



Aktueller Stand Euro 7 für Pkw und Nfz: „Der Weg zu Euro 7+“

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Presenter:







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36 years of emission testing experience in different positions, from test and development engineer, product- and application manager to principal business development manager for emission test systems. The work focus is on emission- and energy-testing, future emission trends and worldwide emission legislations.

Member of various standardization and legislation communities:

- Austrian Standards Institute (ASI)
- International Standardization Organization (ISO)
- UN-ECE GRPE and UN-ECE working groups, like WLTP
- Member of FAD
-  **H₂** • UN-ECE GRPE H2-ICE Expert group (UNR-49)
-  **H₂** • ISO-8178 Carbon Free Fuels Task Force, project leader of Part-1
-  • Advisory Group on Vehicle Emission Standards (AGVES) of the European Commission for Euro-7/VII
-  • Euro 7 Drafting group

Euro 7: European Union - Project



Start 2018: Stakeholder event Preparing for the future European Emission Standards "Post-Euro-6"

2019-2021: 12 AGVES (Advisory Group Vehicle Emission Standards) and CLOVE (Consortium for Low Vehicle Emissions) meetings, with 90 Documents and 2125 pages

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2021-2022: 16 month of EU Commission (EC) internal discussions and impact assessments. Final proposal continuously shifted.

10.11.2022: **"Alea iacta est"**
EU Commission published the Euro-7 proposal

2023-2024?: Start of further AGVES, CLOVE and drafting meetings for defining the "Implementing Regulations". The details how Euro 7 is defined in detail, how it is tested and measured, ...

Euro 7:



- The EU commission proposal (timing and content) will only be discussed anymore at the political level (EU Parliament and council).
- EU council presidency, Sweden, is considering a 2-year lead time, which would delay the 2025 date.
- Delaying of 2025, could also open a discussion to reduce LDV limits and additional gas components.



2027: Euro-7

2025: Euro-7

Such a short lead time and still no implementing regulations available is very questionable

Euro-7

Euro 7: Light-Duty vehicles



CO2 EU "Tailpipe only"

- 2035 Zero CO2
- 2030 EU -55%
- 2025 EU -15%
- 2021 EU Reference

2025: Euro-7

- Evaporative Emission
- Tailpipe emission
- On Board Monitoring
- Energy Consumption
- Batterie requirements
- Brake particle emission
- Tire abrasion

Such a short lead time and still no implementing regulations available is very questionable

Euro 7: Heavy-Duty vehicles



Euro-7 Legislation (based on EC proposal 10.11.2022)












1

Very (most?) advanced emission standard:

- Powertrain Technology open and fuel independent
- Focus on real driving emissions
- Not only vehicle, but also brakes and tires
- Onboard monitoring and tampering detection

2

Most environmental impacts are covered:


1.  Tailpipe Pollutants + new components + longer durability
2.  Evaporative emission from fuel system + re-fueling
3.   Particle from brakes
4.   Micro-Plastic emissions from tires
5.   Energy Consumption: Fuel, e-Energy and e-Driving Range
6.  Battery durability requirements and capacity information


It is not an „Emission“ legislation only, it is Emission, Energy and Electrification

3

Much more effort and testing requirements

- due to infinite variants of ambient and driving conditions
- due to a much higher responsibility of “Signed OEM Declarations”
- but less testing for Type-Approval

Legend:  Pure ICE and types of ICE based hybrids

 Plug-In, BEV and FC

Euro-7 Legislation (based on EC proposal 10.11.2022)



4

Pollutant emissions are limited as RDE emissions:



In case that not all emissions can be tested on the road, an RDE cycle might be done on the Chassis Dyno test bed.



Only the vehicle test is relevant. An additional engine test bed test is in discussion for multistage vehicles.

- On-Board Monitoring (continuous tailpipe emission measurement)
- Antitampering provisions (disabling after treatment systems by vehicle owner).

5

CO2 emission testing (limits aren't defined by Euro 7):



Are defined based on the WLTC chassis dyno testing.



Based on VECTO simulation and engine test bed fuel mapping cycle.

6

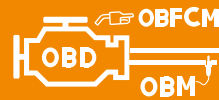
Minimum Battery Performance requirement:

- Durability requirements.
- State of health for battery capacity and distance customer information – important for secondhand market.

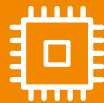


7

OBM (On-Board Monitoring):



- OBM is a direct and continuous monitoring of NO_x , NH_3 , and PM/PN tailpipe emissions measured by physical (NO_x , NH_3) sensors and/or virtual sensors and OBD (PM/PN) data. OBFCM and OBD remains unchanged.



- In each vehicle and for each trip OBM continuously calculates (ECU) a g/s data (except PN/PM) and reports it at the OBD-II interface. After each trip, a RDE result is calculated. The last 10 results are stored in the vehicle and some of these results are randomly selected for transmission to the OEM database and further transmitted to the authority.

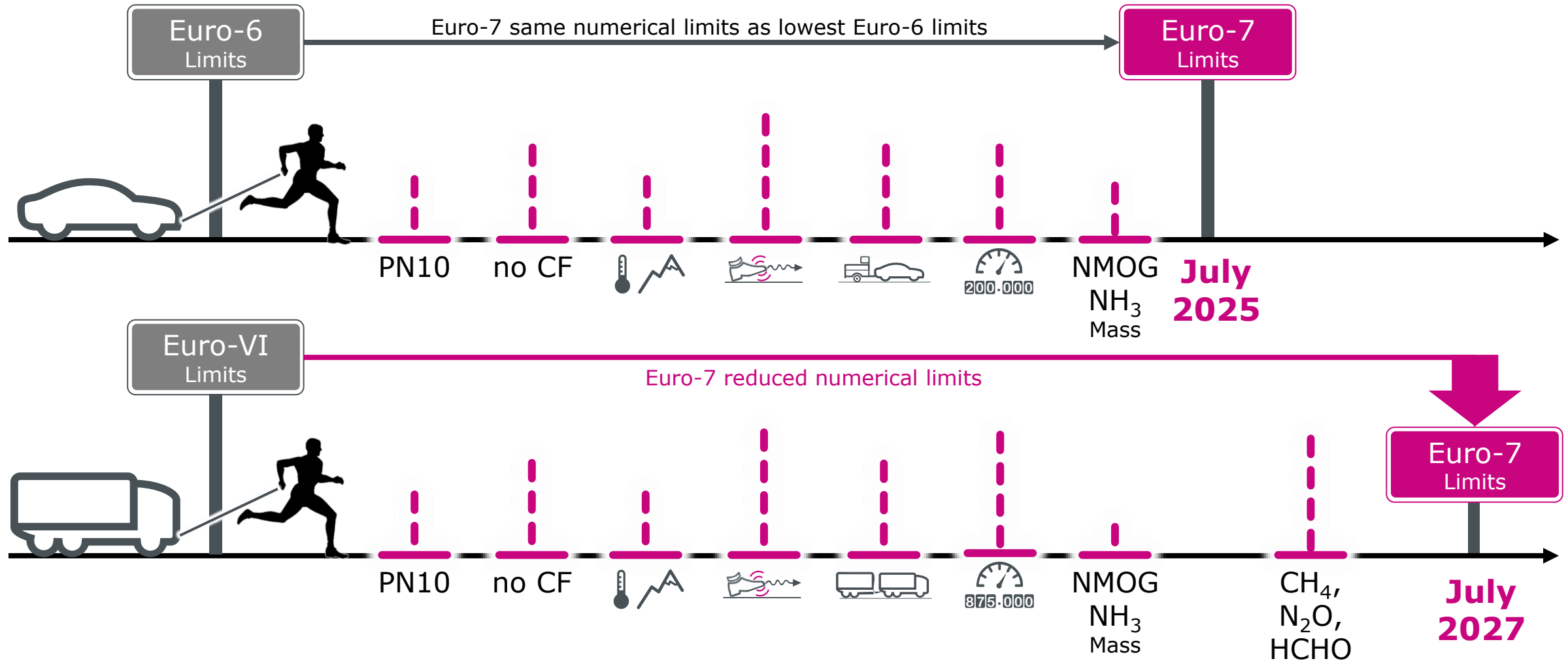


- "Excess Emissions Driver Warning System" (EEDWS) set after each trip a status (green, orange or red). If emissions are above 2,5 of the legal limits, an inducement is progressively done:
 1. Soft warning with sufficient time to enable user to repair it.
 2. Performance Limitation [e.g.: 80km/h]
 3. Engine start is prevented [i.e.: operating an EU-7 vehicle in countries with bad fuel quality might not be possible anymore]



- OBM accuracy and operation is checked at type approval and during RDE ISC tests. OBM must never report lower OBM emissions as the PEMS system. i.e.: manufacturer must all the time "overreport".

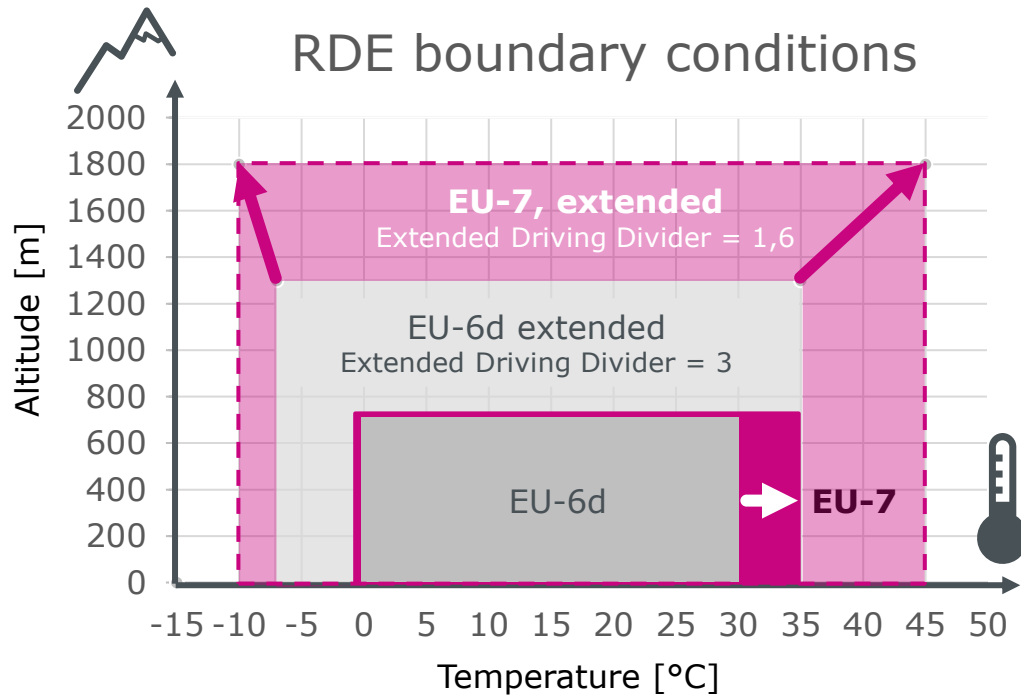
Race to Euro 7: Limits and challenges



RDE Emission Euro-7 proposal "wide open road testing"



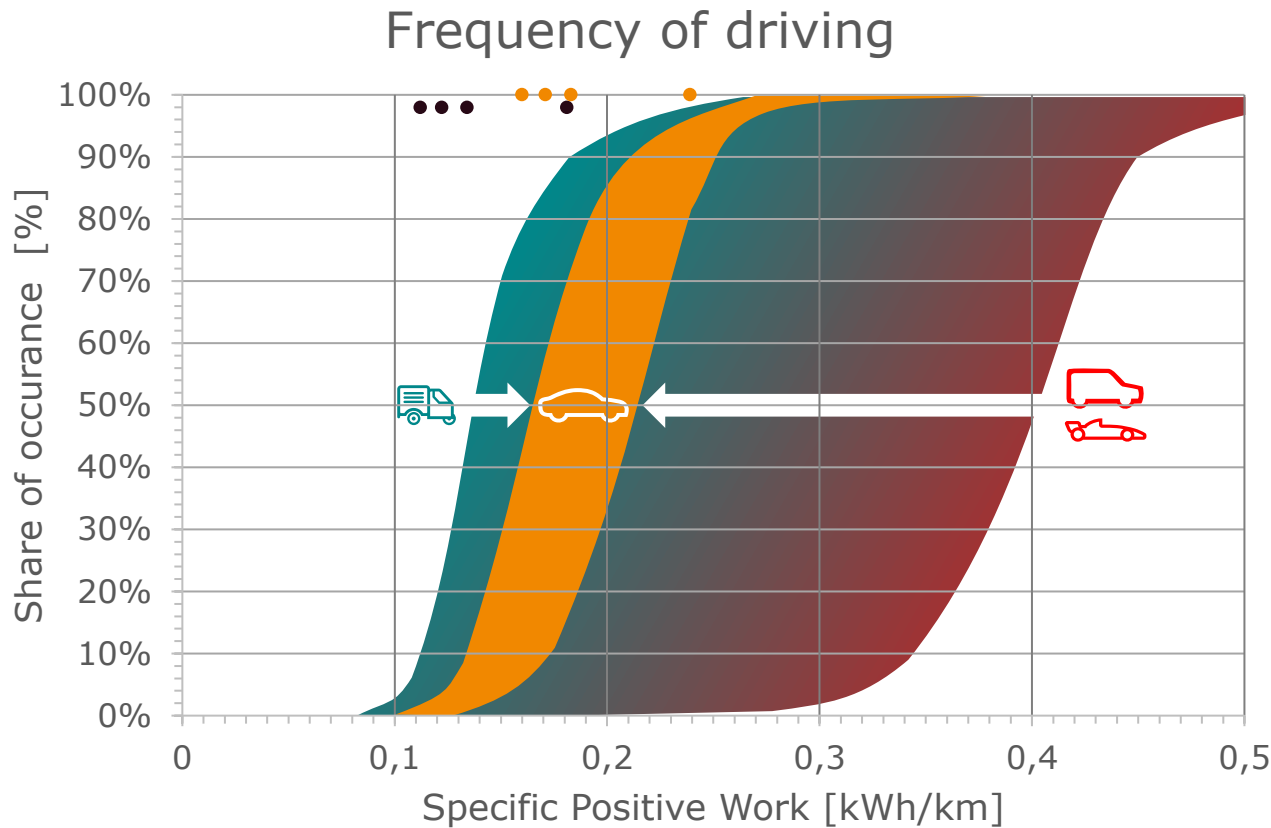
Ambient conditions



Limits and Driving conditions

EU-6d	EU-7 Light-Duty	EU-7 Heavy Duty
CF $CF_{NO_x} = 1,43$ $CF_{PN_{23nm}} = 1,5$	CF = 1. Limits consider RDE/PEMS uncertainty	
$CO_2, CO, NO_x, PN_{23nm}$	$CO_2, CO, NO_x, THC, NMHC (CH_4), NH_3, PN_{10nm}$	$CO_2, NO_x, CO, THC, NMOG, CH_4, N_2O, NH_3, HCHO, PN_{10nm}, PM$
Testing limitations:		
Duration, min distance 23.3	Any or as per normal use	
34% 33% 33%	But there will be a biased driving validation, to make testing, with the purpose to get bad results invalid.	
Avg, max accel., ...		
+	Towing is extended RDE 	
+		Payload $\geq 10\%$ $<10\%$ is extended

Identification of RDE-biased driving



VDA | Verband der
Automobilindustrie

VDA proposal of a "Work Based Approach" (WBA) to identify non-normal or biased RDE driving conditions:

- The specific positive work [kWh/km] of driving depends on the driving style, the weight and power of a vehicle and the slope of the street. In the diagram it is shown for a data analysis of app. 32.000 trips with app. 700.000km of real street driving. That is a much do wide range of variations for defining a limit for abnormal driving.
- With using the driving speed of the actual vehicle and calculating the work for a virtual standard vehicle (2000kg, f_0 200N, f_1 0,5N/kmh, f_2 0,03 N/(km/h)²), the range shrinks down to 0,10 – 0,25 kWh/km. Which could be used to define a limit for normal driving.

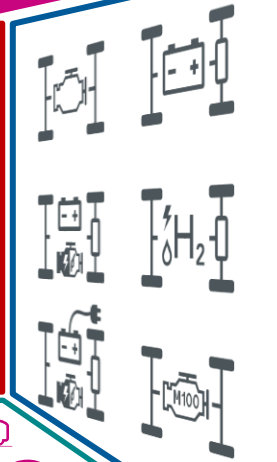
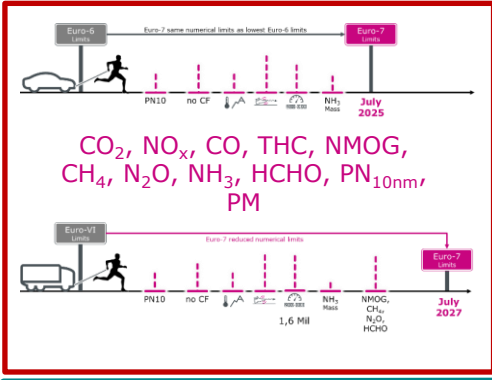
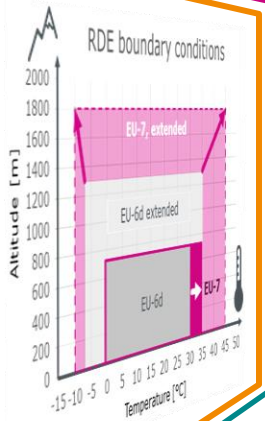
kWh/km	Golf	VDA Standard Vehicle
• NEDC	0,112	0,160
• FTP75	0,122	0,171
• WLTC 3b	0,134	0,183
• US06	0,181	0,239

Euro-7 Challenge



1

Challenging limits and new pollutants limited



Various powertrains and fuel types

4



- Infinite combinations of variables.
- Impossible to physically test all.

Simulation:



SIL Simulation

Tests per shift

6000



HIL Simulation

12

Laboratory:



Engine testing

8



24/7 Powertrain testing

8



Chassis Dynamometer with RDE cycles and full environmental conditioning

2

Road:



RDE validation tests

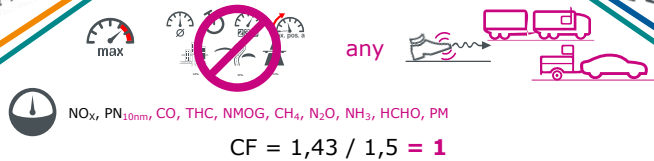
2

2

Wider range of climate and altitude conditions

“Wide open road” testing, driving as per normal use. Whatever that might be?

3



Euro 7_{Light-Duty}:







Euro 7_{Light-Duty}: Limits (1/2)



EURO 7 EMISSION LIMITS

Table 1: Euro 7 exhaust emission limits for M₁, N₁ vehicles with internal combustion engine

Pollutant emissions	 M ₁ , N ₁ vehicles	 Only for N ₁ vehicles with power to mass ratio ¹ less than 35 kW/t	 Emission budget for all trips less than 10 km for M ₁ , N ₁ vehicles	 Emission budget for all trips less than 10 km only for N ₁ vehicles with power to mass ratio less than 35 kW/t
	<i>per km</i>	<i>per km</i>	<i>per trip</i>	<i>per trip</i>
NO _x in mg	60	75	600	750
PM in mg	4.5	4.5	45	45
PN ₁₀ in #	6×10 ¹¹	6×10 ¹¹	6×10 ¹²	6×10 ¹²
CO in mg	500	630	5000	6300
THC in mg	100	130	1000	1300
NMHC in mg	68	90	680	900
NH ₃ in mg	20	20	200	200



The limits apply for RDE as well as for Chassis dyno RDE cycle test. Euro-7 limits are the same numerical numbers as the lowest Euro-6 limits.



These limits (mg/km and PN#/km) apply for all tests with ≥10km.



For trips/tests with less than 10km a fixed emission budget limit applies as mg/trip or PN#/trip. Nevertheless, how long or short the trip was.



Low power vehicles <35kW/t have higher limits.



WLTC Chassis dyno testing for 23°C, 14°C and -7°C CO₂, energy consumption and e-range testing.



-7°C testing capacity might be too low, due to testing all powertrain types and all emission components.

¹ Measured in accordance with paragraph 5.3.2. of UN/ECE Regulation No 85 in the case of ICEVs and PEVs, or, in all other cases, measured in accordance with one of the test procedures laid down in paragraph 6 of UN Global Technical Regulation 21

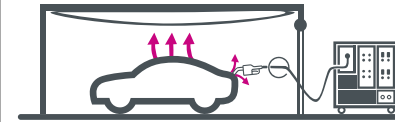
Euro 7 Light-Duty: Limits



EURO 7 EMISSION LIMITS

Table 3: Euro 7 evaporative emission limits for petrol fuelled M1, N1 vehicles

Pollutant emissions	M1, N1 with maximum mass up to 2650 kg	N1 with maximum mass equal or more than 2650 kg
Evaporative emissions (in hot soak + 2 day diurnal test)	0.50 g at worst day + hot soak	0.70 g at worst day + hot soak
Refuelling emissions	0.05 g/L of fuel	0.05 g/L of fuel



Strong reduction of limits plus a new refueling test (ORVR) added.

Table 4: Euro 7 brake particle emission limits in standard driving cycle applying until 31/12/2034

Emission limits in mg/km per vehicle	M1, N1 vehicles	M2, M3 vehicles	N2, N3 vehicles
Brake particle emissions (PM ₁₀)	7		
Brake particle emissions (PN)			



Brake particulate is a totally new test procedure with new test systems. Currently the testing is only defined for light-duty vehicles and heavy-duty vehicles will follow. Limit with 7mg/km is challenging, most current vehicles are higher. In 2035 a 3mg/km limit shall apply.

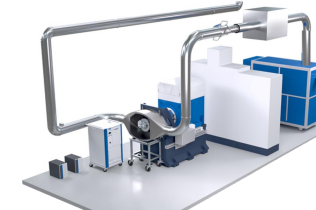


Table 5: Euro 7 brake particle emission limits in applying from 1/1/2035

Emission limits in mg/km per vehicle	M1, N1 vehicles	M2, M3 vehicles	N2, N3 vehicles
Brake particle emissions (PM ₁₀)	3		
Brake particle emissions (PN)			

Table 6: Euro 7 tyre abrasion rate limits

Tyre mass lost in g/1000 km	C1 tyres	C2 tyres	C3 tyres
Normal tyres			
Snow tyres			
Special use tyres			



Tire abrasion test method is currently developed at UN-ECE GRBP/GRPE. Limits are not defined yet and will be based on g lost per 1000km.

Euro 7_{Light-Duty}: More test requirements



Nr.	Test requirements Euro 7			Type approval and compliance						to be measured											New in EU 7			
	UUT	Testing Environment	Type	New in EU-7	Type Appr	OEM Decl	CoP	ISC	MaS	1 CO2	2 Fuel Consumption	3 e-Energy Consum.	4 e-Range	5 CO	6 NOx	7 THC	8 NMHC	9 PM	10 Crankcase Pres.	11 Opacimeter	12 PN 10nm	13 NH3	14 Micro Plastic	15 Battery Durability
1	Vehicle	Road	RDE		✓	✓	-	Opt.	-	-	-	-	-	✓	✓	✓	✓	-	-	-	✓	✓	-	-
2	Vehicle	CD	Emission & Energy WLTC 23°C		✓	✓	✓	Opt.	-	✓	✓	✓	✓	(✓)	(✓)	(✓)	(✓)	✓	-	-	(✓)	(✓)	-	✓
3	Vehicle	CD	ATCT 14°C		-	✓	-	Opt.	-	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Vehicle	CD	-7C Low Temperature		✓	-	-	Opt.	-	-	-	-	-	✓	✓	✓	✓	✓	-	-	✓	✓	-	-
5	Vehicle	CD	Crankcase		-	✓	-	Opt.	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-	-
6	Vehicle	CD	Emission Durability		-	✓	-	-	-	-	-	-	-	✓	✓	✓	✓	✓	-	-	✓	✓	-	-
7	Vehicle	CD + SHED	EVAP Hot-Soak & Diurnal		✓	-	✓	Opt.	-	-	-	-	-	-	-	✓	-	-	-	-	-	-	-	-
8	Vehicle	-	Idle Test		-	✓	-	-	-	-	-	-	-	✓	-	-	-	-	-	-	-	-	-	-
9	Engine	ETB	UNR-24		-	✓	-	-	-	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-
10	Vehicle	CD	OBD		-	✓	-	Opt.	-	-	-	-	-	✓	✓	✓	✓	✓	-	-	✓	✓	-	-
11	Vehicle	CD	OBFCM		-	-	-	-	-	-	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
12	Vehicle	CD	Emission Lab RDE Cycle	✓	Opt.	✓	-	Opt.	-	-	-	-	-	(✓)	(✓)	(✓)	(✓)	✓	-	-	(✓)	(✓)	-	-
13	Vehicle	CD + SHED	EVAP Re-Fueling	✓	✓	-	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-	-	-	-
14	Vehicle	?	OBM	✓	✓	✓	-	✓	-	-	-	-	-	✓	-	-	✓	-	-	✓	✓	-	-	-
15	Brakes	Brake-TB	Brake particle	✓	?	?	-	-	-	-	-	-	-	-	-	-	✓	-	-	✓	-	-	-	-
16	Tyre	?	Tyre abrasion	✓	?	?	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	✓	-
17	Vehicle	?	Battery MPR – Capacity	✓	-	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	✓
18	Vehicle	?	Battery MPR - Range	✓	-	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	✓

On-Road
 Test bed / Laboratory
 New with Euro-7

Euro 7_{Light-Duty}: OEM signed declaration



Nr.	Test requirements Euro 7			Type approval and compliance				
	UUT	Testing Environment	Type	Type Appr	OEM Decl	CoP	ISC	MaS
1	Vehicle	Road	RDE	✓	✓	-	Opt.	-
2	Vehicle	CD	Emission & Energy WLTC 23°C	✓	✓	✓	Opt.	-
3	Vehicle	CD	ATCT 14°C	-	✓	-	Opt.	-
4	Vehicle	CD	-7C Low Temperature	✓	-	-	Opt.	-
5	Vehicle	CD	Crankcase	-	✓	-	Opt.	-
6	Vehicle	CD	Emission Durability	-	✓	-	-	-
7	Vehicle	CD + SHED	EVAP Hot-Soak & Diurnal	✓	-	✓	Opt.	-
8	Vehicle	-	Idle Test	-	✓	-	-	-
9	Engine	ETB	UNR-24	-	✓	-	-	-
10	Vehicle	CD	OBD	-	✓	-	Opt.	-
11	Vehicle	CD	OBFCM	-	-	-	-	-
12	Vehicle	CD	Emission Lab RDE Cycle	Opt.	✓	-	Opt.	-
13	Vehicle	CD + SHED	EVAP Re-Fueling	✓	-	-	-	-
14	Vehicle	?	OBM	✓	✓	-	✓	-
15	Brakes	Brake-TB	Brake particle	?	?	-	-	-
16	Tyre	?	Tyre abrasion	?	?	-	-	-
17	Vehicle	?	Battery MPR – Capacity	-	✓	-	-	-
18	Vehicle	?	Battery MPR - Range	-	✓	-	-	-

OEM signed declaration



Appendix 12 - Manufacturer's RDE certificate of compliance
Manufacturer's certificate of compliance with the Real Driving Emissions requirements

(Manufacturer):
 (Address of the Manufacturer):

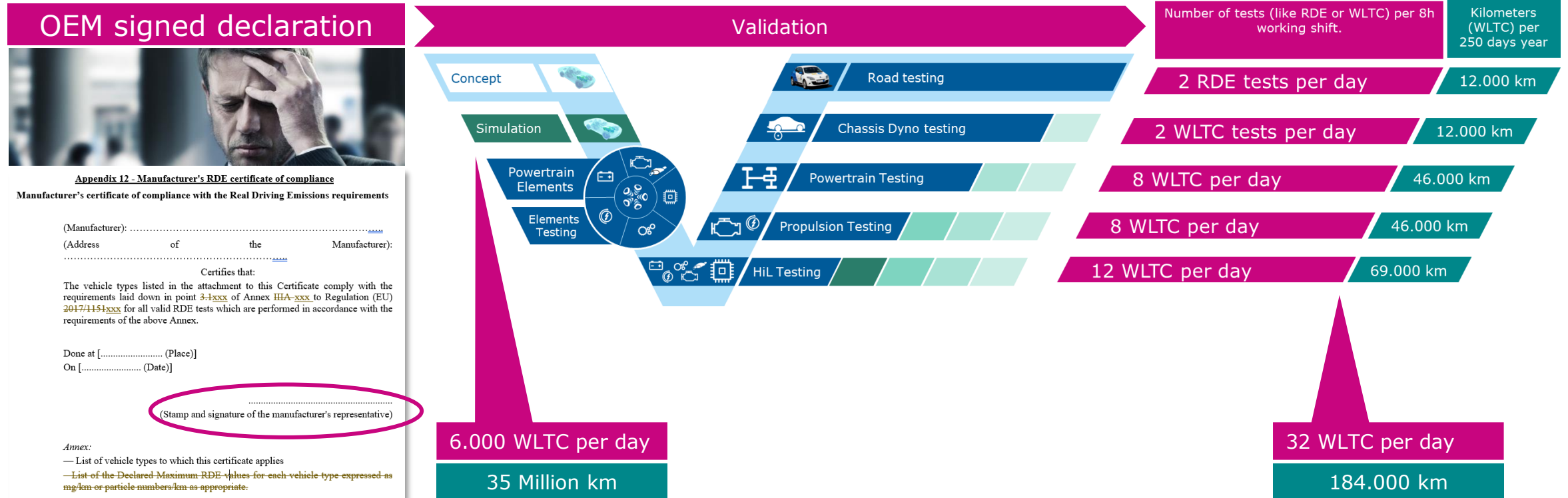
Certifies that:
 The vehicle types listed in the attachment to this Certificate comply with the requirements laid down in point 3.1.1.1 of Annex IIIA to Regulation (EU) 2017/1154 for all valid RDE tests which are performed in accordance with the requirements of the above Annex.

Done at [..... (Place)]
 On [..... (Date)]

.....
 (Stamp and signature of the manufacturer's representative)

Annex:
 — List of vehicle types to which this certificate applies
 — List of the Declared Maximum RDE values for each vehicle type expressed as mg/km or particle numbers/km as appropriate.

How to secure “OEM Certificate of compliance”



Euro 7 Heavy-Duty:





Heavy-Duty Vehicles

Euro 7 Heavy-Duty: Limits




EURO 7 EMISSION LIMITS


Table 2: Euro 7 exhaust emission limits for M₂, M₃, N₂ and N₃ vehicles with internal combustion engine and internal combustion engines used in those vehicles

Pollutant emissions	 Cold emissions ²	 Hot emissions ³	Emission budget for all trips less than 3*WHTC long	Optional idle emission limits ⁴
	<i>per kWh</i>	<i>per kWh</i>	<i>per kWh</i>	<i>per hour</i>
NO _x in mg	350	90	150	5000
PM in mg	12	8	10	
PN ₁₀ in #	5x10 ¹¹	2x10 ¹¹	3x10 ¹¹	
CO in mg	3500	200	2700	
NMOG in mg	200	50	75	
NH ₃ in mg	65	65	70	
CH ₄ in mg	500	350	500	
N ₂ O in mg	160	100	140	
HCHO in mg	30	30		



Tests with more than 3 WHTC windows must fulfill both limits, Cold and Hot. However, there will be no separate hot or cold test.

 Cold limit is 100% percentile, so including cold start peaks.

 Hot limit is 90% percentile, so excluding cold start peaks.

RDE tests up to 3 WHTC windows must fulfill the Emission Budget limit.

Idling (hoteling): Automatic engine off after 300s or Idle emission limit of 5000mg/h.



Engine fuel mapping cycle for VECTO CO₂ simulation.



² Cold emissions refers to the 100th percentile of moving windows (MW) of 1 WHTC for vehicles, or WHTC_{cold} for engines

³ Hot emission refers to the 90th percentile of moving windows (MW) of 1 WHTC for vehicles or WHTC_{hot} for engines

⁴ Applicable only if a system is not present that automatically shuts down the engine after 300 seconds of continuous idling operation (once the vehicle is stopped and brakes applied)

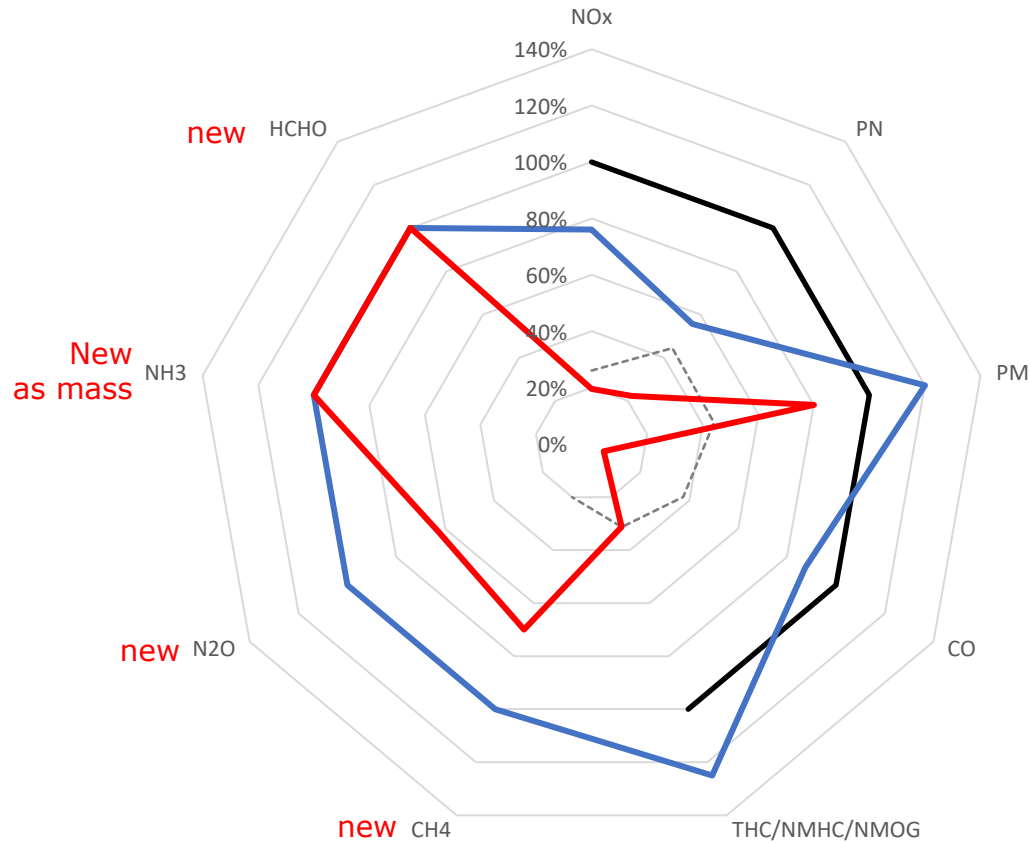


In discussion if an engine pollutant WHTC cycle is needed. EU Commission cares only for vehicle, OEMS prefer a testbed test for **multi stage vehicle** applications.

Euro 7 Heavy-Duty: Limits



Heavy Duty: Euro-VI to Euro 7



Euro VI Limit shown as 100% reference.
i.e.: Weighted Cold (15%) and Warm (85%) WHTC result.

Euro 7 CLOVE limit proposal A.
A was the moderate proposal, there lower version B.

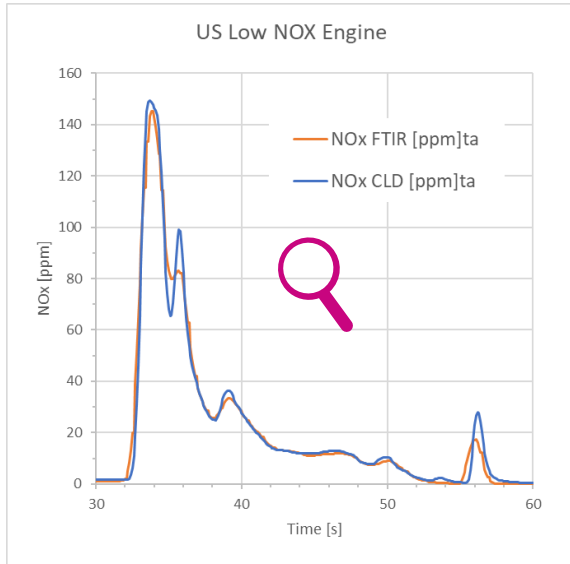
Euro 7 EU Commission proposal – Cold limit

- Cold limit is 100% percentile, so including cold start peaks.
- Euro 7 PN are shown including a factor 1.5 for the reduction from PN23 to PN10

Euro 7 EU Commission proposal – Hot limit

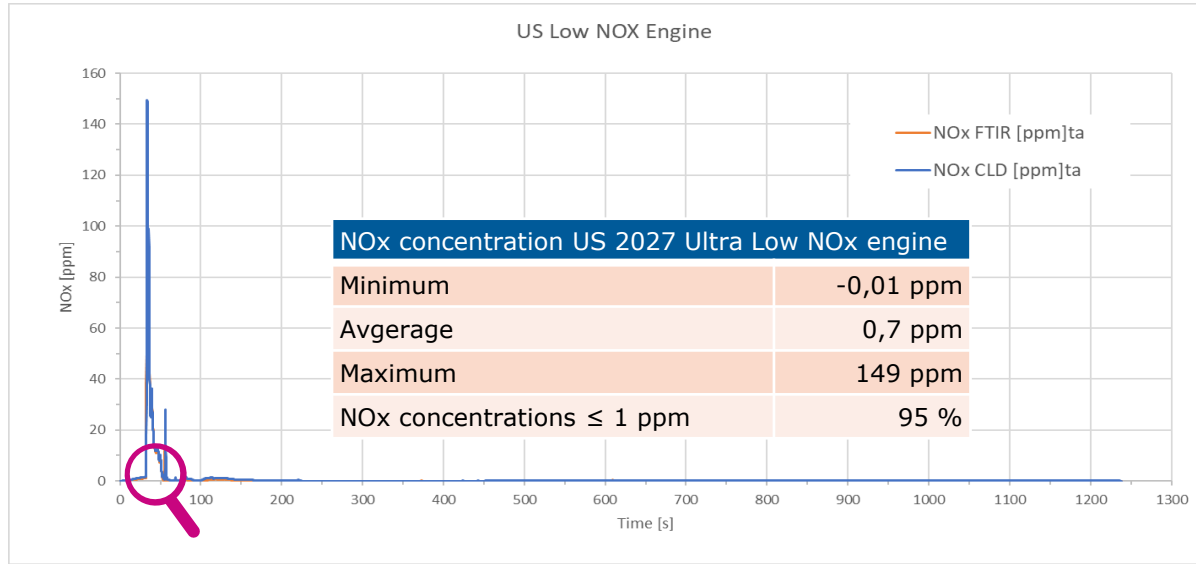
- Hot limit is 90% percentile, so excluding cold start peaks.
- Euro 7 PN are shown including a factor 1.5 for the reduction from PN23 to PN10

US 2027 Ultra Low NOx - Example



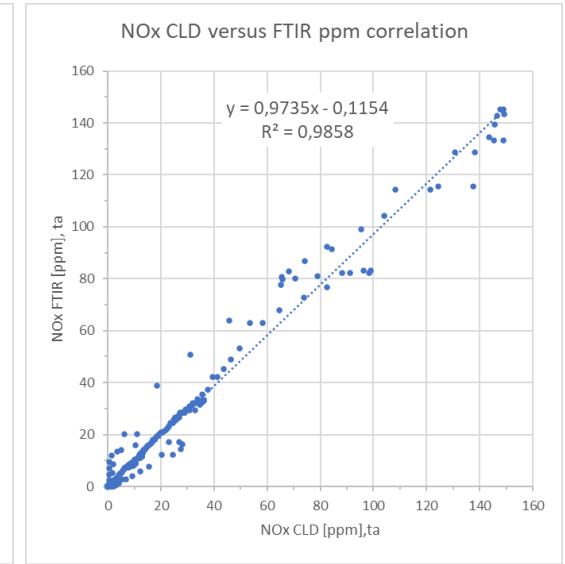
Zoom into engine start

- ✓ Good dynamic
- ✓ Excellent low signal noise



US Heavy-Duty Transient Cycle

- ✓ Good measurement of concentration peaks
- ✓ Excellent close to zero concentration measurement
- 💡 Raw concentration measurement is recommended
- 💡 A stable zero reading (average) is most important. e.g.: 1ppm offset results in 100% error



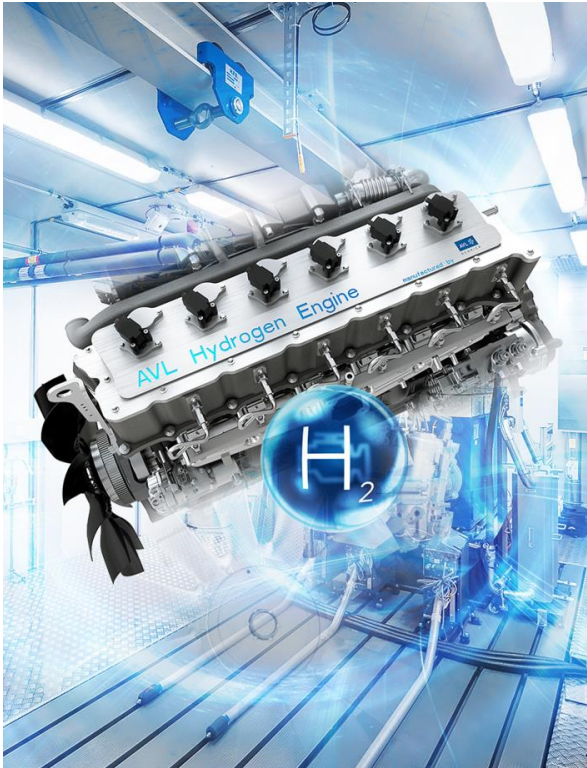
Correlation CLD versus FTIR [ppm] of 10Hz Data i.e.: 12.380 data points

- ✓ Good Correlation between CLD and FTIR

„ta“ is time alinged data

H2 (Carbon free fuel) in Emission Regulations:

⚡H₂



Carbon free fuel ICE Emission Regulations	UN-ECE / EU	USA	ISO
Use cases	(Very) Lean Proposal	All use cases	All use cases
Fuel	H2	All Carbon-free fuels (H2, NH3)	All Carbon-free fuels (H2, NH3)
Fuel type	Mono fuel	Mono and Dual fuels	Mono and Dual fuels
Emissions measured	All limited components	Criteria emissions plus H2O, H2, and NH3	Criteria emissions plus H2O, H2, and NH3
Measurement method:			
Raw exhaust	✓	✓	✓
Continuous diluted	X	✓	✓
Bag diluted	X	✓	✓
Exhaust flow rate determination	<ul style="list-style-type: none"> measured 	<ul style="list-style-type: none"> Measured or Calculated out of 2 quantities of O2, H2O or H2 plus NH3 for NH3 fuel. 	<ul style="list-style-type: none"> Measured or Calculated out of 2 quantities of O2, H2O or H2 plus NH3 for NH3 fuel.
Dry-to-Wet correction	✓	✓	✓
CVS Background correction	No (No CVS measurement)	✓	✓

Euro 7: Limits



Table 4: Euro 7 brake particle emission limits in standard driving cycle applying until 31/12/2034

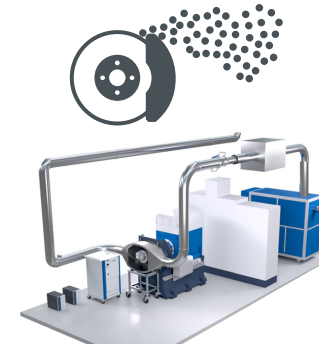
Emission limits in mg/km per vehicle	M1, N1 vehicles	M2, M3 vehicles	N2, N3 vehicles
Brake particle emissions (PM ₁₀)	7	?	?
Brake particle emissions (PN)	?	?	?

Table 5: Euro 7 brake particle emission limits in applying from 1/1/2035

Emission limits in mg/km per vehicle	M1, N1 vehicles	M2, M3 vehicles	N2, N3 vehicles
Brake particle emissions (PM ₁₀)	3	?	?
Brake particle emissions (PN)	?	?	?

Table 6: Euro 7 tyre abrasion rate limits

Tyre mass lost in g/1000 km	C1 tyres	C2 tyres	C3 tyres
Normal tyres			
Snow tyres	?	?	?
Special use tyres			

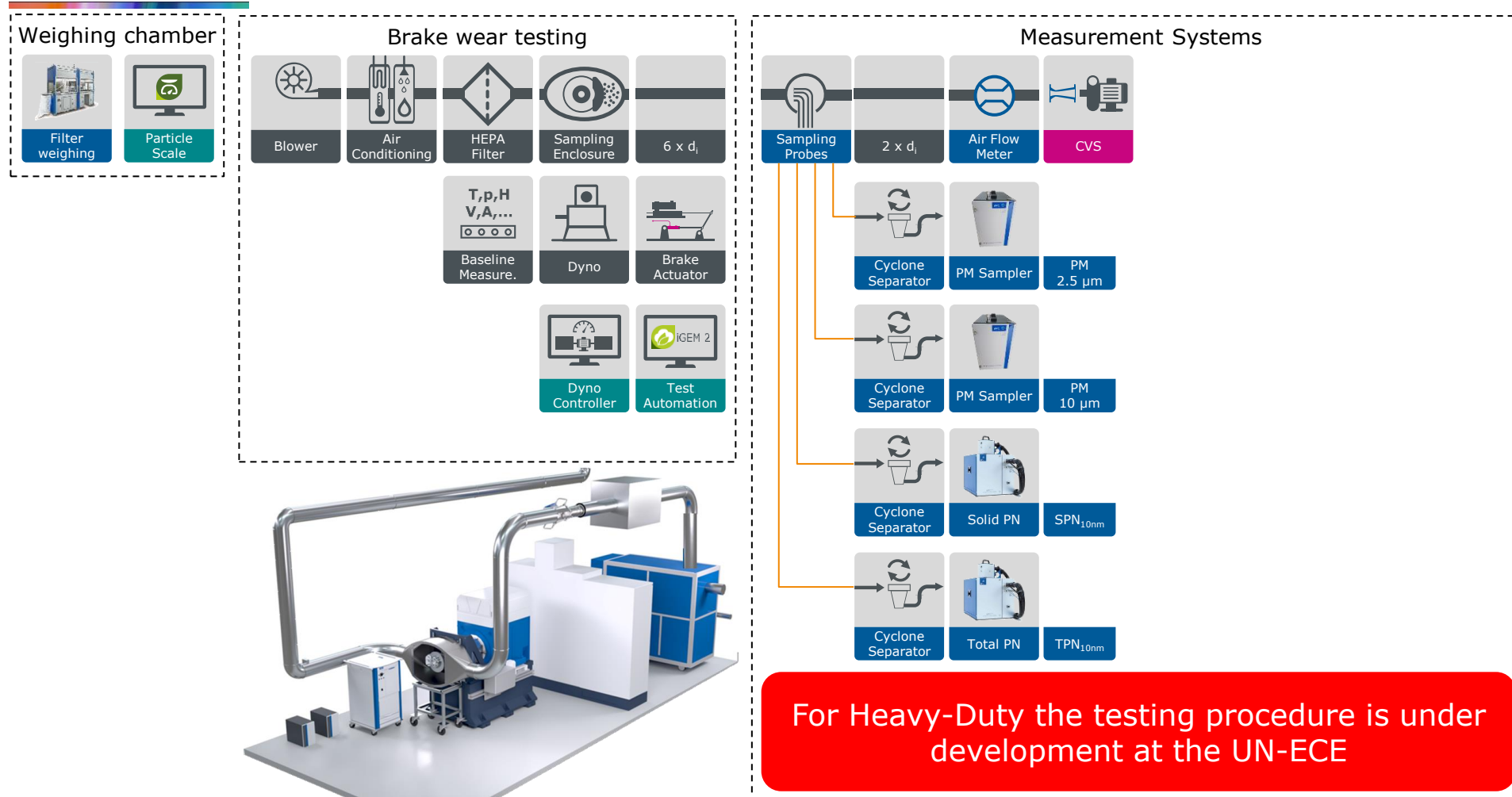


Brake particulate is a totally new test procedure with new test systems. Currently the testing is only defined for light-duty vehicles and heavy-duty vehicles will follow. Limit with 7mg/km is challenging, most current vehicles are higher. In 2035 a 3mg/km limit shall apply.



Tire abrasion test method is currently developed at UN-ECE GRBP/GRPE. Limits are not defined yet and will be based on g lost per 1000km.

Euro 7: Brake wear testing



- Brake wear:**
- New testing and measurement systems
 - Temperature $20 \pm 2^\circ\text{C}$
 - Humidity $50 \pm 5\% \text{RH}$
 - Isokinetic sampling
 - Very long test cycles makes automations systems needed.
 - Filter conditioning and weighing like tailpipe PM

AVL iGEM2™ for Brake Emission Testing

- Diagnostic, test sequence controller, reporting

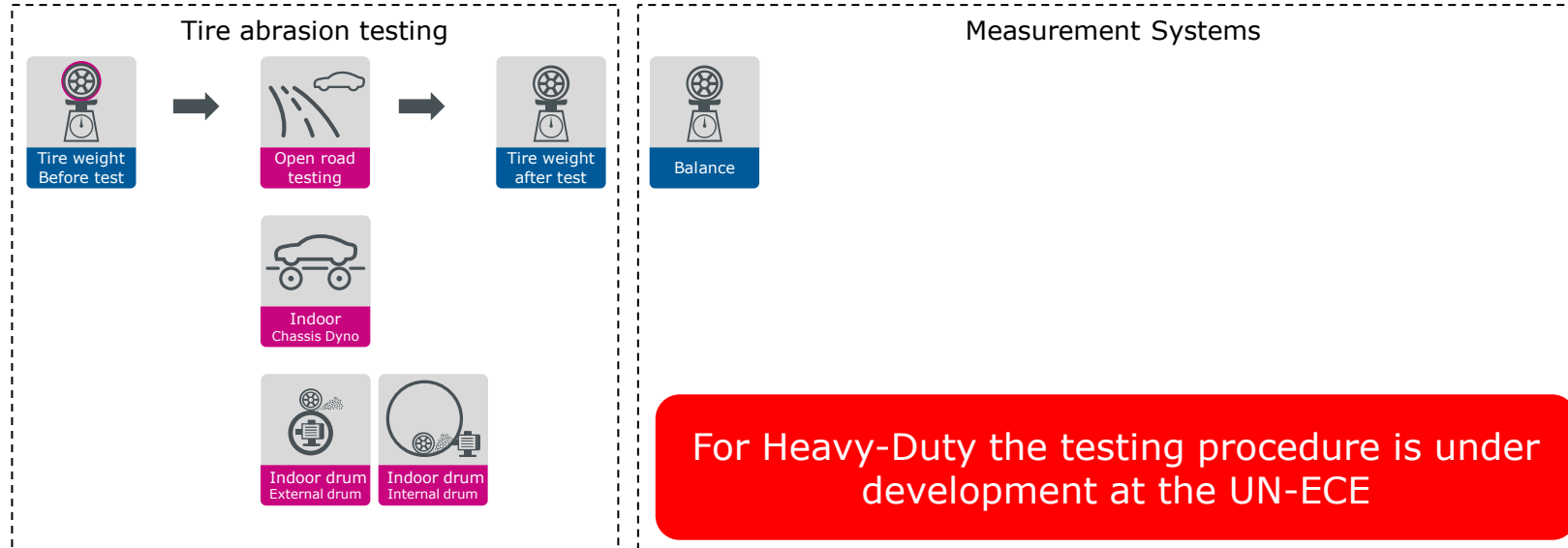
AVL CONCERTO 5™

- Result calculation and reporting

Legend: Testbed and instrumentations | Required / recommended Measurement systems | Alternative Measurement systems | R&D and optional Measurement systems | Automation and SW Systems

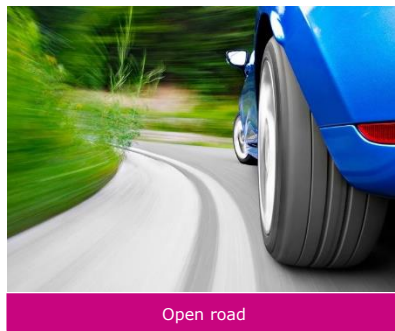


Euro 7: Tire micro plastic abrasion:



Tire abrasion:

- The test method is currently developed at UN-ECE GRBP/GRPE.
- How the tire abrasion is simulated is still open, candidates are:
 - Driving on open road
 - Indoor drum testing
 - Chassis Dyno
 - External Drum
 - Internal Drum
- Measurement will be based on measuring the weight lost of the tire after a certain millage (app. 5000km) driven.



Legend:

Testbed and instrumentations	Required / recommended Measurement systems	Alternative Measurement systems	R&D and optional Measurement systems	Automation and SW Systems
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Summary: Being ready for Euro 7



- 1
- Products
- 2
- 6 different testing solutions / environments
- 3
- Building up Competence



M.O.V.E NH3 PEMS
launched in 2023



M.O.V.E FT (FTIR)
launched in 2023



Automation system



<p>Laboratory: Chassis Dyno</p> <p>✓</p>	<p>Laboratory: Engine Testbed</p> <p>✓</p>	<p>On-Road: Real Driving Emissions</p> <p>✓</p>
<p>Laboratory: Evaporative</p> <p>✓</p>	<p>Laboratory: Brake wear</p> <p>✓</p>	<p>Laboratory: Tire abrasion</p> <p>?</p>

+ Simulation (SWL and HIL) and Powertrain testbeds for development and validation



Hands-On
Experience



Training of AVL service and
technical sales supporters.

One more thing: CO2 Meiner Reise nach Leimen



Diese Präsentation war ist vorbereitet und präsentiert in Leimen, Deutschland.

nachdenken • klimabewusst reisen
atmosfair

Zertifikat

für kompensierte Treibhausgase

Kurt Engeljehringer
kompensiert am 24.05.2023 mit atmosfair
588 kg CO₂ Treibhausgase.

Was bewirkt Ihr Klimaschutzbeitrag?

Mit Ihrem Klimaschutzbeitrag in Höhe von 14,00 Euro unterstützen Sie u.a. folgende Projekte:



Effiziente Kochsysteme für Familien in Nigeria

Mit Ihrem Beitrag kann ca. eine Wunderbox finanziert werden, in der das Essen ohne weitere Energiezufuhr garen kann.



Stromerzeugung aus Senfernte-resten in Indien

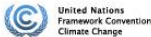
Mit Ihrem Beitrag kann eine Familie 8 Monate mit erneuerbarem Strom versorgt werden.



Bau von Biogasanlagen für Haushalte in Kenia

Mit Ihrem Beitrag kann ca. eine Trainings-einheit eines Malners für den Bau der Anlagen finanziert werden.

Seit dem 01.01.2021 betreibt atmosfair die Genehmigung der Projekte nach dem neuen Regelwerk des Klimaschutzabkommens von Paris. Die hier aufgeführten Projekte haben bereits Zusagen der Gastländer erhalten (inkl. sog. Corresponding Adjustments) oder nutzen CO₂-Minderungen von vor dem obigen Stichtag, um Doppelzählungen auszuschließen.



Mehr auf atmosfair.de

588 kg CO₂

- Fossile Flugreise Graz to Frankfurt: 568 kg CO₂
- Autofahrt 180km: 20 kg CO₂

14€ for CO₂ travel footprint compensation:

- I have privately compensated it at atmosfair.com with 10€ for the flight and 1€ for the rest. The compensation is done by:



Effiziente Kochsysteme für Familien in Nigeria

Mit Ihrem Beitrag kann ca. eine Wunderbox finanziert werden, in der das Essen ohne weitere Energiezufuhr garen kann.



Stromerzeugung aus Senfernte-resten in Indien

Mit Ihrem Beitrag kann eine Familie 3 Monate mit erneuerbarem Strom versorgt werden.



CO₂-neutrales E-Kerosin

Sie fördern die Produktion von CO₂-neutralem E-Kerosin in einer Pilotanlage im Emsland und den Bau von Folgeanlagen.

Thank you



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