

Technology Solution to Remove Soot from Tehran Air

Iranian Society of Engine



Table 1: EU Emission Standards for Heavy-Duty Diesel Engines: **Steady-State Testing**

Stage	Date	Test	CO	HC	NOx	PM	PN	Smoke
			g/kWh				1/kWh	1/m
Euro I	1992, ≤ 85 kW	ECE R-49	4.5	1.1	8.0	0.612		
	1992, > 85 kW		4.5	1.1	8.0	0.36		
Euro II	1996.10		4.0	1.1	7.0	0.25		
	1998.10		4.0	1.1	7.0	0.15		
Euro III	<i>1999.10 EEV only</i>		ESC & ELR	1.5	0.25	2.0	0.02	
	2000.10	2.1		0.66	5.0	0.10 ^a		0.8
Euro IV	2005.10	1.5		0.46	3.5	0.02		0.5
Euro V	2008.10	1.5		0.46	2.0	0.02		0.5
Euro VI	2013.01	WHSC	1.5	0.13	0.40	0.01	8.0×10 ¹¹	

a - PM = 0.13 g/kWh for engines < 0.75 dm³ swept volume per cylinder and a rated power speed > 3000 min⁻¹

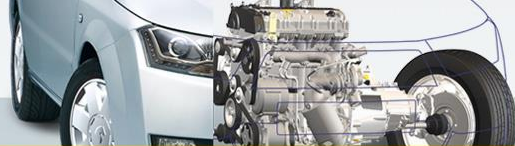


Table 2: EU Emission Standards for Heavy-Duty Diesel and Gas Engines: **Transient Testing**

Stage	Date	Test	CO	NMHC	CH ₄ ^a	NOx	PM ^b	PN ^e
			g/kWh					
Euro III	1999.10 <i>EEV only</i>	ETC	3.0	0.40	0.65	2.0	0.02	
	2000.10		5.45	0.78	1.6	5.0	0.16 ^c	
Euro IV	2005.10		4.0	0.55	1.1	3.5	0.03	
Euro V	2008.10		4.0	0.55	1.1	2.0	0.03	
Euro VI	2013.01	WHTC	4.0	0.16 ^d	0.5	0.46	0.01	6.0×10 ¹¹

a - for gas engines only (Euro III-V: NG only; Euro VI: NG + LPG)

b - not applicable for gas fueled engines at the Euro III-IV stages

c - PM = 0.21 g/kWh for engines < 0.75 dm³ swept volume per cylinder and a rated power speed > 3000 min⁻¹

d - THC for diesel engines

e - for diesel engines; PN limit for positive ignition engines TBD



Table 3: Emission Durability Periods

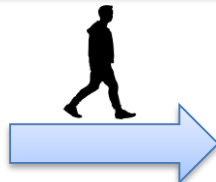
Vehicle Category†	Period*	
	Euro IV-V	Euro VI
N1 and M2	100 000 km / 5 years	160 000 km / 5 years
N2 N3 ≤ 16 ton M3 Class I, Class II, Class A, and Class B ≤ 7.5 ton	200 000 km / 6 years	300 000 km / 6 years
N3 > 16 ton M3 Class III, and Class B > 7.5 ton	500 000 km / 7 years	700 000 km / 7 years

† Mass designations (in metric tons) are “maximum technically permissible mass”
* km or year period, whichever is the sooner



EURO III + DPF

For Gaseous Emission



EURO III:

- CO: 2.1 [g/kWh]
- HC: 0.66 [g/kWh]
- NOx: 5.0 [g/kWh]

For Particle Emission



EURO VI:

- PM: 0.01 [g/kWh]
- PN: 8.0×10^{11} [1/kWh]

Another Proposal: **EEV**
(Enenhanced
Environmentally friendly
Vehicle)



- CO: 1.5 [g/kWh]
- HC: 0.25 [g/kWh]
- NOx: 2.0 [g/kWh]
- PM: 0.02 [g/kWh]
- Smoke: 0.15 [1/m]



- Not all DPF installation is a solution!
- Emissions During Regeneration Period

2.8. Testing of Exhaust Aftertreatment Systems

If the engine is equipped with an exhaust aftertreatment system, the emissions measured on the test cycle(s) shall be representative of the emissions in the field. If this cannot be achieved with one single test cycle (e.g. for particulate filters with periodic regeneration), several test cycles shall be conducted and the test results averaged and/or weighted. The exact procedure shall be agreed by the engine manufacturer and the Technical Service based upon good engineering judgement.

- Fuel quality (sulfur content) >> Emission Durability