

Coast-down and Chassis Dynamometer Testing Events: The Final Frontier

Michigan International Speedway

EPA National Vehicle and Fuel Emissions Laboratory

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Coast-down Essential for Accurate Dyno Testing

- Coast-down test procedure necessary to set chassis dynamometer road load to reflect actual vehicle characteristics
 - Aerodynamic drag
 - Tire rolling resistance
 - Wheel bearing and brake drag
 - Axle and transmission spin loss
 - Inertia of drivetrain elements
- Performed immediately after Final Stage at MIS
- Vehicles impounded at the conclusion of MIS events

Coast-down Test Procedure

- Vehicles removed from impound according to schedule – likely two vehicles tested at once
- Vehicles, driver weighed; vehicles instrumented
- Vehicles driven to 70 MPH on lowest lane of oval track
- Transition to track apron on straight; shift to neutral
- Coast down from 70 to 10 MPH
- Record data; use to derive Polynomial Force Coefficient from velocity, time and mass
- Vehicles returned to impound

Chassis Dyno Testing at EPA, ANL

- Testing performed in August, 2010
- Top 10 vehicles in each class go on to dyno testing
- Team schedule released by end of Final Stage
- Alternative class at EPA; Mainstream at ANL
- Teams required to be in attendance for testing
- Non-U.S. citizens **must** complete security questionnaires 6-8 weeks ahead of testing
- Vehicles driven by professional drivers
- All controls, systems must be automatic
- Preparation and testing will take 3 – 4 days if all goes well
- Teams take their vehicles with them after testing

Inspection and Test Preparation

- Vehicles will undergo safety inspection
- Reminder – all lean burn engines must have a working particulate filter
- Fuel will be drained and replaced with certification fuel where appropriate
- First dynamometer runs used for road load matching, initial runs for driver familiarization, temperature stabilization
- Run HWFET & UDDS cycles and then vehicles placed in “cold soak” for temperature equalization for 12 hours
- Fuel refilled and NEMA 14-50 compatible charging provided during cold soak
- Preparation same for all vehicles

Emissions and MPGe Determined on Dyno

- Tier 2 Bin 8 emissions from cold start must be demonstrated over FTP cycle to win Grand Prize (when applicable)
- MPGe also measured; different procedures for conventional vehicles, HEVs, PHEVs and BEVs
- Range also verified



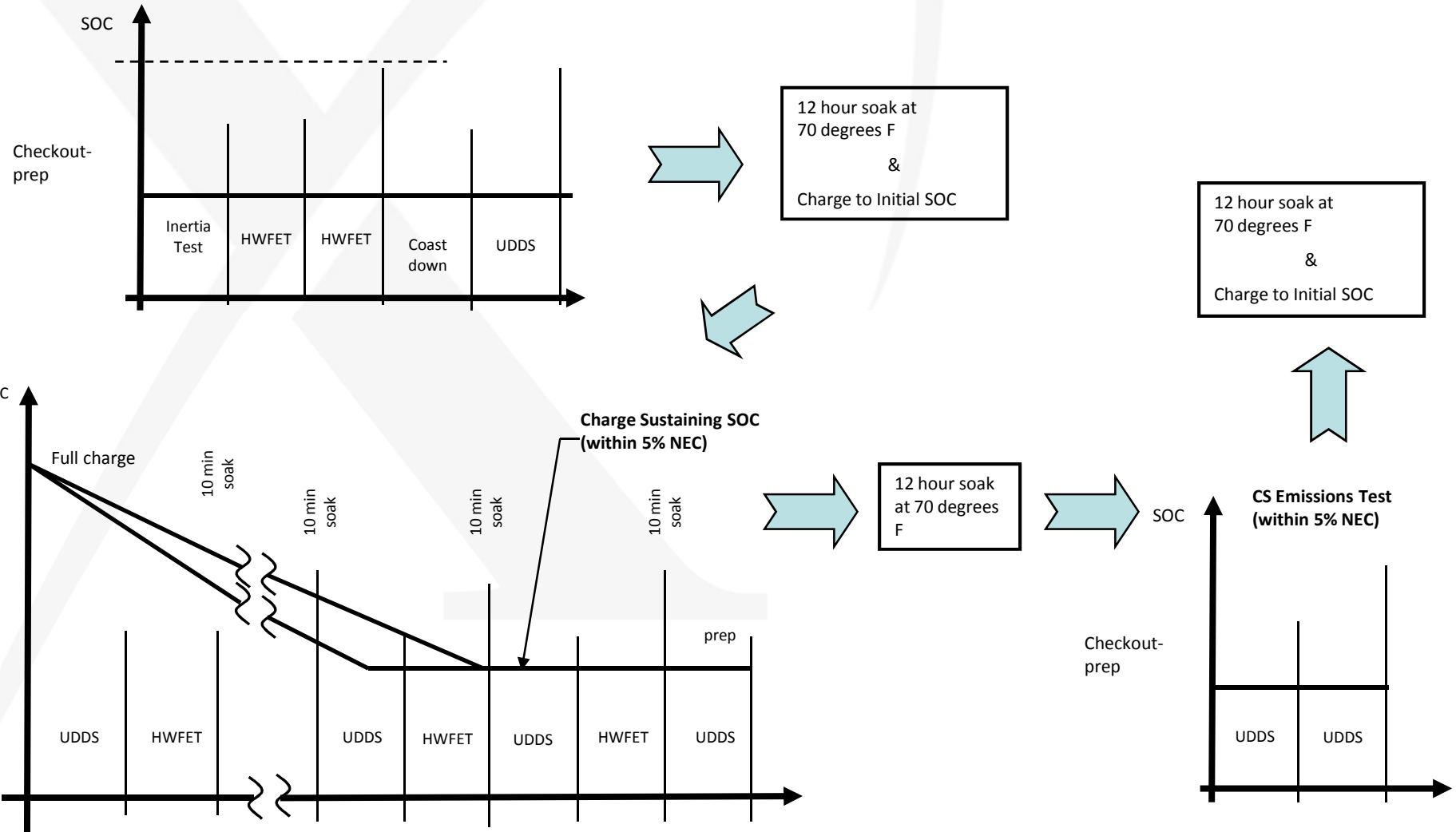
Dyno Test Procedures by Vehicle Type

- DAS used for ESS activity tracking
- Conventional vehicles do alternating UDDS and HWFET cycles – total of 8 cycles
- Charge-sustaining HEVs do alternating UDDS and HWFET – total of 8 cycles – with ESS system monitoring through DAS
- Test procedure may be altered if charge-depletion detected
- Changes in HEV ESS state of charge will be factored into results
- BEVs will be tested using alternating UDDS and HWFET cycles – total of 8 cycles – changes in ESS SOC will be used to compute efficiency and range result

Dyno Test Procedure for PHEVs

- PHEVs will be tested using alternating UDDS and HWFET cycles until charge-sustaining operation achieved
- A pair of UDDS and HWFET will be conducted to determine charge-sustaining behavior is achieved
- A 12 hour soak will done to restore the vehicle to a “cold state”— no recharging done
- Emissions will be measured over two UDDS cycles in a charge sustaining mode
- A final 12 hour soak and ESS recharge will be done
- Energy efficiency will be calculated by weighting the charge-depleting efficiency and the charge sustaining efficiency over a 200 mile trip for Mainstream Class, 100 mile trip for Alternative Class

Dyno Test Procedure for PHEVs



Dyno Test Procedure Stressful

- Teams must be in attendance to help with testing, fix problems
- “Three tries and you are done”
- Cooling of critical systems essential – do not overlook small components like DC/DC converters
- Pre-competition dyno testing advisable
- Attachment points also important – look for strong locations on your vehicle to tie down to dyno
- Vehicle operations need to be simple, automatic – do not expect the driver to do too much

After Dyno Testing, Competition Phase Over

- Chassis dynamometer testing is the last stage of the competition
- Tier 2 Bin 8 emissions from cold start must be demonstrated over FTP cycle to win Grand Prize (when applicable)
- Energy efficiencies from dyno test data averaged with on-road results to determine Grand Prize winners
- Data on their vehicle released to teams subject to strict embargo
- Teams take their vehicles with them after testing finished
- The three winners will be honored in Washington, DC and presented with their prize purse at a major celebration event