R_{cda} =10 miles to 40 miles~~ — EAER$_u$ x (1 – UF~~R~~$_{Rcda}$)/11.028 EAERu ~~R_{cda}~~ > 40 miles — EAER$_{u40}$/29.63	**1.** We would like to propose same as previous comment. The "Rcda > 40miles" in the left column of the VMT Allowance Table should be replaced with "EAERu > 40 miles" . And the "EAERu40/29.63" in the right column of the VMT Allowance Table should be replaced with "EAERu/29.63". **2.** Alternatively, setting a cap in the point of 40miles is acceptable. However, the "EAERu40/29.63" in the right column of the VMT Allowance Table should be replaced with "1.35". For blended PHEV, if the vehicle have EAER>40mile and Rcda >EAER, it can not earn the Allowance rather than 40miles AER vehicle. (See following example) ~~*Urban Equivalent All-Electric Range (EAER)*~~ / *Zero-emission VMT Allowance*: EAER$_u$ < 10 miles — 0.0 EAER$_u$ ~~>=~~ ≧ 10 miles ~~and R_{cda} =10 miles to 100 40 miles~~ — EAER$_u$ x (1 – UF$_{Rcda}$)/~~14.6~~ 11.028 ~~R_{cda} > 100 4~~ EAERu>40mile — ~~1.58~~ EAER$_{u40}$/29.63 or 1.35

1. Zero-Emission VMT Allowance Calculation Example

	Example
Content **Section (c)(3)(A) Calculation of Zero-Emission VMT Allowance**	Vehicle A: 41-mile AER capable PHEV without any blended operation. Vehicle B: 41-mile AER capable PHEV with blended operation between 41 and 50 miles.
Honda comment	In this example, Vehicle B should have be given at least the same (if not more) amount of VMT Allowance as Vehicle A; but in this example, Vehicle B actually receives LESS allowance than Vehicle A! This is penalizing PHEV design with AER capable+Blended strategies.

Vehicles	A	B
	AER	AER+Blended
EAERu (mile)	41	45.5
Rcda (mile)	41	50
ERF (%)	100	91
EAERu40	40	36.4
VMT Allowance	1.34998	1.22848

Range	*Zero-emission VMT Allowance*
$EAER_u < 10$ miles	0.0
$EAER_u >= \geq 10$ miles and R_{cda} =10 miles to 40 miles	$EAER_u \times (1 - UF_{Rcda})/11.028$
$R_{cda} > 40$ miles	$EAER_{u40}/29.63$

11.6 Electric Range Fraction (%).

The Electric Range Fraction means fraction of the total miles driven electrically (with the engine off) for blended operation hybrid electric vehicles.

The Urban Electric Range Fraction (ERF_u) is calculated as follows:

$$ERF_u\ (\%) = \left(\frac{EAER_u}{R_{cda}}\right) * 100$$

11.13 The Urban Equivalent All Electric Range for vehicles with an urban charge depleting actual range greater than 40 miles, $EAER_{u40}$, is determined through the following equation:

$$EAER_{u40}\ (miles) = \left(\frac{EFR_u \times 40\,mi}{100}\right)$$

2. Urban Charge Depleting Range Test

	15-Day Notice	2nd 15-Day Notice
Content Section 5.4.3	(i)At the end of the cold soak period, the vehicle shall be placed or pushed, onto a dynamometer and operated through the Continuous Urban Test Schedule until the SOC Net Change Tolerances (specified in section F.10 of these test procedures) that indicate charge sustaining operation are met for two consecutive UDDSs, or a single UDDS if data is provided showing that charge sustaining operation can consistently be maintained in one UDDS. 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. For this case (no charge depleting hot start cycle), the manufacturer may optionally add one additional hot start cycle.	(ii) Dynamometer run. At the end of the cold soak period, the vehicle shall be placed or pushed, onto a dynamometer and operated through the Continuous Urban Test Schedule until the SOC Net Change Tolerances (specified in section F.10 of these test procedures) that indicate charge sustaining operation are met for two consecutive UDDSs, or a single UDDS if data is provided showing that charge sustaining operation can consistently be maintained in one UDDS. 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. For this case (no charge depleting hot start cycle), the manufacturer may optionally add one additional hot start cycle. [no revision, same as 15-Day Notice]
Honda comment	In the case there is no charge depleting hot start cycle, Honda proposes using the Hot Start UDDS emissions results from the Charge-Sustaining Test in the Charge Depleting Range Test sequence for the purpose of determining hot start emissions.	We would like to propose same as previous comment. In the case there is no charge depleting hot start cycle, Honda proposes using the Hot Start UDDS emissions results from the Charge-Sustaining Test in the Charge Depleting Range Test sequence for the purpose of determining hot start emissions.

5.4.3 **Urban Charge Depleting Range Test.**
(i) At the end of the cold soak period, the vehicle shall be placed or pushed, onto a dynamometer and operated through the Continuous Urban Test Schedule until the SOC Net Change Tolerances (specified in section F.10 of these test procedures) that indicate charge sustaining operation are met for two consecutive UDDSs, or a single UDDS if data is provided showing that charge sustaining operation can consistently be maintained in one UDDS. If there are no charge depleting hot start cycles, then use the ~~**next**~~ hot start cycle ~~**(after the cold start cycle)**~~ in **the Urban Charge-Sustaining Emission** test sequence for the purpose of determining hot start emissions. ~~**For this case (no charge depleting hot start cycle), the manufacturer may optionally add one additional hot start cycle.**~~

3. Minimize unnecessary test

	15-Day Notice	2nd 15-Day Notice
Content Section F.9.6		F.9.6 When determining the SOC tolerance during testing, the current drive cycle **may be aborted if the SOC tolerance is met for previous drive cycle.** (This provision was added to minimize unnecessary testing.) [New section is added]
Honda comment		We would like to clarify this requirement. For CD test, the vehicle run shall consist of UDDS/HWY until CS operation is achieved for two consecutive UDDS/HWY. **We would like to know how this requirement will be applied.**

4. Worst case emission（FTP/HWY/SFTP）

	15-Day Notice	2nd 15-Day Notice
Content Attachment 2 Sections F5, F6, and F7.		F.5、F.6、F.7(F.6 and F.7 were added in 2nd 15-Day Notice.) Vehicles with more than one mode of operation of the auxiliary power unit (e.g., economy mode, performance mode, etc.) for a given charge depleting or charge sustaining test cycle must be tested in the mode(s) which represents the worst case emissions of the auxiliary power unit. Confirmatory testing may also be performed in any mode of operation to ensure compliance with emission standards. Vehicles with more than one mode of operation of the auxiliary power unit (e.g., economy mode, performance mode, etc.) for a given charge depleting or charge sustaining test cycle must be tested in the mode(s) which represents ~~maximum~~ the worst case emissions ~~of operation~~ of the auxiliary power unit. Confirmatory testing may also be performed in any mode of operation to ensure compliance with emission standards.
Honda comment		**Revert to the previous language of "maximum of operation".** In case of vehicles with more than one mode of operation of the auxiliary power unit (e.g., economy mode, performance mode, etc.), we need to evaluate on the worst case emission and demonstrate it. We do not know the definition of those modes. There are several parameters that cause worst emission. We do not understand what operation cause worst emission. If CARB does not issue the guideline regarding test condition, we must look for worst case emission from several operation modes. It is impossible for Mfr to attest the real worst case emission. **Honda requests CARB to retain the original language with "Maximum of Operation".**

5. Hydrogen Fuel Cell Vehicle Driving Range determination

	15-Day Notice
Content	Section E.3.1.2(a) and E.3.2.2(a) – In the current test procedures, a manufacturer is required to determine the urban and highway all-electric range for a fuel cell vehicle and a hybrid fuel cell vehicle by filling the hydrogen tank and running the vehicle over the applicable test cycle until the vehicle is no longer able to maintain the required speed and/or acceleration. However, establishing range using the all-electric range test was not formally specified in the test procedure for fuel cell vehicles. Because the end of the test does not occur until the fuel tank is drained, this is a time consuming test. In order to reduce the testing time for these types of vehicles, staff originally proposed that the urban and highway all-electric range for a fuel cell vehicle and a hybrid fuel cell vehicle be determined in accordance with the recently adopted Society of Engineers test protocol, SAE J2572. Since the release of the 45-day notice, manufacturers have requested that they be given the option of using either the original test procedure or SAE J2572 to determine the urban and highway all-electric range for a fuel cell vehicle and a hybrid fuel cell vehicle. This proposed modification allows both options to be used.
Honda comment	**In order to ensure level playing field, Honda suggests requiring the use of only the J2572 procedure for FCEV driving range determination, NO OTHER OPTIONAL procedure is allowed.** Depending on the vehicle design, the Original method of driving on chassis dyno until the vehicle can no longer follow the trace and the J2572 method could result in big disparity on the driving Range results due to the following technical reasons: 1. In the J2572 method, the FTP (2 x UDDS) fuel economy result includes the 43%/57% Cold/Hot weighting to represent in-use condition, while the Original method does not account for this, and **hence will result in higher driving range than J2572**. Please see next page for example calculation. 2. In the Original method, even when the vehicle's hydrogen tank is empty, the vehicle might still be able to drive for some distance on the UDDS trace using the remaining RESS (i.e. battery, capacitor,..etc.) energy which could create an unleveled playing field; J2572 method simply takes the UDDS fuel economy multiply by the useable hydrogen tank volume and does not include this additional RESS-only drive range. Please see next page for example calculation.

5. Hydrogen Fuel Cell Vehicle Driving Range determination

	Example Calculation
Example	

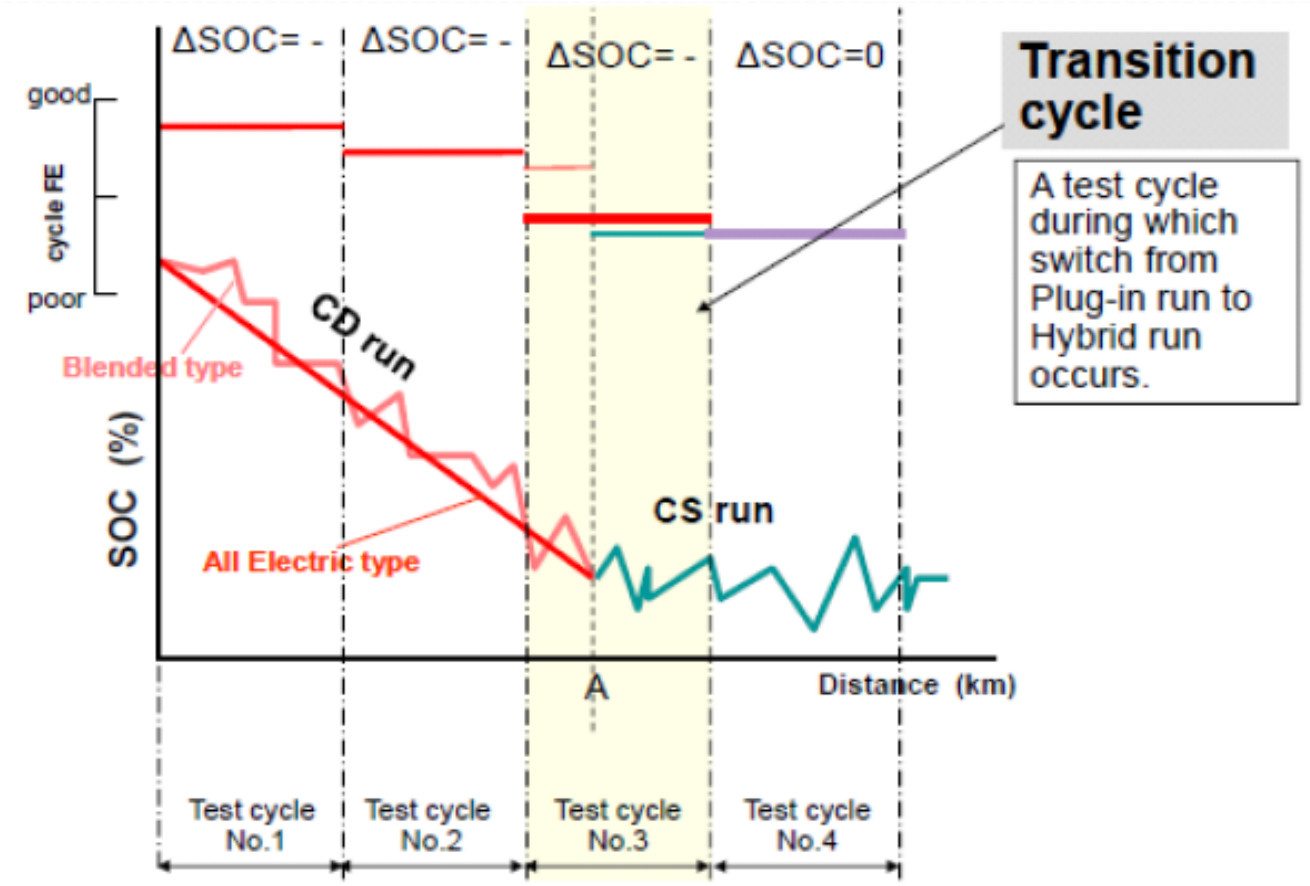
Usable Hydrogen amount (Kg) =>		3.5		
	mile/kg	Range(J2572 with cold/hot weighting)	Original Method (Full Range Test)	Range (J2572 with only Hot UDDS)
Cold UDDS	80			
Hot UDDS	90			
WM	85.7	**300**	**314**	**315**

Please note that Original method results in a driving range similar to J2572 result without cold weighting. This creates unlevel playing field. Driving range should include appropriate Cold weighting to be representative of in-use, hence **SAE J2572 is the only appropriate method**.

6. Rcda in Transition Cycle (transition between CD and CS modes)

	2nd 15-Day Notice
Content Section F.11.9	11.9 The Charge Depleting Actual Range, R_{cda}, shall be defined as the range at which the state-of-charge is first equal to the average state-of-charge of the one or two UDDSs used to end the Urban Charge Depleting Test. This range must be ~~accurate~~ reported to the nearest 0.1 miles. For an illustration of R_{cda} see section H.
Honda comment	Concern with CARB Section F.11.9: Rcda variability may be too big, as it depends on the variability of the state-of-charge in the subsequent charge sustaining cycles. For Rcda determination, **Honda recommends adoption of technical standard method in Japan for Transition Cycle Charge Depleting Range.** This is a mathematical method using CO2 emissions ratio in the Transitional Cycle to refine the accuracy of the resulting Rcda range. This proposal is also been considered by the SAE J1711 Working Group members. Please refer to following pages for explanation of the technical standard method in Japan.

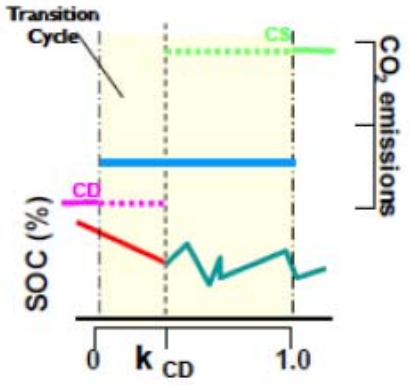
6. Rcda in Transition Cycle (transition between CD and CS modes)

	Technical standard method in Japan Rcda determination in Transition Cycle
Explanation	

6. Rcda in Transition Cycle (transition between CD and CS modes)

	Technical standard method in Japan Rcda determination in Transition Cycle
Explanation	

k_{CD} is calculated by a **CO_2 pro-rate basis.**



CD Running Ratio during Transition Cycle k_{CD} =

$$\frac{\text{CS Cycle } CO_2 \text{ emissions (mg)} - \text{Transition Cycle } CO_2 \text{ emissions (mg)}}{\text{CS Cycle } CO_2 \text{ emissions (mg)} - \text{CD Cycle } CO_2 \text{ emissions (mg)}}$$

to use CO_2 emissions immediately before the Transition Cycle.

Consider the CO_2 emitted from the first start of ICE does not affect to k_{CD} calculation.

CD range is obtained by the following:

$$\text{CD range (km)} = \Sigma \left(\text{CD cycle distance} + \text{Transition cycle CD distance} \right)$$

$$\text{Transition cycle CD distance (km)} = \text{Test cycle distance (8.172 km)} \times k_{plug\text{-}in}$$