

NOx-Emissions of LCV in real world compared to chassis dyno tests

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Vehicle sample

LCV, Euro 6b, N1-III

	Renault Traffic dCi145	Ford Transit 350 L2	Mercedes Benz Vito 119BT4x4	Citroen Jumpy Space Tourer	VW T6 TDI 4M	lveco Daily 35S14
empty weight [kg]	2030	2230	2260	1930	2337	2400
test weight low [kg]	2325	2604	2499	2203	2520	2726
test weight high [kg]	2870	3322	2920	2698	3052	3339
total weight [kg]	3020	3500	3050	2840	3200	3500
displacement [cm3]	1598	1995	2143	1997	1968	2287
rated power [kW]	107	96	140	130	110	100
exhaust aftertreatment [-]	EGR/DOC/DPF/SCR/ASC	EGR/DOC/DPF/SCR/ASC	EGR/DOC/DPF/SCR/ASC	EGR/DOC/DPF/SCR	EGR/DOC/DPF/SCR/ASC	EGR/DOC/NSC/DPF
gearbox [-]	M6	M6	AT7	A6	M6 - AWD	A6
1st certification [mm.jj]	12.2016	11.2016	12.2015	05.2017	07.2017	05.2017
type approval [CH]	1RC363	3FF812	1MG84	1CF812	1VF997	3TB974
mileage [km]	8587	18331	41002	10364	2124	33876

Test weight low: WLTP weight setting with 28% payload *Test weight high:* RDE max Setting (90% of maximum passenger- and payload)















RDE Trip Empa standard RDE route

Trip Daten Trip data				
	Urban	Rural	M.way	Total
Geschwindigkeiten [km/h]: Speed Tresholds [km/h]:	1-60	60-90	90-145	-
Mittl. Geschwindigkeit [km/h]: A verage speed [km/h]:	32.4	78.9	109.8	55.3
v<1 km/h [%], v>100 km/h [min]: v<1 <i>km/h [%], v>1</i> 00 <i>km/h [min]:</i>	11.6	-	4.6	-
Distanz [km]: Distance [km]	13.5	13.0	11.3	37.8
Streckenanteil [%]: Distance share [%]:	35.7	34.2	30.0	100.0
Dauer [min]: Duration [min]:	25.0	9.9	6.2	41.0
Max. Geschwindigkeit [km/h]: Max. Velocity [km/h]:	-	-	128.5	-
Abteil 145 < v < 160 [%]: Share 145< v <160 [%]:	-	-	0.0	-
Stops > 10s [-]; Höhendiff [m]: # of Stops > 10s [-]; delta h [m]:	4	_	_	1.8
Umgebungstemperatur [°C]: Ambient Temperature [°C]:	_	-	-	23.0



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Chassis Dyno Setup

Chassis Dyno Setup





Results, Chassis Dyno

Legislative Cycles, emission limits of Euro6c for N1-III vehicles



Please note that the WLTP weight setting (+28% payload) was used for NEDC testing Empa | Thomas Bütler | NOx-Emissions of LCV, real world vs. chassis dyno | 14.03.19



Results, Chassis Dyno



Comparison of 23°C test to -7°C low temperature test



- SCR systems mostly not active due to low temperature (freezing point AdBlue: -11.5°C)
- Probably also reduced EGR activity at low temperature
- For Euro6b diesel vehicles no low temperature test mandatory, this will change with WLTP



Results, PEMS

Hot RDE emissions (cold start emissions excluded)



- Ambient temperatures between 8°C and 35°C
- No additional exclusion of data points, distance weighted total result
- Red lines indicate the emission limit (solid) and the not to exceed limit for RDE (dashed, factor 2.1)



Data comparison

Chassis dyno vs. PEMS



- NO₂ to NOx fractions lie in a comparable range to other studies
- In general, SCR systems lead to a higher NO₂ share
- The low NO₂ share of the Ford might be explained with the high CO values of this vehicle

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Conclusion

- Particulate emissions (mass and number) of the tested vehicles are complying with the corresponding limit level
- Real world chassis dyno cycle (CADC) delivers mainly comparable NOx values as the RDE testing
- Low temperature chassis dyno test show a significant increase in NOx emission due to reduced activity of the after treatment system
- Real world NOx emissions of the vehicle sample lie mainly above the emission limit and mostly also above the NTE limit for RDE
- Challenges for Euro6d vehicles:
 - Low temperature testing of all vehicle categories
 - Complying with RDE emission limits for a wide range of scenarios and weight settings



Thank you for your attention!

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