

Emission regulation for non-road mobile machinery: EU Stage V – Fact Sheet

1. About this fact sheet

This fact sheet summarizes central aspects of the EU Stage V emission regulation for non-road mobile machinery (NRMM). The regulation

(EU) 2016/1628 of the European Parliament and of the Council of 14 September 2016 on requirements relating to gaseous and particulate pollutant emission limits and type-approval for internal combustion engines for non-road mobile machinery, amending Regulations (EU) No 1024/2012 and (EU) No 167/2013, and amending and repealing Directive 97/68/EC

was published in the Official Journal of the EU on 16 September 2016 and entered into force on 6 October 2016. The regulation shall apply from 1 January 2017. Directive 97/68/EC is repealed with effect from 1 January 2017. Unlike the 97/68/EC, the (EU) 2016/1628 does not need to be transposed into national law.

Supplementing technical details such as the test requirements to obtain a type approval certificate were published in the Official Journal of the EU on 13 April 2017 and entered into force on 3 May 2017. (see Top 10 for further information)

This fact sheet is going to be updated if necessary.

2. What's new

- Extension of the scope to engines with a reference power < 19 kW and > 560 kW, for spark-ignited engines (SI) and compression-ignition engines (CI)
- Introduction of a particle number limit value of $1 \cdot 10^{12}$ #/kWh for engine categories NRE (19 kW - 560 kW), IWA/IWP (greater 300 kW) and RLR, deployment of DPF necessary
- Equal treatment of engines with variable and constant speed
- Emission limits to be applied to gas engines in all power ranges
- In Service Monitoring of engines (Article 19)
- Flexibility Scheme of 97/68/EC is replaced by a transition period of 24 months (see p. 4)
- Engine categories defined in Article 4 of the regulation:
 - **NRE**: engines for non-road mobile machinery
 - **NRG**: engines having a reference power that is greater than 560 kW, exclusively for use in generating sets
 - **NRSh**: hand-held SI engines having a reference power that is less than 19 kW, exclusively for use in hand-held machinery
 - **NRS**: SI engines having a reference power that is less than 56 kW and not included in category NRSh
 - **IWP/IWA**: engines exclusively for use in inland waterway vessels, for their direct or indirect propulsion (IWP) or as auxiliary engines (IWA)
 - **RLL/RLR**: engines exclusively for use in locomotives (RLL) or railcars (RLR), for their propulsion or intended for their propulsion

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3. Introduction dates and emission limits [g/kWh] for engine category NRE (CI/SI), comparison to prior stages according to 97/68/EC

Power [kW]		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
0 < P < 8	Type approval																	Stage V CO 8,00 / HC+NOx 7,50 / PM 0,40 ³⁾ / PN -				
	Placing on the market ¹⁾²⁾																	Stage V				
8 ≤ P < 19	Type approval																	Stage V CO 6,60 / HC+NOx 7,50 / PM 0,40 / PN -				
	Placing on the market ¹⁾²⁾																	Stage V				
18 ≤ P < 37 19 ≤ P < 37 ⁴⁾	Type approval	Stage II CO 5,5 / HC 1,5 / NOx 8,0 / PM 0,8				Stage III A CO 5,5 / HC+NOx 7,5 / PM 0,6								Stage V CO 5,00 / HC+NOx 4,70 / PM 0,015 / PN 1x10 ¹² [#kWh]								
	Placing on the market ¹⁾²⁾	Stage II				Stage III A								Stage V								
37 ≤ P < 56	Type approval	Stage II CO 5,0 / HC 1,3 / NOx 7,0 / PM 0,4				Stage III A CO 5,0 / HC+NOx 4,7 / PM 0,4				Stage III B CO 5,0 / HC+NOx 4,7 / PM 0,025				Stage V CO 5,00 / HC+NOx 4,70 / PM 0,015 / PN 1x10 ¹² [#kWh]								
	Placing on the market ¹⁾²⁾	St. I	Stage II			Stage III A				Stage III B				Stage V								
56 ≤ P < 75	Type approval	Stage II CO 5,0 / HC 1,3 / NOx 7,0 / PM 0,4				Stage III A CO 5,0 / HC+NOx 4,7 / PM 0,4				Stage III B CO 5,0 / HC 0,19 / NOx 3,3 / PM 0,025		Stage IV (01.10.2013) CO 5,0 / HC 0,19 / NOx 0,4 / PM 0,025				Stage V CO 5,00 / HC 0,19 / NOx 0,40 / PM 0,015 / PN 1x10 ¹² [#kWh]						
	Placing on the market ¹⁾²⁾	St. I	Stage II			Stage III A				Stage III B		Stage IV (01.10.2014)				Stage V						
75 ≤ P < 130	Type approval	Stage II CO 5,0 / HC 1,0 / NOx 6,0 / PM 0,3				Stage III A CO 5,0 / HC+NOx 4,0 / PM 0,3				Stage III B CO 5,0 / HC 0,19 / NOx 3,3 / PM 0,025		Stage IV (01.10.2013) CO 5,0 / HC 0,19 / NOx 0,4 / PM 0,025				Stage V CO 5,00 / HC 0,19 / NOx 0,40 / PM 0,015 / PN 1x10 ¹² [#kWh]						
	Placing on the market ¹⁾²⁾ ; NRMM	Stage II				Stage III A				Stage III B		Stage IV (01.10.2014)				Stage V						
	Placing on the market ¹⁾²⁾ ; Tractors	Stage I	Stage II			Stage III A				Stage III B		Stage IV (01.10.2014)				Stage V						
130 ≤ P ≤ 560	Type approval NRMM	Stage II CO 3,5 / HC 1,0 / NOx 6,0 / PM 0,2				Stage III A (2005-07-01) CO 3,5 / HC+NOx 4,0 / PM 0,2				Stage III B CO 3,5 / HC 0,19 / NOx 2,0 / PM 0,025		Stage IV CO 3,5 / HC 0,19 / NOx 0,4 / PM 0,025				Stage V CO 3,50 / HC 0,19 / NOx 0,40 / PM 0,015 / PN 1x10 ¹² [#kWh]						
	Type approval Tractors	Stage II				Stage III A				Stage III B		Stage IV				Stage V						
	Placing on the market ¹⁾²⁾	Stage II				Stage III A				Stage III B		Stage IV				Stage V						
P > 560	Type approval																	Stage V CO 3,50 / HC 0,19 / NOx 3,50 / PM 0,045 / PN -				
	Placing on the market ¹⁾²⁾																	Stage V				
		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	

¹⁾ In Stage I & II for each category, Member States may postpone each date mentioned in the above requirement for two years in respect of engines with a production date prior to the said date. This option became mandatory with Stage III A and will become invalid with Stage V

²⁾ Until Stage IV: Placing on the market of engines, from Stage V: Placing on the market of engines & machines

³⁾ 0,60 for hand-startable, air-cooled direct injection engines

⁴⁾ Range is introduced with Stage III A

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4. Dates of application and emission limits for engine categories IWP/IWA

Power [kW]	CI/SI	CO [g/kWh]	HC ¹⁾ [g/kWh]	NOx [g/kWh]	PM [g/kWh]	PN [#kWh]	A ¹⁾	Date ²⁾
19 ≤ P < 75	both	5,00	(HC + NOx ≤ 4,70)		0,30	-	6,00	1.1.2019
75 ≤ P < 130	both	5,00	(HC + NOx ≤ 5,40)		0,14	-	6,00	1.1.2019
130 ≤ P < 300	both	3,50	1,00	2,10	0,10	-	6,00	1.1.2019
P ≥ 300	both	3,50	0,19	1,80	0,015	1*10 ¹²	6,00	1.1.2020

1) for gas engines the A-Factor is being used to determine HC emission limits

2) Placing on the market, type approval one year earlier

5. Dates of application and emission limits for engine categories RLL and RLR, all power ranges greater 0 kW

Engine category	CI/SI	CO [g/kWh]	HC ¹⁾ [g/kWh]	NOx [g/kWh]	PM [g/kWh]	PN [#kWh]	A ¹⁾	Date ¹⁾
RLL	both	3,50	(HC + NOx ≤ 4,00)		0,025	-	6,00	1.1.2021
RLR	both	3,50	0,19	2,00	0,015	1*10 ¹²	6,00	1.1.2021

1) for gas engines the A-Factor is being used to determine HC emission limits

2) Placing on the market, type approval one year earlier

6. Specific provisions on total hydrocarbon (HC) limits for fully and partially gaseous-fueled engines

- HC limit is replaced by a limit calculated using the following formula $HC = 0,19 + (1,5 \times A \times GER)$, the maxim allowed is $HC = 0,19 + A$
- For sub-categories with a combined HC and NOx limit, the combined limit value for HC and NOx shall be reduced by 0,19 g/kWh and apply for NOx only
- GER is the average gas energy ratio over the appropriate test cycle
- For engine category NRE the A-Factor is 1,10 respectively 6,00 for engines with P > 560 kW
- For engine category NRG the A-Factor is 6,00

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7. Transitional provisions and exemptions (§ 58)

The regulation (EU) 2016/1628 replaces the flexibility scheme of 97/68/EC with a transition period of 24 months, allowing engines to be placed on the EU market which comply with the latest applicable emission limits prior to Stage V.

- The transition period starts with dates for placing on the market of Stage V engines.
- The transition period is applied to all engine categories.
- Transition engines must comply to the latest applicable emission Stage and must be produced until the dates for placing on the market of Stage V engine.
- The machinery in which the transition engine is installed must have a production date not later than 18 months following the start of the transition period.

Power range			2016	2017	2018	2019	2020	2021	2022	
P < 56 kW & P ≥ 130 kW	Production	Engine	previous Stage			Stage V				
		Machine				with transition engine				
	Placing on the market	Engine				Transition period				
		Machine								
56 kW ≤ P < 130 kW	Production	Engine	Stage IV							
		Machine								
	Placing on the market	Engine								
		Machine								

The following exemptions apply:

- For engines of category NRE, **OEMs with a total yearly production of less than 100 units** of non-road mobile machinery equipped with internal combustion engines get an extension of an additional 12 months for the above mentioned dates.
- For engines of category NRE used in **mobile cranes**, the above mentioned dates shall be extended by 12 months.
- For engines of category NRS with an engine power of less than 19 kW used in **snow throwers**, the above mentioned dates shall be extended by 24 months.

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8. Replacement engine provision for engine category NRE (§58 (11))

- A replacement engine according to (EU) 2016/1628 is a newly produced engine exclusively used to replace an engine already placed on the market and installed in non-road mobile machinery that complies with an emission stage which is lower than that applicable on the date of the engine's replacement;
- Statutory marking is required for a replacement engine.
- Replacement engines must comply with the emission limits that the engines to be replaced had to meet when they were originally placed on the Union market. Additionally, the following staggered approach applies:

Power	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
19 kW ≤ P < 37 kW	Stage I or better		Stage II or better						Stage IIIA or better													
37 kW ≤ P < 56 kW	Stage I or better					Stage II or better				Stage IIIA or better					Stage IIIB or better							
56 kW ≤ P < 75 kW	Stage I or better					Stage II or better				Stage IIIA or better					Stage IIIB or better			Stage IV or better				
75 kW ≤ P < 130 kW	Stage I or better					Stage II or better				Stage IIIA or better					Stage IIIB or better			Stage IV or better				
130 kW ≤ P ≤ 560 kW	Stage I or better					Stage II or better				Stage IIIA or better					Stage IIIB or better			Stage IV or better				
P > 560 kW	not regulated																					
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040

Example: A machine with a Stage II engine in the power range 56 kW to 75 kW can only be overhauled with a Stage II replacement engine until the end of 2027. From 2028 onwards the replacement engine must meet Stage IIIA requirements or better.

9. Replacement engine provision for other engine categories

- For engine categories NRS (P ≥ 19 kW) and NRG replacement engines can be placed on the market for a period not longer than 15 years, starting from the applicable dates for the placing on the market of Stage V engines (see §58 (10)).
- For engine category RLL a special provision applies for locomotives running on isolated 1520 mm railway networks (see §58 (9)).
- No replacement engine provision applies or inland waterway vessel (IWA/IWP). Replacement engines placed on the market for the first time must comply with the applicable emission limit on the date of the engine's replacement.

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10. Supplementing regulations

COMMISSION DELEGATED REGULATION (EU) 2017/654 of 19 December 2016 supplementing Regulation (EU) 2016/1628 of the European Parliament and of the Council with regard to technical and general requirements relating to emission limits and type-approval for internal combustion engines for non-road mobile machinery

COMMISSION DELEGATED REGULATION (EU) 2017/655 of 19 December 2016 supplementing Regulation (EU) 2016/1628 of the European Parliament and of the Council with regard to monitoring of gaseous pollutant emissions from in-service internal combustion engines installed in non-road mobile machinery

COMMISSION IMPLEMENTING REGULATION (EU) 2017/656 of 19 December 2016 laying down the administrative requirements relating to emission limits and type-approval of internal combustion engines for non-road mobile machinery in accordance with Regulation (EU) 2016/1628 of the European Parliament and of the Council

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Errors and omissions excepted

This fact sheet is for information only. It does not replace the official legislative text of (EU) 2016/1628.