

EPA Decision Document:

Off-Cycle Credits for Hyundai Motor
Group - Pulse Width Modulated HVAC
Brushless Motor Power Controller
Technology

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Compliance Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

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I. Introduction

EPA's light-duty vehicle greenhouse gas (GHG) rules include opportunities for manufacturers to generate CO₂ credits for technologies that provide CO₂ reductions not captured by the 2-cycle emissions test. There are three pathways by which manufacturers can generate off-cycle credits: (1) a pre-determined "menu" of technologies and credits that is available for 2014 and later model years, (2) a testing based option, and (3) an alternative methodology that includes opportunity for public comment. These are described in more detail in Section II.

Pursuant to those rules, Hyundai Motor Group (Hyundai) submitted applications requesting off-cycle credits for a pulse width modulated (PWM) HVAC brushless motor (BLM) power controller technology, which improves the efficiency of the HVAC system. The application covers 2020 and later model year vehicles.

This technology and methodology for demonstrating the effectiveness of this technology have been previously approved through the public process by the EPA.¹ Therefore, the EPA is not publishing this request and allowing for public comments as no adverse comments to this type of technology have been received to date. Furthermore, the EPA is hereby approving the technologies, methodologies for determining credits, and credit levels as described in the application from Hyundai.

Section II of this document provides background on EPA's off-cycle credits program. Section III provides EPA's decision. This decision document applies only to the applications referenced herein.

II. EPA's Off-cycle Credits Program

EPA's light-duty vehicle greenhouse gas (GHG) program provides three pathways by which a manufacturer may accrue off-cycle carbon dioxide (CO₂) credits for those off-cycle technologies that achieve CO₂ reductions in the real world but where those reductions are not adequately captured on the test procedure used to determine compliance with the CO₂ standards. The first is a predetermined list of credit values for specific off-cycle technologies that may be used beginning in model year 2014.²² This pathway allows manufacturers to use conservative credit values established by EPA for a wide range of

¹ See EPA-420-R-19-015, "EPA Decision Document: Off-Cycle Credits for Toyota Motor North America, October 2019

² See 40 CFR 86.1869-12(b).

technologies, with minimal data submittal or testing requirements. In cases where additional laboratory testing can demonstrate emission benefits of an off-cycle technology, a second pathway allows manufacturers to use a broader array of emission tests (known as “5-cycle” testing because the methodology uses five different testing procedures) to demonstrate and justify off-cycle CO₂ credits.³ The additional emission tests allow emission benefits to be demonstrated over some elements of real-world driving not captured by the GHG compliance tests, including high speeds, hard accelerations, and cold temperatures. Credits determined according to this methodology do not undergo additional public review. The third and last pathway allows manufacturers to seek EPA approval to use an alternative methodology for determining the off-cycle CO₂ credits.⁴ This option is only available if the benefit of the off-cycle technology cannot be adequately demonstrated using the 5-cycle methodology. Manufacturers may also use this option for model years prior to 2014 to demonstrate off-cycle CO₂ reductions for technologies that are on the predetermined list, or to demonstrate reductions that exceed those available via use of the predetermined list.

Under the regulations, a manufacturer seeking to demonstrate off-cycle credits with an alternative methodology (i.e., under the third pathway described above) must describe a methodology that meets the following criteria:

- Use modeling, on-road testing, on-road data collection, or other approved analytical or engineering methods;
- Be robust, verifiable, and capable of demonstrating the real-world emissions benefit with strong statistical significance;
- Result in a demonstration of baseline and controlled emissions over a wide range of driving conditions and number of vehicles such that issues of data uncertainty are minimized;
- Result in data on a model type basis unless the manufacturer demonstrates that another basis is appropriate and adequate.

Further, the regulations specify the following requirements regarding an application for off-cycle CO₂ credits:

- A manufacturer requesting off-cycle credits must develop a methodology for demonstrating and determining the benefit of the off-cycle technology and carry out any necessary testing and analysis required to support that methodology.
- A manufacturer requesting off-cycle credits must conduct testing and/or prepare engineering analyses that demonstrate the in-use durability of the technology for the full useful life of the vehicle.
- The application must contain a detailed description of the off-cycle technology and how it functions to reduce CO₂ emissions under conditions not represented on the compliance tests.

³ See 40 CFR 86.1869-12(c).

⁴ See 40 CFR 86.1869-12(d).

- The application must contain a list of the vehicle model(s) which will be equipped with the technology.
- The application must contain a detailed description of the test vehicles selected and an engineering analysis that supports the selection of those vehicles for testing.
- The application must contain all testing and/or simulation data required under the regulations, plus any other data the manufacturer has considered in the analysis.

Finally, the alternative methodology must be approved by EPA prior to the manufacturer using it to generate credits. As part of the review process defined by regulation, the alternative methodology submitted to EPA for consideration must be made available for public comment.⁵ EPA will consider public comments as part of its final decision to approve or deny the request for off-cycle credits.

Although these credits are requested under regulatory provisions that don't explicitly require limitations, or caps, on credit values, EPA is stipulating here that credits for technologies for which there is a regulatory cap must be held to the applicable regulatory cap, if such credits are approved by EPA. For example, for reasons described in the implementing rulemaking documents and analyses, EPA established caps on thermal technology credits of 3.0 grams/mile for cars and 4.3 grams/mile for trucks. The rationale for these caps is applicable regardless of the off-cycle pathway being used to achieve such credits. EPA also established caps on technologies that improve the efficiency of air conditioning systems (5 grams/mile for cars and 7.2 grams per mile for trucks). Thus, credits approved in this Decision Document are being approved only to the extent that the regulatory caps on credits for certain technologies or categories of technologies are not exceeded.

III. EPA Decisions on Off-cycle Credit Applications

Hyundai applied for off-cycle credits using the alternative demonstration methodology pathway for a PWM brushless motor power controller used in the HVAC system, which improves the efficiency of the HVAC system. The application covers 2020 and later model year vehicles. Credits are approved according to the Table 1.

Table 1, Approved HVAC Brushless Motor Credits

Units: g CO ₂ /mi	Total Credit	A/C On Credit	A/C Off Credit
Manual A/C System	0.4	0.2	0.2
Automatic A/C System	0.4	0.3	0.1

EPA has evaluated the application and finds that the methodologies described therein are sound and appropriate. Therefore, EPA is approving the credits requested by Hyundai for the 2020 and later model years. Caps or limits on credits that are specified in the regulations also apply to the credits being approved in this document, as discussed above. The PWM/BLM technology is found to be an air conditioning efficiency technology and must be subject to the applicable regulatory caps for credits

claimed for A/C operation (5.7 grams/mile per vehicle through model year 2016, and 5 grams/mile for cars and 7.2 grams/mile for trucks for later model years). As described in the application, PWM/BLM technology credits for period when the A/C is not operating shall not be subject to any regulatory caps. All information necessary to determine the total Megagrams of credits must be included in the reporting to EPA, and the total Megagrams for each fleet and model year should be included in a summary of credit averaging, banking, and trading.