



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL VEHICLE AND FUEL EMISSIONS LABORATORY
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OFFICE OF
AIR AND RADIATION

CD-2022-12 (LDT, LDV)

July 25, 2022

SUBJECT: EPA interpretation of CFR Sections 86.128-79 and 1066.415 for Chassis-Certified MPGe and Range Testing for Battery Electric Vehicles (BEV)

Dear Manufacturer:

The purpose of this letter is to revise EPA testing policy for battery electric vehicles (BEV) with multiple driver mode selections. These revisions are intended to ensure all label data is generated in a consistent manner that will better reflect real-world performance, and to reduce testing burden for the industry. Enclosure 1 includes the overview, background, discussion, and definitions relating to this revised policy.

This new policy is applicable to new testing for 2024 model year and later vehicles. It may be applied to new testing for 2023 model year vehicles. Vehicles utilizing carry-over data may continue to use data generated under previous policy for as long as the tests are valid (i.e., no changes to the vehicle requiring new MPGe/range testing are required). Manufacturers who add a new configuration to a test group for 2024 and later must present new test results using this policy, but existing data can still be used if it is representative.

If you have any questions about this letter, please contact your certification engineer, or Dan Cullen by e-mail at cullen.daniel@epa.gov, or by telephone at 734-214-4233.

Sincerely,

A handwritten signature in black ink, appearing to read "Byron Bunker".

Byron Bunker, Director
Compliance Division
Office of Transportation and Air Quality

Enclosure

Enclosure to CD-2022-12

Overview

The real-world performance of a modern vehicle can be changed by the operator's direct or indirect choices using touch screens, switches, buttons, menu selections, and adaptive features. Similarly, these same choices can affect vehicle performance on official certification tests that are used to determine MPGe and range. The regulations at 40 CFR 86.128-79 and 1066.415 describe how light-duty vehicles (LDV), medium-duty passenger vehicles (MDPV), and chassis certified heavy-duty vehicles (HDV) should be operated on a chassis dynamometer during a chassis rolls test to determine MPGe and range. This document seeks to clarify the EPA's interpretation of these regulations. This document applies to testing to meet the requirements of §600.

This document clarifies EPA interpretations that apply to Battery Electric Vehicles (BEV) only. Manufacturers of vehicles with other powertrains should contact their certification engineer for specific guidance for their product(s). The contents of this document do not have the force and effect of law and are not meant to bind the public in any way. This document is intended only to provide clarity to the public regarding existing requirements under the law or agency policies. This interpretation supersedes previous select-shift and multimode transmission guidance, **for BEV only**, provided in EPA guidance letters CISD-09-19 "Policy Revisions for Testing Vehicles Equipped with Select-Shift Transmissions, Multimode Transmissions and Shift Indicator Lights (SILs)" CCD-02-10 "Errata Correction to Dear Manufacturer Letter CCD-01-25 issued December 17, 2001: Policy Revisions to Fuel Economy Testing of Vehicles Equipped with Select-Shift Automatic Transmissions," dated July 12, 2002; CCD-01-025R, "Policy Revisions to Fuel Economy Testing of Vehicles Equipped with Select-Shift Automatic Transmissions," dated December 17, 2001 and revised July 10, 2002; and CD-87-01, "Current Policy on Driver-Selectable Devices," dated January 23, 1987.

Background and Discussion

Both the regulations in 40 CFR Part 86 and 40 CFR Part 1066 require the vehicle to be operated per the manufacturer's instructions with the caveat that these instructions be representative of real-world performance and reasonable. The EPA recognizes that modern vehicles have a multitude of driver selections and driver-influenced selections that can influence vehicle operation on a chassis test. The number of possible selections increases with each model year, and each added feature. Furthermore, due to the complexity, it is unclear that all drivers read, understand and follow the instructions in the owner's manual. Some vehicles may have more than 100 unique drive modes. Because of this increased complexity, the EPA believes that the drive mode that the manufacturer programs the vehicle to be in during real-world operation is very important. The drive mode that is active when the key is turned on is called the default drive mode (defined below) and this is the mode that will be selected at the time vehicle is started unless the operator actively makes a different selection. EPA interprets the following language as meaning that vehicles should be operated in default mode for official testing.

From §86.128-79, "...Such recommendations are representative of what may reasonably be expected to be followed by the ultimate purchaser under in-use conditions"

From §1066.415, "...operate the vehicle according to the recommendations in the owner's manual, unless those recommendations are unrepresentative of what may reasonably be expected for in-use operation"

EPA expects that the manufacturer's published instructions to the vehicle operator match the default drive mode if one exists.

A vehicle with a single default drive mode may be tested for MPGe and range in that mode. If a vehicle has drive mode effecting features that allow the default drive mode to be changed from drive to drive, then it is not considered to have a single default drive mode. If a single default drive mode does not exist, the manufacturer must test for range and MPGe in one of two methods:

1. Determine the best-case and worst-case latching modes for range and MPGe. Test in both modes and average the results.
2. Determine the worst-case latching mode for range and MPGe and test in that mode only.

It is important to note that the drive selector (commonly called a shift lever or shifter in a conventional ICE powered vehicle) of the vehicle must be manually set each time the vehicle is driven. Therefore, this drive mode effecting feature is unique because it cannot be programmed to return to the same selection for every drive. If a vehicle is equipped with a drive selector that can activate multiple drive modes, the manufacturer should provide the end user instructions on which mode to use. For vehicles with multiple drive modes available by drive selector choices, the vehicle will only be considered to have a single drive mode (and thus be tested in this mode) if the manufacturer provides direction to use a single drive selector choice. If the manufacturer does not provide instructions to the customer on how to set the drive mode, or if they tell the customer that multiple mode works equally well, then the vehicle will not be considered to have a single default drive mode, and the manufacturer must follow the process outlined above to determine the drive mode the vehicle should be tested in to determine MPGe and range.

Additionally:

1. Because the EPA interprets the "reasonable" expectation in the regulations to be the factory drive mode, barring **substantial evidence** that the vehicle will be driven in another mode, we will determine the official test data for the vehicle in the factory drive mode. The vehicle will be left in the factory drive mode provided that the owner's manual and other information do not instruct the driver to use other modes for normal use. "Other information" may include written manuals, letters, articles as well as electronic information from the manufacturer or the manufacturer's proxy published on any website, and instructions provided by the manufacturer's employees or proxies for the manufacturer (such as customer service representatives). If the "other information" conflicts with the default drive mode, the EPA may test in both modes and average (using appropriate calculations) the fuel economy/MPGe and range results.

2. Vehicles with a “soft latching” mode as defined below will be tested in the factory drive mode.
3. If the manufacturer has data demonstrating that all latching modes yield equivalent MPGe and range, the EPA may approve testing in a single mode. This must be requested before certification. As state previously, if multiple modes latch, the manufacturer, to reduce test burden, may opt to perform MPGe testing in the worst-case latched mode only. The prohibition of defeat devices in §86.1809-12 always applies.
4. Drive Modes that include activation of low range, or include the locking of vehicle differentials are intrinsically not considered practical street driving modes, and therefore do not need to be considered as testable drive modes even if they latch. Autonomous drive modes that limit vehicle speed below speeds or accelerations found on the MCT test also do not need to be considered as testable drive modes even if they latch. Therefore, the EPA will not conduct official testing in any of these modes. The prohibition of defeat devices in §86.1809-12 always applies.
5. For BEV’s with multi-speed transmissions, based on the regulatory provisions of 40 CFR 86.128-79 and 40 CFR 1066.415(e), if the vehicle does not latch in Select Shift Transmission (SST) mode, or the manufacturer does not instruct the owner to operate the vehicle in this mode normally, then the manufacturer does not need to present official test data for the vehicle in this mode for the fuel economy label. The manufacturer also does not need to determine a shift schedule for this mode. The prohibition of defeat devices in §86.1809-12 always applies.
6. The California Air Resources Board (CARB) may require different testing and/or drive mode usage for specific California requirements related to BEV’s. Manufacturers who wish to receive a CARB EO and CARB specific credits should consult with CARB regarding additional test requirements.

Definitions

Default Drive Mode (also called Default Mode) – This is the drive mode that the vehicle is in when the key is turned on (or equivalent functionality of a key such as button press, or activation by the presence of key cards, phones, fobs, or other devices). For a vehicle that does not have latch features, the default drive mode is the same as the factory drive mode. If a vehicle has latching features, it can have multiple default drive modes, and they can change from drive to drive.

Drive Mode Effecting Feature – A drive mode effecting feature is a feature of the vehicle (which can be standard equipment or optional equipment) which is controlled by the operator of the vehicle and that has the primary purpose of modifying the vehicle’s driveability. Examples include drive mode switches, shift actuator positions, ride height adjustments, “Eco,” “Range,” “Sport,” “Tow/Haul” or “Track” buttons, selectable regeneration levels, selectable pedal to motor torque request transfer function maps, and other buttons, or menu items. Primary vehicle controls (the accelerator, brakes, steering) are not drive mode effecting features. Transfer case selectors are drive mode effecting features. Transmission selectors which can change the shift map (transmission shift points at a constant pedal position) or other characteristics of the vehicle that affect MPGe and range are drive mode effecting features. Transmission selectors which only control drive

direction, or “range select” (limit or block gears), without driving characteristics of the vehicle are not drive mode effecting features. Vehicle features which are controlled by the operator of the vehicle and have a different primary purpose are not considered drive mode effecting features. Examples of this include headlamp switches, primary HVAC controls, audio controls, and stability control defeats. **The EPA considers tire pressure to be a drive mode effecting feature, even on vehicles where tire pressure must be set manually. Please contact your certification engineer before or during the certification preview when new features that may fall into this definition are to be included in a new model.**

Driver Selectable Mode (also called Drive Mode) – A driver selectable mode, or drive mode, is a unique collection of “drive mode effecting features.” If there is no method for the operator to adjust vehicle settings (including adaptive or artificial intelligence [AI] features), the vehicle is not considered to have multiple drive modes. A particular drive mode may include: the shift map, the pedal to motor torque request transfer function, climate control operation inhibitions (including compressor activation reductions, seat and steering wheel heating and cooling), suspension tuning, ride height, traction/stability control system function, transfer case operation, power steering feel, regenerative braking level, or any other driver selectable features that may change the way the vehicle drives. Knobs, buttons, switches, levers, or menu selections are used to change a drive mode. Each combination of settings constitutes a drive mode. For example, if there are three different controls, each with three possible unique (mutually exclusive) settings, that vehicle would have 27 different Driver Selectable Modes.

Drive Selector – This is the object by which the user selects forward motion, reverse motion, or park. This is typically a lever or a knob, but can be a series of buttons, or other method of motion direction selection. In a conventional ICE vehicle, this is the transmission selector (commonly called a “shifter”).

Factory Drive Mode – This is the drive mode that the vehicle is in when it is delivered to the ultimate consumer. The Driver, or vehicle algorithms that learn or adapt to driver actions would need to take some action to move the vehicle from this drive mode using a button, menu, toggle, wheel, or shift lever input in order to activate a different drive mode.

Latching – features where the driver’s selection of drive mode effecting features is saved across a key cycle. A vehicle that always returns to a single default drive mode will not “latch” to a drive mode that is not the factory drive mode. For example, a vehicle with a latching sport mode would, once the user selects sport mode, restart in sport mode after being parked overnight. Vehicle features that are enabled by recognition of a particular driver (sometime called “Smart Key,” “Teen Key,” or “My Key,”) also qualify as latching. For example, if the vehicle has multiple key fobs, and each fob can be programmed to activate different drive modes or activate select-shift mode whenever the particular fob operates the vehicle, that is considered latching. HVAC control settings that only affect climate control operation are not considered latching drive mode effecting features.

Range Select Transmission - A transmission designed with driver-controllable gear shift capability allows the operator to “limit” the highest gear in which the vehicle may shift to. For example, a range select transmission that has five total gears might allow the operator to select “3.” In this case the transmission would shift based on programming between gears 1, 2, and three, but would not shift above gear 3. Vehicles which shift to a higher gear for engine protection (over-rev) even when the operator selects a lower gear can still be considered “range select.” In a range select transmission, putting the selector in a particular gear does not lock the transmission in that gear, it simply limits the range of gear choices. Transmissions where the vehicle is locked in a particular gear based on operator input are considered “Select-Shift” as defined below.

Soft Latch – feature where the driver’s selection of a drive mode is saved across a key cycle in limited circumstances. This may be enabled by a timer, or the detection of a trailer, or by other means. For example, a vehicle with a soft latch when placed in tow-haul mode would restart in tow haul mode after a 10-minute stop for fuel but would restart in factory drive mode when parked overnight or at work for the day. Features that rely on an engine-off time for deactivation will be considered “soft latch” only if the timer is limited to 240 minutes unless the manufacturer gets prior approval from the EPA. The EPA would need compelling evidence that such long timer would be in the interest of vehicle performance or safety before approval. Other methods of soft latching should be discussed with the EPA prior to application for certification.

Select-Shift Transmission - A transmission designed with driver-controllable gear shift capability which permits shifting in a manner like a conventional manual transmission. These transmissions are known by a variety of names, but for purposes of this letter, EPA will call these automatic transmissions "select-shift" transmissions (SST). In general, select shift transmissions lock the vehicle in the specific gear set by the operator. Vehicles that override operator inputs and automatically down shift at low speeds (often called coastdown speeds), are still considered select-shift. Also, transmissions that override operator input and upshift automatically at the redline to protect the engine from overspeed are still considered select-shift transmissions. A vehicle with a continuously variable transmissions (CVTs) may also be considered a select shift transmission if there are operator selectable simulated gear steps in transmissions in order to provide a sportier, or more controlled feeling for the operator.