

Integrating GTR No. 22 into the EPA light- and medium-duty multipollutant proposal

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Reading material

- Preamble and regulatory text:
 - <https://www.epa.gov/system/files/documents/2023-04/lmdv-multi-pollutant-emissions-my-2027-nprm-2023-04.pdf>
 - III.F.2: Battery Durability
 - III.F.3: Battery and Vehicle Component Warranty
 - III.F.4.ii: Definition of Monitor Family
 - III.F.4.iii: Definition of Battery Durability Family
 - PART 86—CONTROL OF EMISSIONS FROM NEW AND IN-USE HIGHWAY VEHICLES AND ENGINES
 - PART 600—FUEL ECONOMY AND GREENHOUSE GAS EXHAUST EMISSIONS OF MOTOR VEHICLES
 - PART 1036— CONTROL OF EMISSIONS FROM NEW AND IN-USE HEAVY-DUTY HIGHWAY ENGINES
- Draft Regulatory Impact Analysis (DRIA):
 - <https://www.epa.gov/system/files/documents/2023-04/420d23003.pdf>
 - DRIA 1.3: Development of the proposed battery durability standards
- Please be aware that EPA nomenclature adopted for this proposal is different from UNECE:
 - **BEV** = “battery electric vehicle” (same as UN “PEV” or “pure electric vehicle”)
 - **PHEV** = “plug-in hybrid electric vehicle” (same as OVC-HEV)
 - **PEV** = “plug-in electric vehicle” (includes **BEV** and **PHEV**)

Integration of the GTR

- The requirements and general framework of the proposed battery durability program broadly parallel the GTR in terms of:
 - Program structure
 - Minimum performance requirements
 - Monitoring and compliance requirements
 - Statistical methods and metrics
 - Criteria for monitor and durability families
- The April 14, 2022 version of GTR No. 22 is incorporated by reference
- With specific differences outlined in the regulation
 - Some naming conventions and procedural changes were required to adapt the GTR to EPA-based testing and compliance demonstration
 - Some specific provisions were modified or specified in greater detail (for example, not requiring an SOCR monitor, and specific schedule for Type A testing, among others)

Regulatory text affected

- § 85.2103 Emission performance warranty.
- § 85.2104 Owners' compliance with instructions for proper maintenance and use.
- § 86.1815 Battery-related requirements for electric vehicles and plug-in hybrid electric vehicles.
- § 86.1829-15 Durability and emission testing requirements; waivers.
- § 86.1839-01 Carryover of certification and battery monitoring data.
- § 86.1844-01 Information requirements: Application for certification and submittal of information upon request.
- § 86.1845-04 Manufacturer in-use verification testing requirements.
- § 86.1847-01 Manufacturer in-use verification and in-use confirmatory testing; submittal of information and maintenance of records.
- § 86.1848-10 Compliance with emission standards for the purpose of certification.
- § 600.116-12 Special procedures related to electric vehicles and hybrid electric vehicles.
- § 1036.635 Certification requirements for high-GCWR medium-duty vehicles.

Statutory authority

- EPA has historically required manufacturers to demonstrate the durability of their engines and emission control systems under our Clean Air Act (CAA) section 206 authority
- Such standards are applicable to vehicles and engines for their full useful life
- EPA has also specified minimum warranty requirements for ICE emission control components
- Powertrain electrification is an emissions control technology
 - GHG credits, which can be traded with ICE vehicles and among manufacturers, are based on an assumed lifetime VMT being achieved by the vehicle
 - In order for the environmental benefits that are credited to PEVs to be fully realized under this structure, it is important that their potential to achieve a similar mileage during their lifetime be comparable to that of ICE vehicles, and this depends in part on the life of the battery.
- HEV and PHEV manufacturers are currently required to account for potential battery degradation that could result in an increase in CO2 emissions
- In addition, vehicle manufacturers are required to demonstrate compliance with criteria pollutant standards using fully aged emission control components that represent expected degradation during useful life
- EPA is applying these well-established precedents to the durability of BEV and PHEV batteries

Elements included in the proposal

- Battery durability
 - User-readable SOCE monitor
 - Monitor accuracy (Part A)
 - Minimum Performance Requirement or MPR (Part B)
 - Monitor and battery durability families
- Battery and vehicle component warranty
 - Not part of GTR No. 22, but promotes similar goals
 - Analogous to existing warranty requirement for ICE emission control
- An additional calculation was proposed for the PHEV test procedure to provide a UBE value for PHEVs

Battery durability

Proposed Requirement	Light-duty BEVs and PHEVs	Class 2b and 3 BEVs and PHEVs
Battery SOCE monitor	Yes	Yes
Monitor accuracy requirement	Yes	Yes
Minimum Performance Requirement	Yes	No

Minimum Performance Requirement	Light-duty BEVs and PHEVs	Class 2b and 3 BEVs and PHEVs
5 years or 62,000 miles	80 percent SOCE	N/A
8 years or 100,000 miles	70 percent SOCE	N/A

Battery and vehicle component warranty

- New warranty requirement for BEV and PHEV batteries and associated electric powertrain components (e.g., electric machines, inverters, and similar key electric powertrain components)
- Light-duty:
 - EPA is proposing to designate the high-voltage battery and associated electric powertrain components as “specified major emission control components” under CAA section 207(i)(2)
 - This means that they are subject to a warranty period of 8 years or 80,000 miles
- Class 2b and 3:
 - EPA is proposing to specify a warranty period for the high-voltage battery and associated electric powertrain components under CAA section 207(i)(1)
 - 8 years or 80,000 miles

Test procedures

- BEVs:
 - Light-duty and Class 2b and 3 would be tested according to the EPA multi-cycle test (MCT) to determine the vehicle's UBE and range
- PHEVs:
 - Light-duty and Class 2b and 3 would be tested according to the single cycle UDDS and HFET test to determine the vehicle's charge depleting UBE and range
- New calculation for the PHEV charge depletion test:
 - Measure the DC discharge energy by measuring the change in state-of-charge in ampere-hours over each cycle and the average voltage of each cycle as required by SAE J1711.
 - The average voltage can be either an average of continuous voltage measurements over the entire cycle, or the average voltage measured prior to the start of the cycle and at the conclusion of the cycle as defined in SAE J1711.
 - The measured DC discharge energy in watt-hours for each cycle would be determined by multiplying the average cycle voltage by the cycle's change in ampere-hours.
 - The DC discharge energy is added for all the charge depleting cycles including the transition cycles used to determine the charge depleting cycle range, R_{cdc} as defined in SAE J1711.
- Class 2b and 3 BEVs and PHEVs would be tested at adjusted loaded vehicle weight (ALVW), consistent with the testing required for measuring criteria and GHG emissions.

SOCR monitor not included

- The proposal does not include a requirement for an SOCR monitor
- EPA recognizes that GTR No. 22 and the California durability program does include SOCR monitoring
- We also recognize that GTR No. 22 and California will result in data being collected that could inform a future rulemaking
- We are taking comment on inclusion of an SOCR monitor
- We are also taking comment on including “reserve capacity” information in calculation of SOCE, as done by California

New testing requirements

- Currently, only light-duty vehicle manufacturers (not Class 2b and 3) are required to perform range testing on BEVs and PHEVs
 - These results are used only to inform the fuel economy/range label for a vehicle model, and are not for vehicle certification
 - Not all variations need to be tested to determine a fuel economy/range label value (meaning that some vehicles in a battery durability family may not have a UBE test result already available from label testing)
 - Further, the PHEV test does not result in a UBE determination at all
- Manufacturers would perform new testing to:
 - Determine the UBE of light-duty vehicles that might not otherwise have been tested for the label requirement
 - Determine the UBE of Class 2b/3 BEVs and PHEVs
 - Perform Part A in-use vehicle testing for each monitor family at 1 year, 3 years, and 5 years

Monitor and durability families

- Monitor and durability families use the same criteria as GTR No. 22
- Durability family renamed “Battery durability family”
 - EPA already uses “durability family” for ICE emissions durability
 - “Battery durability family” replaces “durability family” for BEVs

Specific detail added: Part A

- How often is Part A testing performed?
 - At 1 year/10K miles, 3 years/30K miles, and 5 years/50K miles - similar to existing in-use structure
 - **Low-mileage testing:** within 12 months of the end of production of that monitor family for that model year.
 - **Intermediate-mileage testing:** within 3 years of the end of production of that monitor family for that model year.
 - **High-mileage testing:** start the test program within 4 years of the end of production of the monitor family and complete the test program within 5 years of the end of production of the monitor family.
- Carryover concept to reduce Part A test burden
 - If no change in the vehicle model has occurred, it is not required to repeat each phase of tests for each model year
 - “In lieu of testing electric vehicles or plug-in hybrid electric vehicles for monitor accuracy under § 86.1822-01(a) and submitting the test data, a manufacturer may rely on previously conducted testing on a similar vehicle for which such test data have previously been submitted to demonstrate compliance with monitor accuracy requirements. For vehicles to be eligible for this provision, they must have designs for battery monitoring that are identical in all material respects to the vehicles tested under § 86.1845-04(g).”
- What happens if a monitor family fails Part A?
 - Recall the vehicles in the failing monitor family to bring the SOCE monitor into compliance, as demonstrated by passing the Part A statistical test with vehicles using the repaired monitor.
 - “If vehicles do not comply with monitor accuracy requirements under this section, the recall provisions in 40 CFR part 85, subpart S, apply for each affected monitor family.”
 - “If a monitor family fails to meet accuracy requirements, repeat the testing under § 86.1845-04(g) as soon as practicable.”

Specific detail added: Part B

- For Part B, what constitutes a statistically adequate sample?
 - “Randomly select test vehicles from at least 10 different U.S. states or territories, with no more than 20 percent of selected vehicles coming from any one state or territory.”
 - “Select vehicles to represent a wide range of climate conditions and operating characteristics.”
- What happens if battery durability family fails Part B?
 - Manufacturers would have to adjust their credit balance to remove compliance credits previously earned by those vehicles
 - “If vehicles do not comply with battery durability requirements under this section, the manufacturer must adjust all credit balances to account for the nonconformity (see § 86.1850-01).”

Thank you