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Brake-emission norms under Euro 7

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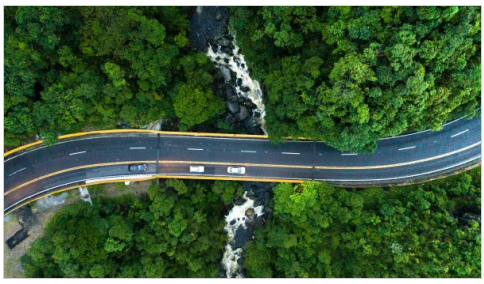
In an interview with SAE International, Patricio Barbale, Chassis team lead at S&P Global Mobility, highlighted the complexities around meeting the brake-emission norms under Euro 7 and how the new regulations can drive production of high-voltage hybrids with a regenerative-braking system.



Euro 7, a proposed regulation by the European Commission, aims to establish stricter emissions standards for vehicles, including the introduction of limits on particulate matter (PM) emissions from brakes and tire friction.

Barbale emphasized that automakers and braking suppliers are particularly concerned about meeting the compliance requirements by 2025, rather than focusing on the long-term goals set for 2035. He highlighted two key strategies for achieving Euro 7 brake-emissions compliance: vehicle electrification and friction-material innovations.

Patricio Barbale to SAE International.

> **"Automakers and braking suppliers are much more concerned with 2025 than 2035. The most important impacting factor is the timing, you have one year, a year-and-a-half, to be compliant."**

One significant aspect of Euro 7 that often goes unnoticed is the correction factor applied to different types of engines in vehicles. This factor, as explained by Barbale, takes into consideration the type of engine, especially in electric vehicles, when determining the acceptable brake-particulate emissions. Essentially, the crucial point is the existence of a correction-coefficient specific to the engine type within the vehicle. The treatment differs for EVs compared to internal combustion engine (ICE) vehicles.

In the case of a pure electric vehicle, only 15% of the total emissions are considered. For instance, if an ICE vehicle emits 10 mg/km of brake emissions, it would have to find a way to meet the maximum allowed 7 mg/km under Euro 7. In contrast, an EV emitting the same 10 mg/km is rated at just 0.15 of its measured output, equivalent to a baseline-brake emission of 1.5 mg/km, well below the Euro 7 limits for 2025 and 2035.

Euro 7 offers a range of compliance-correction factors based on the level of vehicle electrification, creating an incentive for transitioning to EVs. Pure ICE vehicles are subject to a 1:1 ratio, while EVs receive a correction factor of 0.15, resulting in a significant reduction of brake emissions considered for compliance. Plug-in hybrids have a correction factor of 0.3, conventional hybrid electric vehicles (HEVs) at 0.4 and mild hybrids at 0.6.

Barbale stressed the advantage of EVs in meeting the Euro 7 brake-emissions regulation. Although fully electric vehicles may be expensive, the addition of a small 48V battery in mild-hybrid vehicles that essentially function as traditional ICE vehicles, can provide a 40% reduction in emissions. The generous correction factor for EVs and high-voltage HEVs recognizes the potential for regenerative braking, which produces zero particulate emissions as friction brakes are not utilized. Regenerative-braking systems can significantly decrease brake-dust emissions by over 95%, according to Bosch, a major braking-system developer.

The weight of EVs poses a challenge

When friction brakes are used, the increased vehicle mass can lead to higher brake emissions and tire-related PM. Studies suggest that EVs may emit 3% to 8% more brake- and tire-related PM 2.5 due to their weight. Consequently, while EVs offer advantages in terms of correction factors and regenerative braking, a new generation of Euro 7-inspired hybrids, such as mild hybrids, are expected to emerge after 2025 to address these concerns.

Patricio Barbale to SAE International.

"Having an [EV] is a big advantage for this regulation, of course, the complete battery[-]electric vehicle is expensive. But if you think about a mild-hybrid vehicle that is essentially a traditional ICE vehicle plus a small 48[V] battery, it's not a big addition to the vehicle. [In addition,] you are allowed a reduction of 40[%] of the emissions."

In summary, Euro 7 brake-emissions compliance presents a complex landscape for automakers and suppliers. Electrification, combined with the correction factors for different engine types, offers a path toward meeting the stringent regulations. EVs enjoy significant advantages due to their low-baseline brake emissions. However, the weight of EVs may contribute to increased brake emissions when friction brakes are utilized. Overall, the shift toward electrification and the development of innovative friction materials will play a crucial role in achieving Euro 7 brake emissions compliance by 2025 and beyond.

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