

24 June 2019

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## **Agreement**

### **Concerning the Adoption of Harmonized Technical United Nations Regulations for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these United Nations Regulations\***

(Revision 3, including the amendments which entered into force on 14 September 2017)

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### **Addendum 131 – UN Regulation No. 132**

#### **Revision 1 - Amendment 1**

Supplement 1 to the 01 series of amendments – Date of entry into force: 28 May 2019

#### **Uniform provisions concerning the approval of Retrofit Emission Control Devices (REC) for heavy duty vehicles, agricultural and forestry tractors and non-road mobile machinery equipped with compression ignition engines**

This document is meant purely as documentation tool. The authentic and legal binding texts is: ECE/TRANS/WP.29/2018/151.



**UNITED NATIONS**

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\* Former titles of the Agreement:  
Agreement concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, done at Geneva on 20 March 1958 (original version);  
Agreement concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions, done at Geneva on 5 October 1995 (Revision 2).



*Paragraph 3.13.*, amend to read:

- "3.13. "Engine system" means
- (a) For vehicles defined in paragraph 2.1., the engine, the emission control system and the communication interface (hardware and messages) between the engine system Electronic Control Unit(s) (ECU) and any other powertrain or vehicle control unit.
  - (b) For engines defined in paragraphs 2.2. to 2.4., an energy converter, other than a gas turbine, designed to transform chemical energy (input) into mechanical energy (output) with an internal combustion process; it includes, where they have been installed, the emission control system and the communication interface (hardware and messages) between the engine's electronic control unit(s) and any other powertrain or category T vehicle or non-road mobile machinery control unit."

*Paragraph 3.31.*, amend to read:

- "3.31. "Particle number" means the number of particles which is defined in the relevant series of amendments to UN Regulations Nos. 49 and 96."

*Paragraph 5.4.*, amend to read:

- "5.4. REC samples for approval testing shall be clearly identified with at least the applicant's name and the reference of the application for type approval."

*Paragraph 7.5.1.*, amend to read:

- "7.5.1. A particulate reduction REC shall be equipped with a monitoring device that detects incorrect operation or removal of the REC and that triggers an audible and/or visual alarm to the operator. For reagent based particulate reduction REC the monitoring device shall include the detection of the interruption of the input of any reagent or additive. The warning system can be based for example on the continuous measurement of the engine exhaust back-pressure"

*Paragraph 7.9.*, amend to read:

- "7.9. The approval shall be conditional upon the manufacturer providing:
- (a) written maintenance instructions to be given by the installer to the driver or operator.
  - (b) installation documents for the REC.
  - (c) instructions for an operator warning system, the inducement system and the reagent freeze protection (where applicable) to be given by the installer to the repair-workshop, or the driver or the operator, as appropriate.
  - (d) written statement to the installer, to be given to the driver or operator, on the normal operating conditions (temperature range, environmental conditions, ...) within which the REC will operate correctly."

*Add a new paragraph 8.2.2.* to read:

- "8.2.2. The specific requirements regarding the approval of a REC with respect to the emissions limits set out in the 06 series of amendments of UN Regulation No. 49 or 05 series of amendments of UN Regulation No. 96 are laid down respectively in Annex 12 and Annex 13."

*Renumber paragraph 8.2.2. (former) as paragraph 8.2.3. (new)*

*Paragraph 8.3.2.*, amend to read:

"8.3.2. The reduction efficiency shall be determined by comparison of the emissions measured over the weighted WHTC for REC to be applied to heavy-duty engines or over the weighted NRTC for REC to be applied to non-road mobile machinery or Category T vehicles engines. The reduction efficiency shall be calculated as defined in 8.3.4. of this Regulation."

*Paragraph 8.5.2., amend to read:*

"8.5.2. Direct sampling from raw exhaust gas prior to dilution is permitted. The dilution ratios of the particle number diluters (PND1 and PND2 of the particle transfer system, as defined in UN Regulations Nos. 49 and 96) shall then be adapted to the measurement range of the Particle Number Counter (PNC)."

*Paragraph 8.5.2., amend to read:*

"8.6.2. For Class III and Class IV REC, emissions of ammonia shall not exceed a mean value of 25 ppm when measured using the procedures defined in Appendix 7 to Annex 4 of the 06 series of amendments to UN Regulation No. 49 or in Appendix 7 to Annex 4 of the 05 series of amendment to UN Regulation No. 96."

*Paragraph 14.1., subparagraph (d) and (e), amend units to read:*

"(g/m<sup>3</sup>)"

*Annex 1*

*First paragraph of the Information document, amend to read:*

" Information document No..... of UN Regulation No. 132 relating to the type approval of Retrofit Emission Control devices (REC) for heavy duty vehicles, Category T vehicles and non-road mobile machinery equipped with compression ignition engines."

*Paragraphs 4.3.5., 4.3.6., 5.3.5. and 5.3.6., amend units to read:*

"(g/m<sup>3</sup>)"

*Annex 3*

*Paragraph 1., amend to read:*

"1. ...

<i>Engine No.</i>	<i>1</i>	<i>2</i>	<i>n</i>
Make			
Type			
Engine			
Power			
Category/Sub-category			

Paragraph 3., amend to read:

"3. ...

<i>Number</i>			
Vehicle or engine manufacturer			
Model year from/to			
Engine type			
Swept volume /cylinder (cm <sup>3</sup> )			
Swept volume VH (cm <sup>3</sup> )			
Engine power (kW @ min <sup>-1</sup> ) <sup>(1)</sup>			
Engine baseline emissions			
Silencer replaced			
Type identification of the REC			
REC Type and Reduction Level			

<sup>(1)</sup> Either engine power according to UN Regulation No.85 or engine maximum net power according to UN Regulation No. 120 or engine rated net power according to UN Regulation No. 120 as applicable"

*Annex 5*

Paragraph 4.6.1., second sub-paragraph, amend to read:

" ...

The determination of the NO<sub>2</sub> and NO<sub>x</sub>-mass emissions is to be carried out by simultaneous measurement in accordance with paragraph 4.7.2. of this annex and paragraph 13. of this Regulation."

Paragraph 4.7.2., third sub-paragraph, amend to read:

" ...

For CI engines used in non-road mobile machinery or Category T vehicles having an installed net power higher than 19 kW, but not more than 560 kW the calculation of the NO<sub>x</sub> and NO<sub>2</sub> emissions shall be determined over the complete NRTC cycle."

*Annex 6*

Paragraph 4.3., (fourth sub-paragraph), amend to read:

" ...

For CI engines used in non-road mobile machinery or Category T vehicles having an installed net power higher than 19 kW, but not more than 560 kW the calculation of the NO<sub>x</sub> and NO<sub>2</sub> emissions shall be determined over the complete NRTC cycle."

Annex 9

Table A9/2, amend to read:

**Equivalence Matrix for UN Regulation No. 96 / REC Class I / II**

Baseline*	Net Power (kW)	Component (g/kWh)	Class I / II, to the standard of										
			H	I	J	K	L	M	N	P	Q	R	Stage V
E	$130 \leq P \leq 560$	PM	-	-	-	-	0.025	-	-	-	0.025	-	0.015
F	$75 \leq P < 130$	PM	-	-	-	-	-	0.025	-	-	-	0.025	0.015
G	$37 \leq P < 75$	PM	-	-	-	-	-	-	0.025 <sup>(1)</sup>	0.025 <sup>(2)</sup>	-	0.025 <sup>(1)</sup>	0.015
D <sup>(3)</sup>	$19 \leq P < 37$	PM	-	-	-	0.6	-	-	-	-	-	-	0.015
H	$130 \leq P \leq 560$	PM	-	-	-	-	0.025	-	-	-	0.025	-	0.015
I	$75 \leq P < 130$	PM	-	-	-	-	-	0.025	-	-	-	0.025	0.015
J	$37 \leq P < 75$	PM	-	-	-	-	-	-	0.025 <sup>(1)</sup>	0.025 <sup>(2)</sup>	-	0.025 <sup>(1)</sup>	0.015
K	$19 \leq P < 37$	PM	-	-	-	-	-	-	-	-	-	-	0.015
L	$130 \leq P \leq 560$	PM	-	-	-	-	-	-	-	-	-	-	0.015
M	$75 \leq P < 130$	PM	-	-	-	-	-	-	-	-	-	-	0.015
N	$56 \leq P < 75$	PM	-	-	-	-	-	-	-	-	-	-	0.015
P	$37 \leq P < 56$	PM	-	-	-	-	-	-	-	-	-	-	0.015
Q	$130 \leq P \leq 560$	PM	-	-	-	-	-	-	-	-	-	-	0.015
R	$56 \leq P < 130$	PM	-	-	-	-	-	-	-	-	-	-	0.015

<sup>(1)</sup> Only for engines  $56 \leq P < 75$

<sup>(2)</sup> Only for engines  $37 \leq P < 56$

<sup>(3)</sup> Power band  $19 \leq P < 37$  adapted to the subdivision defined in 05 series of amendment of UN Regulation No. 96 (Stage V)

\* Where the baseline corresponds to that in 04 series of amendment of UN Regulation No. 96.

Table A9/3, amend to read:

**Equivalence Matrix for UN Regulation No. 96 / REC Class III**

Baseline*	Net Power (kW)	Component (g/kWh)	Class III, to the standard of										
			H	I	J	K	L	M	N	P	Q	R	Stage V
E	130 ≤ P ≤ 560	NO <sub>x</sub>	4.0 <sup>(4)</sup>	-	-	-	2.0	-	-	-	0.4	-	-
F	75 ≤ P < 130	NO <sub>x</sub>	-	4.0 <sup>(4)</sup>	-	-	-	3.3	-	-	-	0.4	-
G	37 ≤ P < 75	NO <sub>x</sub>	-	-	4.7 <sup>(4)</sup>	-	-	-	3.3 <sup>(1)</sup>	4.7 <sup>(2,4)</sup>	-	0.4 <sup>(1)</sup>	-
D <sup>(3)</sup>	19 ≤ P < 37	NO <sub>x</sub>	-	-	-	7.5 <sup>(4)</sup>	-	-	-	-	-	-	4.70 <sup>(4)</sup>
H	130 ≤ P ≤ 560	NO <sub>x</sub>	-	-	-	-	2.0	-	-	-	0.4	-	-
I	75 ≤ P < 130	NO <sub>x</sub>	-	-	-	-	-	3.3	-	-	-	0.4	-
J	37 ≤ P < 75	NO <sub>x</sub>	-	-	-	-	-	-	3.3 <sup>(1)</sup>	4.7 <sup>(2,4)</sup>	-	0.4 <sup>(1)</sup>	-
K	19 ≤ P < 37	NO <sub>x</sub>	-	-	-	-	-	-	-	-	-	-	-
L	130 ≤ P ≤ 560	NO <sub>x</sub>	-	-	-	-	-	-	-	-	0.4	-	-
M	75 ≤ P < 130	NO <sub>x</sub>	-	-	-	-	-	-	-	-	-	0.4	-
N	56 ≤ P < 75	NO <sub>x</sub>	-	-	-	-	-	-	-	-	-	0.4	-
P	37 ≤ P < 56	NO <sub>x</sub>	-	-	-	-	-	-	-	-	-	-	4.70 <sup>(4)</sup>
Q	130 ≤ P ≤ 560	NO <sub>x</sub>	-	-	-	-	-	-	-	-	-	-	-
R	56 ≤ P < 130	NO <sub>x</sub>	-	-	-	-	-	-	-	-	-	-	-

<sup>(1)</sup> Only for engines 56 ≤ P < 75

<sup>(2)</sup> Only for engines 37 ≤ P < 56

<sup>(3)</sup> Power band 19 ≤ P < 37 adapted to the subdivision defined in 05 series of amendment of UN Regulation No. 96 (Stage V)

<sup>(4)</sup> Sum of hydrocarbons and oxides of nitrogen

\* Where the baseline corresponds to that in 04 series of amendment of UN Regulation No. 96.

Table A9/4, amend to read:

**Equivalence Matrix for UN Regulation No. 96 / REC Class IV**

Baseline*	Net Power (kW)	Component (g/kWh)	Class IV, to the standard of										
			H	I	J	K	L	M	N	P	Q	R	Stage V
E	$130 \leq P \leq 560$	PM	-	-	-	-	0.025	-	-	-	0.025	-	0.015
		NO <sub>x</sub>	4.0 <sup>(4)</sup>	-	-	-	2.0	-	-	-	0.4	-	-
F	$75 \leq P < 130$	PM	-	-	-	-	-	0.025	-	-	-	0.025	0.015
		NO <sub>x</sub>	-	4.0 <sup>(4)</sup>	-	-	-	3.3	-	-	-	0.4	-
G	$37 \leq P < 75$	PM	-	-	-	-	-	-	0.025 <sup>(1)</sup>	0.025 <sup>(2)</sup>	-	0.025 <sup>(1)</sup>	0.015
		NO <sub>x</sub>	-	-	4.7 <sup>(4)</sup>	-	-	-	3.3 <sup>(1)</sup>	4.7 <sup>(2,4)</sup>	-	0.4 <sup>(1)</sup>	-
D <sup>(3)</sup>	$19 \leq P < 37$	PM	-	-	-	0.6	-	-	-	-	-	-	0.015
		NO <sub>x</sub>	-	-	-	7.5 <sup>(4)</sup>	-	-	-	-	-	-	4.70 <sup>(4)</sup>
H	$130 \leq P \leq 560$	PM	-	-	-	-	0.025	-	-	-	0.025	-	0.015
		NO <sub>x</sub>	-	-	-	-	2.0	-	-	-	0.4	-	-
I	$75 \leq P < 130$	PM	-	-	-	-	-	0.025	-	-	-	0.025	0.015
		NO <sub>x</sub>	-	-	-	-	-	3.3	-	-	-	0.4	-
J	$37 \leq P < 75$	PM	-	-	-	-	-	-	0.025 <sup>(1)</sup>	0.025 <sup>(2)</sup>	-	0.025 <sup>(1)</sup>	0.015
		NO <sub>x</sub>	-	-	-	-	-	-	3.3 <sup>(1)</sup>	4.7 <sup>(2,4)</sup>	-	0.4 <sup>(1)</sup>	-
K	$19 \leq P < 37$	PM	-	-	-	-	-	-	-	-	-	-	0.015
		NO <sub>x</sub>	-	-	-	-	-	-	-	-	-	-	4.70 <sup>(4)</sup>
L	$130 \leq P \leq 560$	PM	-	-	-	-	-	-	-	-	-	-	0.015
		NO <sub>x</sub>	-	-	-	-	-	-	-	-	0.4	-	-
M	$75 \leq P < 130$	PM	-	-	-	-	-	-	-	-	-	-	0.015
		NO <sub>x</sub>	-	-	-	-	-	-	-	-	-	0.4	-
N	$56 \leq P < 75$	PM	-	-	-	-	-	-	-	-	-	-	0.015
		NO <sub>x</sub>	-	-	-	-	-	-	-	-	-	0.4	-
P	$37 \leq P < 56$	PM	-	-	-	-	-	-	-	-	-	-	0.015
		NO <sub>x</sub>	-	-	-	-	-	-	-	-	-	-	4.70 <sup>(4)</sup>
Q	$130 \leq P \leq 560$	PM	-	-	-	-	-	-	-	-	-	-	0.015
		NO <sub>x</sub>	-	-	-	-	-	-	-	-	-	-	-
R	$56 \leq P < 130$	PM	-	-	-	-	-	-	-	-	-	-	0.015
		NO <sub>x</sub>	-	-	-	-	-	-	-	-	-	-	-

<sup>(1)</sup> Only for engines  $56 \leq P < 75$

<sup>(2)</sup> Only for engines  $37 \leq P < 56$

<sup>(3)</sup> Power band  $19 \leq P < 37$  adapted to the subdivision defined in 05 series of amendment of UN Regulation No. 96 (Stage V)

<sup>(4)</sup> Sum of hydrocarbons and oxides of nitrogen

\* Where the baseline corresponds to that in 04 series of amendments of UN Regulation No. 96.

*Annex 10*

*Paragraph 8.2., amend to read:*

- "8.2. The manufacturer shall specify a minimum acceptable reagent concentration CD<sub>min</sub>, which results in tailpipe NO<sub>x</sub> emissions not exceeding the lower of either the applicable NO<sub>x</sub> limit multiplied by 2.25 or the applicable NO<sub>x</sub> limit plus 1.5 g/kWh. For engine sub-categories with a combined HC and NO<sub>x</sub> limit, the applicable NO<sub>x</sub> limit value for the purpose of this paragraph shall be the combined limit value for HC and NO<sub>x</sub> reduced by 0.19 g/kWh."

*Insert a new Annex 13, to read:*

## "Annex 13

### **Specific requirements regarding the approval of a REC with respect to the emission limits set out in the 05 series of amendments of UN Regulation No. 96**

1. Introduction  
This annex sets out the specific requirements for the approval of a REC fitted to an engine, for the purpose of meeting the emission limits set out in the 05 series of amendments to UN Regulation No. 96.
2. Specific requirements
  - 2.1. The retrofitted engine system shall meet the following specific requirements
    - 2.1.1. The NO<sub>x</sub> and PM emissions limits set out in Table 7 and Table 8, Appendix 1 to paragraph 5. of the 05 series of amendments to UN Regulation No. 96.
    - 2.1.2. The requirements for the verification of the durability of engine systems, as laid down in Annex 8 to the 05 series of amendments to UN Regulation No. 96.
    - 2.1.3. The specific requirements to limit off-cycle emissions, as laid down in paragraph 5.6. of the 05 series of amendments to UN Regulation No. 96.
    - 2.1.4. The requirement to verify the emissions of crankcase gases, as laid down in paragraph 5.7. of the 05 series of amendments to UN Regulation No. 96.
    - 2.1.5. The requirements with regard to emission control strategies NO<sub>x</sub> control measures and particulate control measures, as laid down in Annex 9 to the 05 series of amendments to UN Regulation No. 96.
    - 2.1.6. Notwithstanding paragraph 8.6.2. of this Regulation, for Class III and Class IV REC, emissions of ammonia shall not exceed a mean value of 10 ppm when measured according to the requirements of paragraph 3.4. of Annex 9 to the 05 series of amendments to UN Regulation No. 96."