

Table of Contents	New Issue	<p>Does not have listed F.9 “Additional Provisions”. Adding this would change subsequent section numbering like:</p> <p>9. Additional Provisions 9-10. State-of-Charge Net Change Tolerances</p> <p>Also the entry below is not correct, there is only one section F.11 with calculations, not two sections. 10. Calculations – Exhaust Emissions for Off-Vehicle Charge Capable Hybrid Electric Vehicles</p> <p>11. Calculations - Equivalent All-Electric Range for Off-Vehicle Charge Capable Hybrid Electric Vehicles</p>
B.1 Definitions	Repeat comment	<p>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.</p> <p>However the language in these definitions require the manufacturer to repeat the extended soak <u>after each pair</u>.</p> <p>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</p>
B.1 Definitions	New Issue	<p>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</p>
B.1 Definitions	Repeat comment	<p>The “Charge-depleting net energy consumption” definition for Ecd should be AC energy only for a level playing field perspective. This would then include parasitic losses in the DC charger – like the consumer will see</p>
C.3.3 Zero Emission VMT PZEV Allowence	New Issue	<p>Clarification on which utility factor will be used from J2841. Recommend change to the last sentence of this section as follows:</p> <p>“The Fleet Utility Factor (UF) based on the charge depleting actual range (Rcda) shall be determined according to SAE J2841 March 2009.”</p>
E HEV Procedures	Repeat comment	<p>General comment – no 20° or 50°F testing guidance</p>

E.3.3 (b) Recording Requirements	Repeat comment	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.
E.3.3 (d) Recording Requirements	Repeat comment	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.
E6.2.1	New Issue	Sections refer to sampling particulates using filter method of primary plus back up. Current practice for this type of sampling has been to utilize single high efficiency filters for this sampling. This method was granted per an EPA Dear Manufacture letter (CCD-04-08 http://www.epa.gov/dis/display_file.jsp?docid=14262&flag=1) to utilize Heavy Duty regulations on Light Duty testing. Additionally those methods described in Part 1065 of the CFR should be allowed. We would prefer that these allowances be granted within the regulations prior to finalization. This will avoid further workload for all parties for later deviation or approval.
E.8.1.2.1.1 & 8.1.2.1.2 US06 Vehicle Preconditioning	New issue	<p>8.1.2.1.1 “Delete subparagraph (i), and replace with: If the hybrid electric vehicle is charge-sustaining over the US06, 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.”</p> <p>8.1.2.1.2 “Delete subparagraph (ii), and replace with: If the hybrid electric vehicle is charge-depleting over the US06, battery state-of-charge shall be set at the level recommended by the manufacturer for activating the auxiliary power unit when operating in highway driving conditions. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the US06 preconditioning cycle.”</p> <p>These paragraphs should not be deleted from the CFR preconditioning sequence of 86.132.00 (n) because the CFR provides guidance on warming up the vehicle between the last test element and the US06 test sequence, especially if this soak period is > 2 hours. This guidance will be needed with such a complex test sequence where delays may be encountered.</p>

E.8.3.2.1.1 & 8.3.2.1.2 SC03 Vehicle Preconditioning	New issue	<p>8.3.2.1.1 “Delete subparagraph (i), and replace with: If the hybrid electric vehicle is charge-sustaining over the SC03, 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 SC03 preconditioning cycle.”</p> <p>8.3.2.1.2 “Delete subparagraph (ii), and replace with: If the hybrid electric vehicle is charge-depleting over the SC03, battery state-of-charge shall be set at the level recommended by the manufacturer for activating the auxiliary power unit when operating in highway driving conditions. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 preconditioning cycle.”</p> <p>These paragraphs should not be deleted from the CFR preconditioning sequence of 86.132.00 (o) because the CFR provides guidance on warming up the vehicle between the last test element and the SC03 test sequence, especially if this soak period is > 2 hours. This guidance will be needed with such a complex test sequence where delays may be encountered.</p>
E.10 New section	Non executable & Repeat comment	<p>Additional Provisions, add the following clause</p> <ul style="list-style-type: none"> 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. <p>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</p>
F. PHEV Procedures	Repeat Comments	<p>General comments:</p> <ol style="list-style-type: none"> May need to raise the mileage limit on test vehicles due to the long test sequences (like CD range tests). Very complex test procedures and new vehicle technology. There will be unforeseen issues as we implement the test procedures and learn about PHEV’s. 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. Another suggestion would be for the regulations not to require bag emissions analysis during electric only modes (measure zero). 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 (b) Recording Requirements	Repeat Comment	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	Repeat Comment	“(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;” Delete “...or charge sustaining...” Reason: There is no requirement to measure energy from a charge sustaining test. This would require a full battery recharge after every charge sustaining test which was not illustrated in figure G2 (45 day notice) and is extremely burdensome to the test process
F. 3.1 (c) Recording Requirements	Repeat Comment	(c) Should record the AC wall energy while the charger is plugged in and it is recommended that the manufacturer stop charging the vehicle from the wall AC energy source within 3 hours once full charge is obtained
F. 3.1 (d) Recording Requirements	Repeat Comment	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	Repeat Comment	“(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” Delete “...or charge sustaining...” Reason: There is no requirement to measure energy from a charge sustaining test. This would require a full battery recharge after every charge sustaining test which was not illustrated in figure G2 (45 day notice) and is extremely burdensome to the test process
F. 3.1 (d) Recording Requirements	Repeat Comment	Should record the AC wall energy while the charger is plugged in and it is recommended that the manufacturer stop charging the vehicle from the wall AC energy source within 3 hours once full charge is obtained;

F. 3.2 Regenerative Braking	Non-executable & Repeat Comment	<p>“3.2 Regenerative braking. Regenerative braking systems... The driving schedule speed and time tolerances specified in F.3.1 or F.3.2 shall not be exceeded ...”</p> <p>Delete “F.3.1 or F.3.2” because there are no speed or time tolerances specified in either of these sections. This verbiage was copied from the HEV procedures where there was speed and time tolerances in the referenced sections.</p> <p>Should just say “in this section F” which would bring in the normal CFR tolerances</p>
F.5. UDDS	Non-executable & Repeat Comment	<p>“The sum of NMOG + NOx emissions shall constitute the worst case for the urban charge sustaining or charge depleting modes of operation and determine the operation mode for US06 and SC03 emission tests.”</p> <p>It appears that this sentence refers to the 20° and 50°F tests as specified in section F.8. Recommend deletion of “and determine the operation mode for US06 and SC03 emission tests”. Reasons are: (1) no CD US06 or CD SC03 emissions test procedures, and (2) contradicts specific language in F7.1, F.7.2, F.7.3 and F.7.4 requiring these tests to be run in charge sustaining mode.</p>
F.5.2.1 UDDS	Non-executable & Repeat Comment	<p>“If the energy required to charge the vehicle from urban charge sustaining operation to full charge is not equivalent (within ± 1% of the AC energy) to the energy required to charge the vehicle from highway charge sustaining operation to full charge, the vehicle must be recharged. If the energy required to charge the vehicle from urban charge sustaining operation to full charge is equivalent (within ± 1% of the AC energy) to the energy required to charge the vehicle from highway charge sustaining operation to full charge, the vehicle may be recharged.”</p> <p>This sentence should be deleted because it is not executable [requires knowledge of a future event (CD HWY test) and its associated data]. In addition it does not specify what voltage to recharge it to.</p> <p>Instead this language should be changed to require fully recharging the battery to determine the AC wall charge energy, which is needed for reporting purposes. Then depending on the next test sequence, the vehicle is either discharged for a CS test the next day or the full battery charge is maintained for a CD test the next day.</p>
F 5.2.1	New Issue	<p>Sections refer to sampling particulates using filter method of primary plus back up. Current practice for this type of sampling has been to utilize single high efficiency filters for this sampling. This method was granted per an EPA Dear Manufacture letter (CCD-04-08 http://www.epa.gov/dis/display_file.jsp?docid=14262&flag=1) to utilize Heavy Duty regulations on Light Duty testing. Additionally those methods described in Part 1065 of the CFR should be allowed. We would prefer that these allowances be granted within the regulations prior to finalization. This will avoid further workload for all parties for later deviation or approval.</p>

F. 5.4.3 UDDS-CD	Repeat Comment	<p>Add: After the Urban charge depleting range test is completed, recharge the battery (per 5.4.2) to full charge and record the AC energy required to do this. If the next test sequence does not require a full battery charge, discharge the battery to the manufacturer specified nominal SOC for CS operation, using good engineering judgment.</p>
F. 5.5.1 Calculations	Non-executable & Repeat Comment	<p>“n = number of hot start UDDSs in Charge Depleting operation”</p> <p>This is inconsistent with F.5.4.3 (i) and F.5.6.1 for the definition of “n”. Needs to be consistent as follows:</p> <p>F.5.6.1: “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. For this case (no charge depleting hot start cycle), the manufacturer may optionally add one additional hot start cycle for an n=2.”</p> <p><u>Important Note:</u> 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</p>
F.6 HFEDS	New issue	<p>“The third HFEDS of the Highway Charge Sustaining Test shall be used to calculate highway NOx emissions and must be within the SOC criterion in section F.10. As an option, the Highway Charge Sustaining Test may be performed with two HFEDS provided that the second HFEDS meets the SOC criterion in section F.10. In this case, the second HFEDS shall be used to calculate emissions.”</p> <p>Suggest changing this language to “At the manufacturers option”</p>
F.6 HFEDS	New issue	<p>Should use the same wording as section F.5 for choosing operation mode (i.e. performance, eco, etc.):</p> <p>“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.”</p>

F.6.2 HFEDS	Non-executable & Repeat Comment	<p>This section provides specific guidance on how to run either a CD or CS highway emissions test, but wording implies it <u>just applies</u> to the CS test sequence. Language does not differentiate the two test sequences. Also confusing terminology. Specifically:</p> <ol style="list-style-type: none">1. “Third HFEDS”, “HFEDS preconditioning cycle”, “HFEDS emission measurement cycle”, “HFEDS emission test, two highway emission tests”. It is unclear whether the preconditioning cycle is included or not in these counts. Is it 3 HFEDS total including the preconditioning cycle?2. If the answer to #1 above is 3 HFEDS cycles total, then this is inconsistent with all previous HEV test procedures which have 4 HFEDS cycles, 1 prep + 3 emissions. Why are PHEV’s being treated differently than HEV’s as far as the number of cycles allowed to achieve SOC? Should be the same3. 6.2.2.3 The paragraph “Three HFEDSs, separated by a 15 second key-on hot soak period...If the SOC criterion is not satisfied, the test shall be stopped, and sections F.6.2.2.2 and this section F.6.2.2.3 shall be repeated...” wording needs to be corrected because it just directs the reader to paragraphs F.6.2.2.2 and F.6.2.2.3 instead of the guidance past this point – F.6.2.2.4+. The paragraph is out of place in the test process, should be at the end.4. 6.2.2.8 gives guidance on when to end the multiple CS HFEDS test sequence, but is incorrect for a CD test sequence. <p>Language in this section 6.2 should be changed to clarify these issues</p>
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F.6.3.3 HFEDS - CD	Non-executable & Repeat Comment	<p>“If the energy required to charge the vehicle from highway charge sustaining operation to full charge is not equivalent (within $\pm 1\%$ of the AC energy) to the energy required to charge the vehicle from urban charge sustaining operation to full charge, repeat subparagraphs F.6.2.2 and F.6.2.3.”</p> <p>This sentence requires manufacturers to repeat a <u>HWY CS</u> test sequence (F.6.2.2 and F.6.2.3) if we fail the <u>HWY CD</u> test battery recharge test criteria? (Note, see comments above regarding the applicability of F.6.2.2 for HWY CD test sequences).</p> <p>This is burdensome and should be deleted. Replace with guidance on performing a full battery recharge w/o the 1% comparison criteria to the urban CD test sequence.</p> <p>Suggest: “After the highway charge depleting range test is completed, recharge the battery (per 6.3.2) to full charge and record the AC energy required to do this. If the next test sequence does not require a full battery charge, discharge the battery to the manufacturer specified nominal SOC for CS operation, using good engineering judgment.”</p>
F.6.3.4 (ii) HFEDS - CS	Non-executable & Repeat Comment	<p>Have the same concerns regarding the count and definition of HFEDS cycles as expressed in F.6.2 above.</p> <p>Also:</p> <ol style="list-style-type: none"> 1. Should state that the third HFEDS cycle is to be used for emissions compliance determination (NOx) 2. Should allow a fourth HFEDS cycle (includes prep) to be consistent with HEV regulations 3. “The vehicle must meet the SOC criterion in section F.10 for the third HFEDS. If the SOC criterion is not satisfied, the test shall be stopped, and sections F.6.3.2, F.6.3.3, and this section F.6.3.4 shall be repeated.” <p>This states that if one fails to achieve the $\pm 1\%$ SOC for the <u>HWY CS</u> test sequence, that the manufacturer must repeat the <u>HWY CD</u> test sequence. This is extremely burdensome and should be deleted. Instead allow a 4th HFEDS cycle (like HEV procedures) to achieve the $\pm 1\%$ SOC.</p>
F.7 SFTP	Non-executable & New Issue	<p>“Hybrid electric vehicles with more than one mode of operation for a given charge depleting or charge sustaining test cycle must be tested in the mode(s) which represents maximum operation of the auxiliary power unit. Confirmatory testing may also be performed in any mode of operation to ensure compliance with emission standards.”</p> <p>This charge depleting clause contradicts specific guidance in F.7.1 & F.7.2 (US06) and F.7.3 (SC03) to run both of</p>

		<p>these tests in charge sustaining mode only. This language appears focused to HEV's, not PHEV's.</p> <p>Also there are no CD emissions test procedures / equations / algorithms for US06 or SC03 test sequences. Adding these would be extremely burdensome to manufacturers on an already lengthy test process. Recommend changing this to CS modes of operation only since this should represent maximum APU operation with most PHEV vehicles.</p>
F. 7.1.2.1.1 US06 Vehicle Preconditioning	New issue	<p>"Delete subparagraphs (i) and (ii)"</p> <p>These paragraphs should not be deleted from the CFR preconditioning sequence of 86.132.00 (n) because the CFR provides guidance on warming up the vehicle between the last test element and the US06 test sequence, especially if this soak period is > 2 hours. This guidance will be needed with such a complex test sequence where delays may be encountered.</p>
F.7.2.1 US06	New issue	<p>F.7.4.1: ... "A preconditioning cycle shall not be used for emission calculations. The SC03 cycle that meets the SOC criteria shall be used to calculate emissions."</p> <p>This same clause should be added to F.7.2.1 (US06), except "US06" being substituted for SC03</p>
F.7.3.2.1.1 SC03 Vehicle Preconditioning	New issue	<p>"Delete subparagraphs (i) and (ii)"</p> <p>These paragraphs should not be deleted from the CFR preconditioning sequence of 86.132.00 (o) because the CFR provides guidance on warming up the vehicle between the last test element and the SC03 test sequence, especially if this soak period is > 2 hours. This guidance will be needed with such a complex test sequence where delays may be encountered.</p>
F.7.4.4.1 (ii) & (iii) SC03	New issue	<p>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.</p>
F.8 20 & 50 °F UDDS	Non-executable & Repeat comment	<p>No general guidance on test process like temperature to refuel at or recharge at.</p>
F. 8.3 20 & 50 °F UDDS - CD	Non-executable & Repeat comment	<p>"If measurement of worst case emissions requires the urban charge depleting range test to be performed, the vehicle shall be preconditioned according to section F.5.1 and fully charged..."</p> <p>Delete "...according to section F.5.1..." because the vehicles must be preconditioned at the same temperature</p>

		they will be tested at (CFR requirement for 20°F cold testing). This is also consistent with the deletion of this phrase in F.8.2.
F.9 Additional Provisions	Non- executable & Repeat Comments	<p>To improve testing efficiency, and feasibility, suggest several Additional Provisions be provided as follows:</p> <ul style="list-style-type: none"> • (Non-executable) 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. <p>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</p> <ul style="list-style-type: none"> • Allow manufacturers not to collect emissions samples for those drive cycles where the vehicle starts the test sequence in a non-APU firing mode (i.e., battery only operation), and continues to stay in this non-APU firing mode (again, battery only operation) for the duration of whole drive cycles. During the actual test, the manufacturer must validate the engine did not fire for these cycles. • Allow manufactures 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. • (Non-executable) Because of the longer testing distances involved with PHEV testing, allow manufacturer to refuel the vehicle if they have determined there is insufficient fuel to run the next test sequence (example, before CD HWY range test). In this case perform a 40% fuel fill with 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). <p>Also since there are several testing options provided for the manufacturer, provide that</p> <ul style="list-style-type: none"> • ARB will test the vehicles the same manner as the manufacturer tested it with respect to options selected.
F. 11.3 Calculations	Non- executable & Repeat Comments	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 NO _x 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. 11.7 Calculations	Repeat Comments	<p>(two places) "Ecd = Total DC or AC electrical energy used to fully charge the vehicle battery from an external power source after the charge depleting test has been completed"</p> <p>Delete reference to DC electrical energy. Ecd should be AC (wall) charge energy only which would include charger efficiencies, and allow for level playing field.</p>
G Test Sequence Figure	New issue	<p>Missing, can't comment on ARB proposed test sequence.</p> <p><u>Suggested Alliance Test Sequence (high level, exhaust test sequence only)</u></p> <ol style="list-style-type: none"> 1. Preconditioning (fuel drain & fill, 6 hour soak, Prep Cycle, 2nd fuel drain & fill. 12-36 hours cold soak w/ canister butane load & full battery charge) 2. CD UDDS Test 3. Cold Soak (12-36 hour) + full recharge 4. Cold CD HWY Test 5. Cold Soak (12-36 hours) + full recharge 6. CD US06 Range Test (optional) <ol style="list-style-type: none"> a. If CD US06 test is run, run prep cycle and cold soak 12-36 hours b. If US06 is not run, discharge battery during step 5 above 7. Cold CS HFEDS Test 8. Preconditioning (fuel drain & fill, 12-36 hours cold soak w/ canister butane load) 9. CS UDDS Test 10. CS US06 Test 11. CS SC03 Test 12. Prep Cycle @ 50°F, Cold Soak @ 50°F (full charge if CD test is next) 13. 50°F CS <u>or</u> CD UDDS Test 14. 75°F cold weather fuel change, 20°F Cold Soak, 20° Prep Cycle, 20°F Cold soak (full charge if CD test is next) 15. 20°F CS <u>or</u> CD UDDS Test <p>(Note additional preps as needed & need some flexibility in sequence for optimization purposes)</p>
H SOC Figures	New issue	Missing, can't comment