

Euro 7: The new emission standard for light- and heavy-duty vehicles in the European Union

Authors: Jan Dornoff, Felipe Rodríguez

On December 18, 2023, the European Parliament and the Council of the European Union (EU) reached an agreement on new emission standards for light- and heavy-duty vehicles.¹ Pending formal adoption by both Parliament and Council, the new regulation will supersede the current Euro 6 regulation for passenger cars and vans, (EC) 715/2007,² and the Euro VI regulation for trucks and buses, (EC) 595/2009.³

The Euro 7 regulation sets requirements for the type-approval of vehicles, brake systems, and tires intended for sale in the European Union regarding their emissions behavior. It stipulates emission limits, sets emission-relevant minimum durability requirements, and defines requirements for on- and off-board compliance verification methods.

This policy update summarizes the key elements of the Euro 7 regulation and highlights the changes compared to the current emission standards.

SCOPE OF EURO 7

The Euro 7 emission standards regulation replaces the previously separate regulations for light- and heavy-duty vehicles. It sets new rules for passenger transport vehicles of categories M₁, M₂ and M₃, for vehicles for carrying goods of categories N₁, N₂ and N₃, as well as for trailers of categories O₃ and O₄.⁴

- ¹ Council of the European Union, "Regulation on Type-Approval of Motor Vehicles and Engines and of Systems, Components and Separate Technical Units Intended for Such Vehicles, with Respect to Their Emissions and Battery Durability (Euro 7) - Analysis of the Final Compromise Text with a View to Agreement," December 21, 2023, <https://data.consilium.europa.eu/doc/document/ST-16960-2023-REV-1/en/pdf>.
- ² European Union, "Regulation (EC) No 715/2007 of the European Parliament and of the Council of 20 June 2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information (Text with EEA relevance)," Pub. L. No. 32007R0715, 171 OJ L (2007), <http://data.europa.eu/eli/reg/2007/715/2020-09-01>.
- ³ European Commission, "Regulation (EC) No 595/2009 of the European Parliament and of the Council of 18 June 2009 on Type-Approval of Motor Vehicles and Engines with Respect to Emissions from Heavy Duty Vehicles (Euro VI) and on Access to Vehicle Repair and Maintenance Information and Amending Regulation (EC) No 715/2007 and Directive 2007/46/EC and Repealing Directives 80/1269/EEC, 2005/55/EC and 2005/78/EC (Text with EEA Relevance)," *Official Journal of the European Union* L 188/1 (July 18, 2009), <http://data.europa.eu/eli/reg/2009/595/oj/eng>.
- ⁴ Details about the vehicle categories can be found in the type-approval framework regulation (EU) 2018/858.

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Despite being a single regulation for these vehicle categories, it defines different requirements and limits for light- and heavy-duty vehicles. Within the regulation, light-duty vehicles are vehicles of category M₁ and N₁ and heavy-duty vehicles are vehicles of category M₂, M₃ and N₂, N₃.

The scope of Euro 7 now goes beyond setting the type-approval requirements for vehicles, extending the regulatory framework to the type-approval of brake systems and tires, particularly related to particle emissions and abrasion respectively. The regulation applies to tires of classes C1 (passenger cars and vans), C2 (light commercial vehicles) and C3 (heavy commercial vehicles) as specified in UN Regulation 117.⁵

EURO 7 TIMELINE

The implementation dates of the Euro 7 regulation are defined relative to its entry-into-force date, which is 20 days after its publication in the European Union’s Official Journal. This is expected to occur in the second quarter of 2024, considering that both Parliament and Council are required to officially adopt the regulation before it can be translated and published in the EU gazette.

As shown in Figure 1, Euro 7 will first apply to the type-approval of new light-duty vehicle models and their brake systems 2.5 years after the regulation is entered into force. One year later, all newly registered vehicles need to comply with the new rules. For heavy-duty vehicles, Euro 7 applies to new vehicle models 4 years after the entry into force and after 5 years to all new vehicles.

Figure 1
Euro 7 introduction timeline for light- and heavy-duty vehicles



Independent of the actual Euro 7 introduction dates, brake particle limits for heavy-duty systems will only apply from 2030 onwards. For tires, the abrasion limits will be implemented in July 2028 for class C1 tires, April 2030 for class C2 tires, and April 2032 for C3 tires. Additional details are presented in sections on brake and tire particle emissions below.

The effective implementation of Euro 7 also relies on complementary pieces of legislation, called implementing acts, which establish detailed procedures and methodologies for type-approval testing, administrative processes, and documentation for vehicle emissions compliance. Those implementing acts will be adopted 12 months after the standards are entered into force for M₁ and N₁ vehicles, and 30 months after for M₂, M₃, N₂, and N₃ vehicles.

⁵ Economic Commission for Europe of the United Nations, “Regulation No 117 of the Economic Commission for Europe of the United Nations (UN/ECE) – Uniform Provisions Concerning the Approval of Tyres with Regard to Rolling Sound Emissions and to Adhesion on Wet Surfaces and/or to Rolling Resistance [2016/1350],” *Official Journal of the European Union* L 218 (December 8, 2016): 3–63. <https://op.europa.eu/en/publication-detail/-/publication/48d3ed27-604f-11e6-9b08-01aa75ed71a1>.

TAILPIPE EMISSION LIMITS

LIGHT-DUTY VEHICLES

Euro 7 tailpipe emission limits for light-duty vehicles are identical to the Euro 6 limits. This means that different limits continue to apply for compression ignition and spark ignition engine vehicles as well as for cars and vans, as shown in Table 1. However, Euro 7 requires that all spark ignition vehicles comply with particle number and particulate matter limits, whereas under Euro 6, indirect injection engines were exempt. Furthermore, under Euro 7, particles with a diameter as small as 10nm count towards the particle number limit while the Euro 6 limit only comprised particles as small as 23nm.

Table 1

Euro 7 tailpipe emission limits for passenger cars of category M₁ and light-duty vans of category N₁

Category and class	CO		THC		NMHC		NO _x		THC + NO _x		PM	PN ₁₀
	SI	CI	SI	CI	SI	SI	SI	CI	CI	CI	SI & CI	SI & CI
M ₁ & N ₁ class I	1000	500	100	—	68	—	60	80	—	170	4.5	6x10 ¹¹
N ₁ class II	1810	630	130	—	90	—	75	105	—	195	4.5	6x10 ¹¹
N ₁ class III	2270	740	160	—	108	—	82	125	—	215	4.5	6x10 ¹¹

Notes: SI: Spark ignition; CI: Compression ignition; CO: Carbon monoxide; THC: Total hydrocarbons; NMHC: Non-methane hydrocarbons; NO_x: Nitrogen oxides; PM: Particulate matter; PN₁₀: Number of particles larger than 10 nm

HEAVY-DUTY VEHICLES

More stringent tailpipe emission limits were introduced with Euro 7 for heavy-duty vehicles, as shown in Table 2. While under Euro VI, different emission limits applied for the World Harmonized Stationary Cycle (WHSC) and World Harmonized Transient Cycle (WHTC), the limits are harmonized under Euro 7. The provisions under UN Regulation No. 49 continue to apply for all exhaust emission tests conducted on engine bench.⁶

For the WHSC, which only applies to compression ignition engines, nitrogen oxides (NO_x) emission limits are reduced by 50%, particulate matter (PM) by 20%, and particle number (PN) by 25%. PN includes particles as small as 10nm in diameter under Euro 7. The Euro VI total hydrocarbon (THC) limit was replaced by a limit for non-methane organic gases (NMOG) and a separate limit for methane (CH₄). Compared to the Euro VI THC limit of 130 mg/kWh, the NMOG limit of 80 mg/kWh is 38% lower. At the same time, CH₄ emissions might be as high as 500 mg/kWh. Carbon monoxide (CO) limits are the same as for Euro VI. New gravimetric limits for ammonia (NH₃) of 60 mg/kWh and for nitrous oxide (N₂O) of 200 mg/kWh are introduced.

The WHTC limits apply to both compression and spark ignition engines. For this cycle, Euro 7 NO_x emission limits are 56% lower than Euro VI. PM limits are reduced by the same percentage as for the WHSC, at 20%. A 62% reduction of CO emissions is required for Euro 7 compared to Euro VI and the NMOG emission limit is set to 80 mg/kWh. This is 50% lower than the NMOG limit for gas engines and the THC limit for diesel engines under Euro VI. The same new NH₃ and N₂O limits apply for the WHTC test.

Table 2

⁶ United Nations Economic Commission for Europe, "Regulation No 49 of the Economic Commission for Europe of the United Nations (UN/ECE) – Uniform Provisions Concerning the Measures to Be Taken against the Emission of Gaseous and Particulate Pollutants from Compression-Ignition Engines and Positive Ignition Engines for Use in Vehicles," *Official Journal of the European Union* L 171 (June 24, 2013), [http://data.europa.eu/eli/reg/2013/49\(2\)/oj](http://data.europa.eu/eli/reg/2013/49(2)/oj).

Euro 7 tailpipe emission limits for heavy-duty vehicles of categories M₂, M₃, N₂ and N₃

	WHSC (only CI engines)			WHTC (CI and SI engines)			On-road emissions limit		
	Euro VI (mg/kWh)	Euro 7 (mg/kWh)	Change compared to Euro VI	Euro VI (mg/kWh)	Euro 7 (mg/kWh)	Change compared to Euro VI	Euro VI (mg/kWh)	Euro 7 (mg/kWh)	Change compared to Euro VI
NO_x	400	200	-50%	460	200	-56%	690	260	-62%
PM	10	8	-20%	10	8	-20%	—	—	—
PN₁₀^a	8x10 ¹¹	6x10 ¹¹	-25%	6x10 ¹¹	6x10 ¹¹	No change	9.8x10 ¹¹	9x10 ¹¹	-8%
CO	1500	1500	No change	4,000	1,500	-62%	6,000	1,950	-68%
NMOG	—	80	-38% ^c	160 ^b	80	-50%	240	105	-56%
THC	130	—	—	160 ^c	—	—	—	—	—
NH₃	—	60	New	—	60	New	—	85	—
CH₄	—	500	New	500 ^b	500	No change	750	650	-13%
N₂O	—	200	New	—	200	New	—	260	—

Notes: WHSC: World Harmonized Stationary Cycle; WHTC: World Harmonized Transient Cycle; CI: Compression ignition; SI: Spark ignition; ^a Particle number limit in #/kWh; ^b Only for gas engines; ^c Only for diesel engines; ^d compared to Euro VI THC

For verifying emissions under real driving conditions, most of the provisions set under UN Regulation No. 49 continue to apply, with two important exceptions:

1. The conformity factor for all pollutant species is set to 1.0 and not to 1.5 as in UN Regulation No. 49.⁷ Instead, Euro 7 defines a separate set of limits, shown in the right of Table 2. Compared to the WHSC and WHTC limits, NO_x, CO, NMOG, CH₄, and N₂O emissions are permitted to be about 30% higher during RDE tests. NH₃ and PN₁₀ on-road limits are 42% and 50% higher than the laboratory limits, respectively.
2. The power threshold, used to assess the validity of the windows used in the moving average window (MAW) evaluation, is lowered to 6%. The thresholds under UN Regulation No. 49 and the last implementation step of Euro VI were 20% and 10%, respectively. This leads to the on-road test capturing more low-load and low-speed operation.

NON-TAILPIPE EMISSIONS

Besides tailpipe emissions, Euro 7 sets limits for the evaporative emissions from gasoline vehicle fuel tanks. In addition, emission limits for the particle abrasion from tires and brakes are introduced with Euro 7.

EVAPORATIVE EMISSIONS

While the procedure for testing evaporative emissions during type-approval is the same as under Euro 6, the limits were lowered from 2.0 g of hydrocarbons per test to 1.5 g per test. Evaporative emission limits apply only to gasoline passenger cars and vans of category N₁.

⁷ Not-to-exceed limits for RDE testing are calculated by multiplying the emission standard tailpipe limits with the pollutant specific conformity factor.

BRAKE PARTICLE EMISSIONS

Brake particle emissions stem from abrasion of brake pads and discs. They can be reduced by optimizing individual brake system components, the pairing of pads and discs, and by brake dust suction devices. Compared to conventional vehicles, electric and electrified combustion engine vehicles can avoid substantial quantities of brake particles by using regenerative braking. This means, instead of using the brakes to decelerate the vehicle, the electric motor is used in generator mode.

This technological difference is partially reflected in the Euro 7 requirements by setting lower brake particle limits for battery electric vehicles than for other powertrain types, as shown in Table 3. As a first step, Euro 7 defines particulate matter limits for passenger cars and for N₁ light commercial vehicles until the end of 2029. From 2030 onwards, the regulation also contains a placeholder for particulate number emissions and for extending the scope to buses and trucks of categories M₂, M₃ and N₂, N₃. To define these limits, the European Commission will submit an analysis by the end of 2027.

Brake particle emissions of brake systems for M₁ and N₁ vehicles are tested according to the UN Global Technical Regulation No. 24.⁸ The type-approval is granted for the brake system, which can then be fitted to many vehicle models. The test procedure for heavy-duty vehicles is yet to be developed.

Table 3
Euro 7 brake particle emission limits for particulate matter

Date	Powertrain type	Vehicle categories		
		M ₁ / N ₁ class I & II	N ₁ class III	M ₂ / N ₂ and M ₃ / N ₃
Until December 2029	Battery electric vehicles	3 mg/km	5 mg/km	none
	Other powertrain types	7 mg/km	11 mg/km	none
January 2030 – December 2034	Battery electric vehicles	tbd	tbd	tbd
	Other powertrain types	tbd	tbd	tbd
From January 2035	All powertrain types	3 mg/km	tbd	tbd

TIRE PARTICLE EMISSIONS

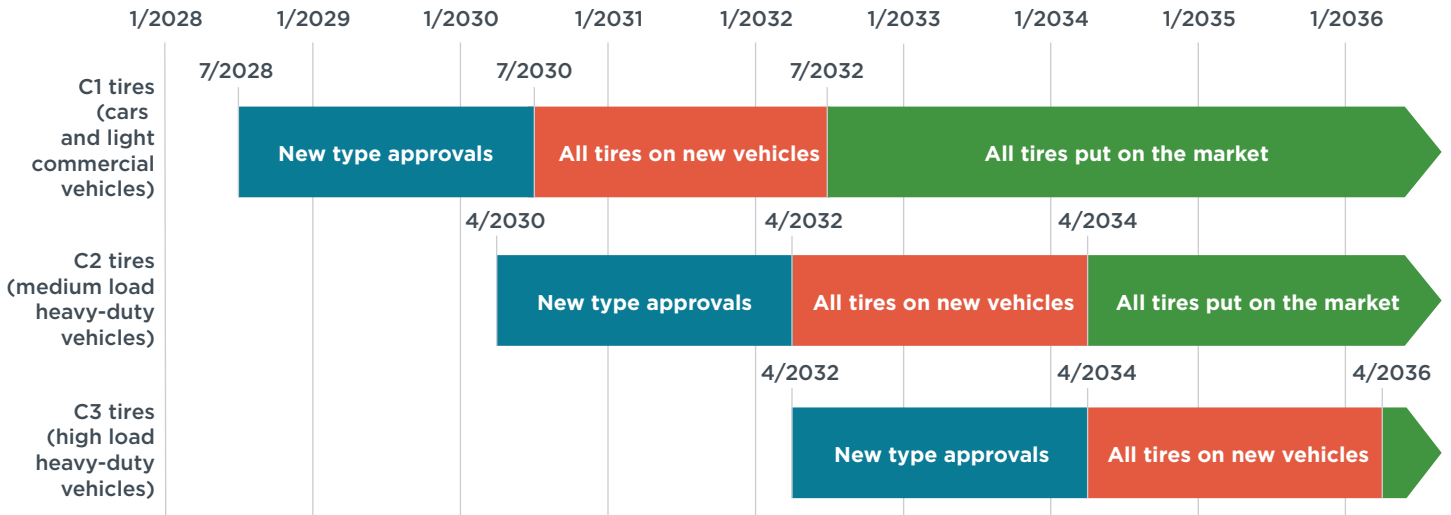
Euro 7 will also limit the emissions stemming from tire abrasion. As for brake particle emissions, the tire itself is undergoing type-approval testing, as opposed to the vehicle. Only tires with abrasion rates below the Euro 7 limits will receive type approval. The test procedure and limits are under development at the United Nations Economic Commission for Europe (UNECE) and will amend the Euro 7 regulation. If a UNECE regulation is not adopted in time, the Commission is empowered to develop a tire testing procedure and set limits instead.

As shown in Figure 2, Euro 7 requirements will apply to tires of different classes at different times—first to C1 tires from July 2028, then to C2 tires from April 2030, and to C3 tires from April 2032. The introduction sequence is the same for all categories. In the first stage, Euro 7 applies to new tire models that are type-approved for the first time. Two years later, new vehicles put on the market must be equipped with Euro 7 type-approved tires, and another two years later, all tires put on the market must comply with Euro 7 requirements.

⁸ United Nations Economic Commission for Europe, “Addendum 24: UN Global Technical Regulation No. 24 - Laboratory Measurement of Brake Emissions for Light-Duty Vehicles,” Pub. L. No. ECE/TRANS/180/Add.24 (2023), <https://unece.org/sites/default/files/2023-07/ECE-TRANS-180-Add.24.pdf>.

Figure 2

Introduction dates for Euro 7 tire abrasion rate limits



DURABILITY

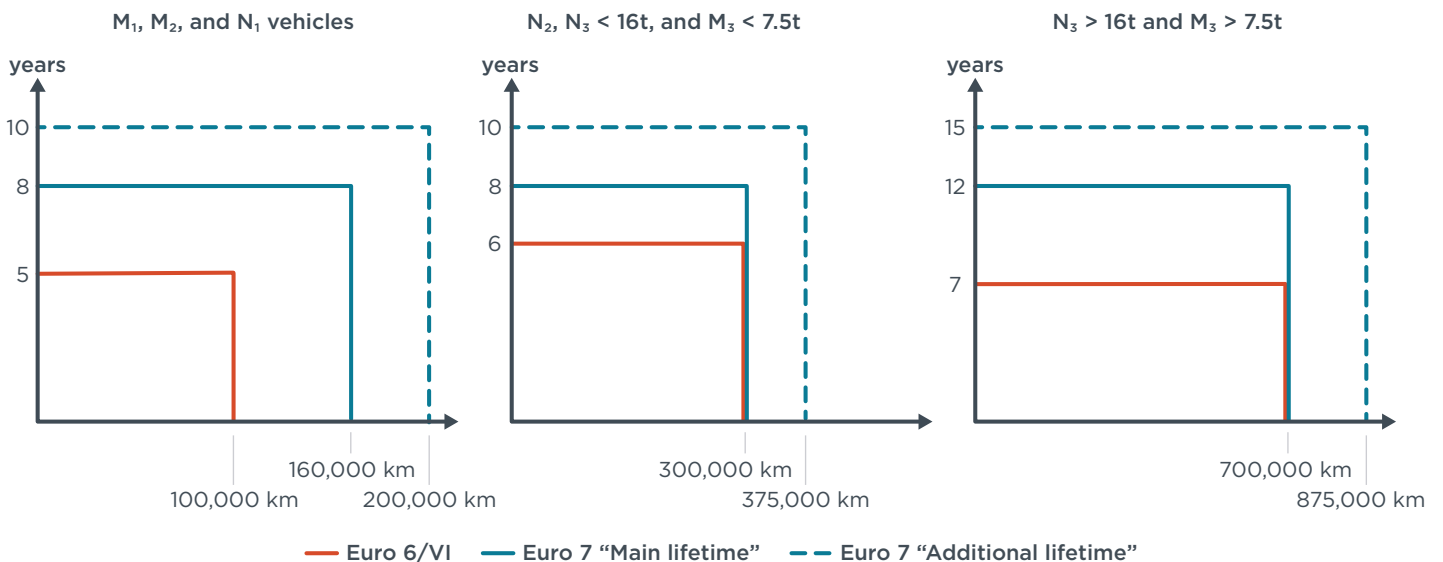
VEHICLE LIFETIME

Vehicles are required to comply with emissions limits for a defined vehicle lifetime. During this period, emission compliance can be verified through in-service conformity and market surveillance testing. Euro 7 extends the lifetime requirements compared to Euro 6/VI and introduces the concept of an “additional lifetime” beyond the “main lifetime.” During the additional lifetime, emission limits of gaseous pollutants are adjusted using a durability multiplier. For vehicles of category M₁, M₂, and N₁, the multiplier is 1.2. This means gaseous emissions are allowed to be 20% higher than shown in Table 1 and Table 2. Emission multipliers for heavy-duty vehicles of categories N₂, N₃, and M₃ are foreseen in the regulation and will be defined after an analysis to be performed by the European Commission by December 2025.

Figure 3 reflects the lifetime in terms of calendar age in years and lifetime mileage in kilometers for both main and additional lifetime, and compared to the Euro 6/VI values. The lifetime is exceeded when one threshold is passed.

Figure 3

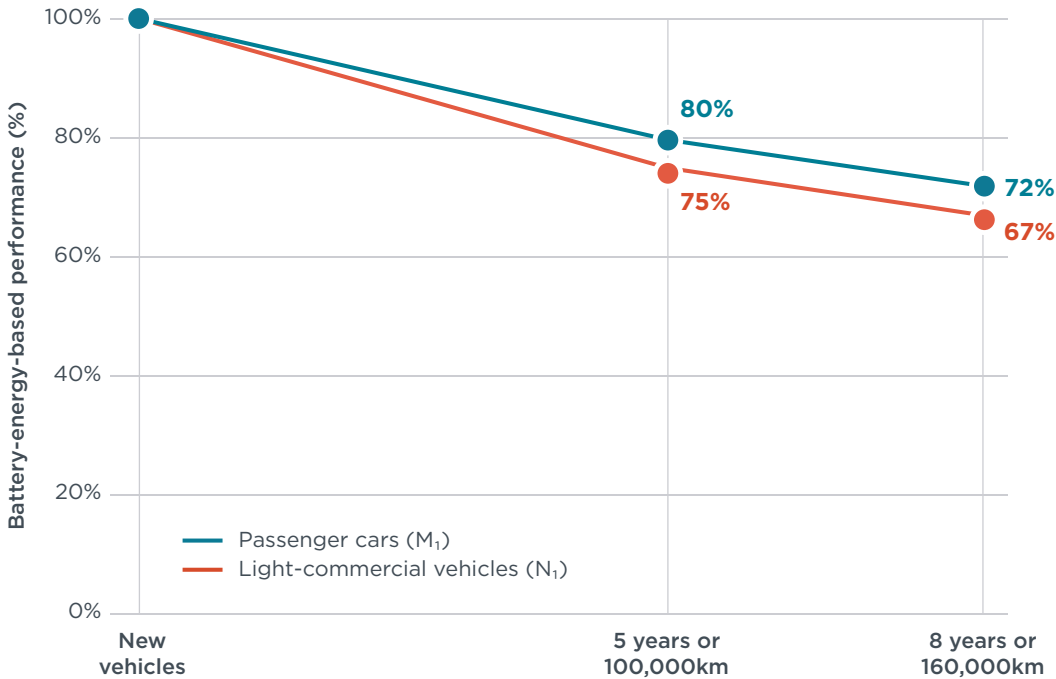
Euro 7 lifetime requirements compared to Euro 6/VI



BATTERY DURABILITY

Euro 7 sets first time durability requirements for the batteries of battery electric vehicles (BEV) and plug-in hybrid vehicles (PHEV) registered in the EU, reflected in Figure 4. After 5 years or 100,000 km, whichever is sooner, the batteries of BEV and PHEV passenger cars of category M₁ must retain an energy storage capability of 80%. After 8 years or 160,000 km, the energy storage capacity must not have deteriorated to less than 72%. For N₁ light-commercial vehicles, the durability thresholds are set at 75% and 67% for the same usage periods.

Figure 4
Euro 7 battery durability requirements for battery electric vehicles and plug-in hybrid vehicles of categories M₁ and N₁



For determining battery performance and verifying compliance with the durability requirements for light-duty vehicles, the UN Global Technical Regulation No 22 will be transposed to EU legislation.⁹

Battery durability requirements are also foreseen in the regulation for heavy-duty vehicles. The corresponding legislation is under development at UNECE, closely linked to the regulation for light-duty vehicles; durability thresholds will be defined later.

In addition to setting thresholds for the durability in terms of energy storage capacity, the Euro 7 regulation contains placeholders for durability requirements related to the achievable range.

Battery durability requirements will be revised either when a corresponding UNECE regulation is adopted or based on a battery durability report to be submitted by the European Commission at the end of 2027. The review will also aim to align the period where durability requirements apply with the vehicle lifetime requirements, including the additional lifetime.

Euro 7 requires that battery state of health information is accessible to vehicle users, for example by display, and can be retrieved through the vehicle's diagnostic interface.

⁹ United Nations Economic Commission for Europe, "Addendum 22: United Nations GTR No. 22," ECE/TRANS/180/Add.22 § (2022), https://unece.org/sites/default/files/2022-04/ECE_TRANS_180a22e.pdf.

OTHER ELEMENTS

ON-BOARD FUEL AND ENERGY CONSUMPTION MONITORING

On-board fuel and energy consumption monitoring (OBFCM) devices were gradually introduced in the EU for all new cars and vans with internal combustion engines starting in 2020. Euro 7 will extend the scope of OBFCM to all vehicle categories and all powertrain types, including electric vehicles.

While OBFCM data from Euro 6 vehicles is only accessible through the vehicle's diagnostic interface, Euro 7 vehicles will be required to display the information to vehicle users and be capable of transmitting the data over the air.

ON-BOARD EMISSIONS MONITORING

On-board emissions monitoring (OBM) is a new compliance verification element introduced by Euro 7. In all Euro 7 vehicles that have tailpipe emissions, the OBM system monitors the levels of NO_x and PM emissions, and, for heavy-duty vehicles, also NH₃ emissions. Exceedances that are 2.5 times higher than the applicable emission limit are recorded.

Data recorded by the OBM can be accessed through the vehicle's diagnostic port, and in anonymized form can be transmitted over the air. OBM data will be used to assess the roadworthiness of individual vehicles and to monitor emission compliance of vehicle types.

Euro 7 also foresees that significant emission exceedance determined by the OBM system will trigger a driver warning system and an inducement mechanism to ensure a timely repair. The regulation does not define what would constitute a significant exceedance of emissions.

VEHICLES WITH GEOFENCING TECHNOLOGY

Euro 7 allows manufacturers to type-approve hybrid vehicles with geofencing technologies as a separate category. For these vehicles, manufacturers must demonstrate that they can only drive in zero-emission zones when a zero-emission mode is activated, which means the combustion engine must not run. When the battery depletes, while driving in a zero-emission zone, the vehicle can continue driving using the combustion engine for 5 kilometers. Vehicles with type-approved geofencing technology will be labeled as Euro 7G.

INFORMATION ABOUT ENVIRONMENTAL VEHICLE PERFORMANCE

All Euro 7 vehicles will be equipped with an environmental vehicle passport (EVP), which will contain, in electronic format, information relevant to the environmental impact and performance of the new vehicle. The information will include the pollutant level, CO₂ emissions, fuel and/or energy consumption, electric range, battery durability information, and vehicle parameters like motor power. The data stored in the EVP is to be displayed in the vehicle and shall be retrievable for off-board usage.

In addition, Euro 7 requires that data about the current environmental performance of the vehicle, coming from the OBM system and the OBFCM device, is made available to the user.

SUMMARY AND OUTLOOK

Once adopted by the European Parliament and the Council of the European Union, the Euro 7 regulation will be published in the EU Official Journal and will enter into force 20 days thereafter.

To implement the requirements defined in the Euro 7 regulation, the European Commission will develop implementing acts that address procedures and methods for testing, warning and inducement systems, data transmission and communication, and administrative and reporting requirements. For a timely adaption to technical progress, the Commission is empowered to adopt delegated acts, based on Commission research or regulatory developments at the UNECE. These acts can cover, for example, test conditions, innovative technologies, emission durability multipliers, and formaldehyde emission limits for heavy-duty vehicles.

The effectiveness of the Euro 7 regulation will be evaluated by September 2031, when the European Commission is tasked with submitting a progress report to the co-legislators that includes an evaluation of emission reductions achieved in the EU Member States.



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