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Item 4(b) of the provisional agenda

Retrofit Emission Control Devices (REC)

Proposal for the 01 series of amendments to the UN Regulation on uniform provisions concerning the approval of Retrofit Emission Control devices for heavy duty vehicles

**Submitted by the Chair of the informal working group on Retrofit
Emission Control devices (REC)***

The text reproduced below was prepared by the chairman of the informal working group on Retrofit Emission Control devices (REC) as a result of the discussion of the informal group on retrofit emission control devices (REC) regarding a proposal for amendments to the Regulation on REC.

The modifications to the original English text are marked using track changes. The same modifications in the French and Russian versions are marked in bold for new or strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2012–2016 (ECE/TRANS/224, para. 94 and ECE/TRANS/2012/12, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

I. Proposal

Paragraph 1., amend to read:

"1. Purpose

This Regulation provides a harmonized method for the classification, evaluation and approval of Retrofit Emission Control (REC) systems for particulate matter (PM), for oxides of nitrogen (NO_x), or for both PM and NO_x, and for the determination of the levels of emissions from compression-ignition (CI) engines used in applications within the scope indicated in paragraph 2.

The Regulation provides a framework for approval of RECs for different applications with corresponding environmental performance levels **and for the identification in Type Approval of those levels.**"

Paragraph 3.5., amend to read:

"3.5. **"Class IIA or IIB retrofit emission control device (REC)"** means a REC device which is intended to control particulate matter emissions only, and which does not increase the direct tailpipe NO₂ emissions by more than the percentage specified in paragraph 8.4.2 based on the engine baseline emission NO₂ level."

Paragraph 6.2., amend to read:

"6.2. An approval number shall be assigned to each REC approved. Its first two digits (at present ~~00~~01 according to **this series of amendments**~~the Regulation in its original form~~) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The same type approval number shall not be assigned to another REC."

Add a new paragraph 7.5.4., to read:

"7.5.4. **The filter of a particulate reduction REC or a combined PM and NO_x reduction REC shall be designed and constructed in a way that in can only be installed in one direction. Intentionally or unintentionally reversing the filter shall be physically impossible.**"

Paragraph 8.3.1., amend Table 1 to read:

"8.3.1. The reduction level of a REC system is characterised by means of its reduction efficiency as specified in Table 1:

Table 1

Reduction levels

	Minimum reduction efficiency (%)	
	PM mass	NO _x
Reduction level 00 01	50 90	60

"

Paragraph 8.4.2., amend to read:

- "8.4.2. For a Class IIA REC, the NO₂ incremental increase shall not be more than ~~30-20~~ percentage points greater than the level recorded when no REC is fitted (baseline). As an example, if baseline NO₂ is 10 per cent of NO_x, the maximum permitted NO₂ emission with the REC is ~~40-30~~ per cent of NO_x measured as defined in Annex 5. For a Class IIB REC, the NO₂ incremental increase shall be no more than 30 percentage points."

Paragraph 8.5., amend (also adding paragraphs 8.5.1. to 8.5.4.) to read:

- "8.5. ~~[This paragraph is reserved for future use.]~~PM Number emissions requirements
- 8.5.1. Type I, Type II and Type IV REC approved to PM Reduction Level 01 shall provide a reduction efficiency for PM number of at least 97% from the engine baseline emissions of the test engine as defined in paragraph 12 when measured using the test procedure(s) set out in this Regulation.
- 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 Regulation 49) shall then be adapted to the measurement range of the particle number counter (PNC).
- 8.5.3. The PM number reduction efficiency is determined as the difference of 1 minus the penetration, which is the ratio between the PM number emissions downstream of the REC system and the PM number emission of the engine system before fitment of the REC. The PM number reduction efficiency is indicated as a percentage. The PM number reduction efficiency shall be determined for the appropriate test cycle as defined in paragraph 8.3.2.
- $$\text{reduction efficiency (percent)} = (1 - (E_{\text{REC}} \div E_{\text{Base}})) \times 100.$$
- 8.5.4. If two PM number measurement systems are used in parallel for measurement of the PM number reduction efficiency, they shall give measurements within 5% of each other when measuring simultaneously from the same sample point."

Paragraph 11.3., amend to read:

- "11.3. The emission control system of the original engine manufacturer shall not be modified, except for:
- (a) Modifications allowed by written permission of the original engine manufacturer; or
 - (b) In the case of a Class I, Class IIA or Class IIB REC, replacement of an existing diesel oxidation catalyst providing that:
 - (i) The requirements of paragraph 8.4. are met; and
 - (ii) The retrofitted engine system meets at least the limits for the stage to which the base engine was approved for each of the other controlled pollutants relevant to that stage;
 - (c) The installation of temperature and/or pressure measuring probes at the entrance of the NO_x reduction REC system including the dosing unit."

Add a new section 26, to read:

"26. Transitional provisions

- 26.1. As from the official date of entry into force of the 01 series of amendments, no Contracting Party applying this Regulation shall refuse to grant ECE approval under this Regulation as amended by the 01 series of amendments.
- 26.2. As from the official date of entry into force of the 01 series of amendments, Contracting Parties applying this Regulation shall not refuse the sale of RECs which meet the requirements of this Regulation as amended by the 01 series of amendments.
- 26.3. As from [1 month] after the official date of entry into force of the 01 series of amendments, Contracting Parties applying this Regulation may refuse the sale of RECs which do not meet the requirements of the 01 series of amendments to this Regulation."

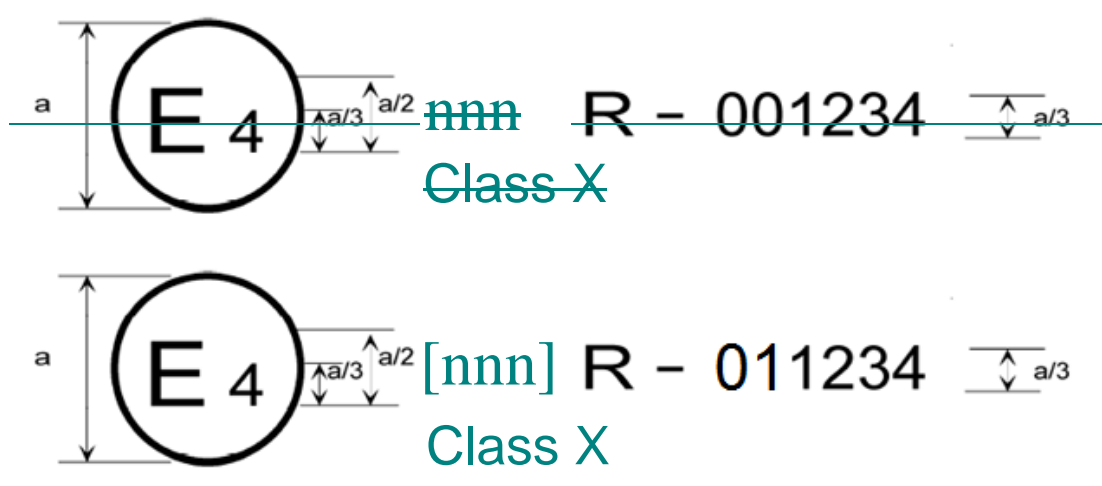
Annex 4, amend to read:

"Annex 4

Arrangement of the REC ~~System~~-Type-Approval mark

Model A

(See paragraph 5 of this Regulation)



a = 8 mm min

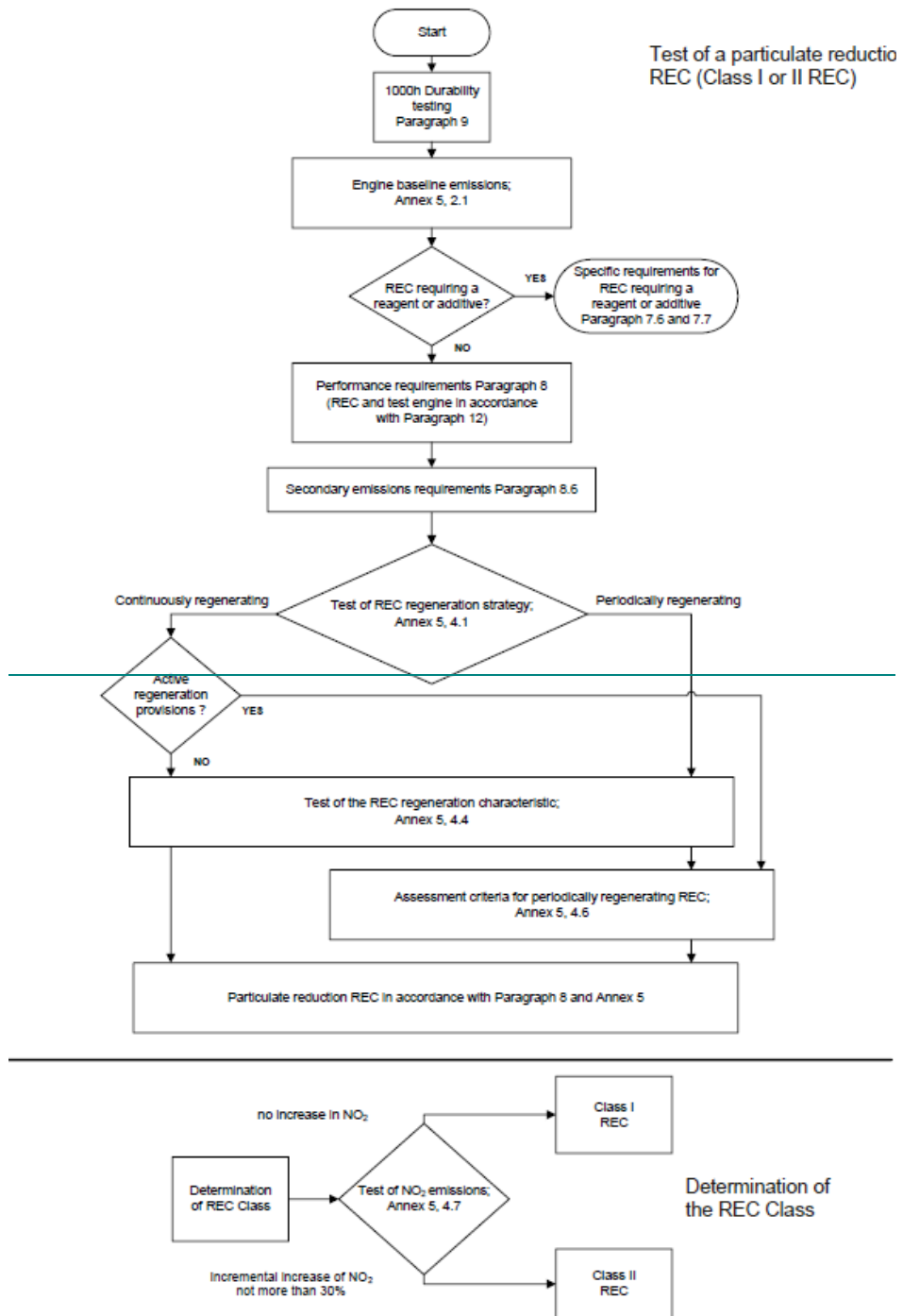
The above example type-approval mark affixed to a REC shows that the type concerned has been approved in the Netherlands (E4), pursuant to Regulation No. [nnn] under type-approval No. 001234. The first two digits of the type-approval number indicate that the approval was granted in accordance with the requirements of Regulation No. [nnn] in ~~its original~~the form amended by this series. The approval mark shall also show the Class of REC (I, IIA, IIB, III or IV)."

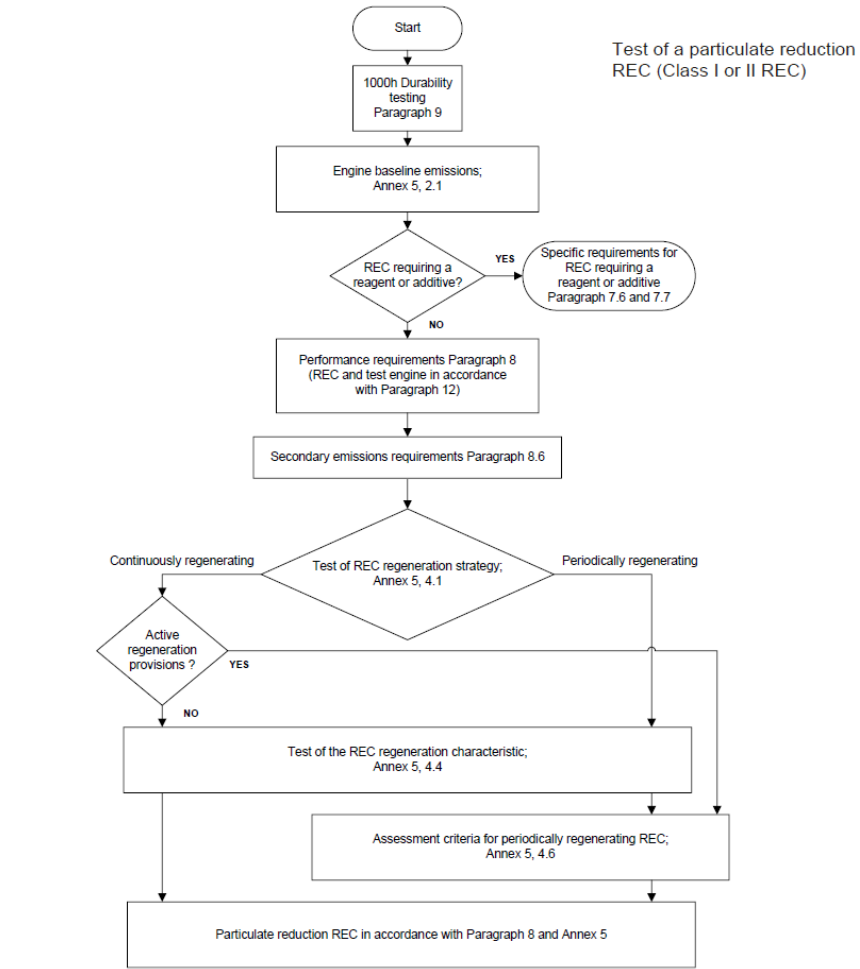
Annex 8, amend to read:

"Annex 8

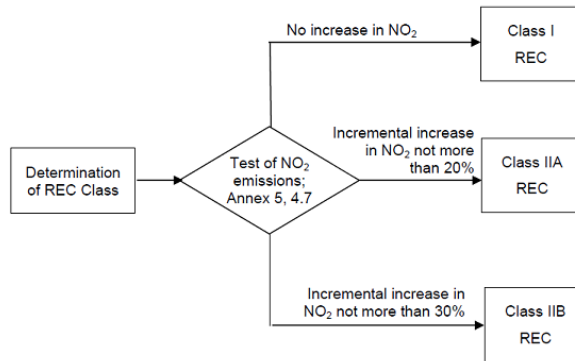
Test sequences

1. Test sequence for particulate reduction REC





Determination of the REC Class



2. ..."

Annex 9, amend to read:

"Annex 9

Limit value equivalence tables

1. The requirements for each type of REC in terms of meeting the limits of the next more stringent emission stage, as required by paragraph 8.2. of this Regulation, are illustrated in the tables below.
2. The tables below show emission limits in g/kWh that would have to be met in order to achieve equivalence to the standard shown from each baseline.
3. The efficiency requirements detailed in paragraph 8.3. of this Regulation may require that the measured emissions are lower than these limit values.

Table A9/1

Equivalence matrix for Regulation No. 49 Standard series

Emission limits in g/kWh.

Baseline*	Component		Class I/IIA/IIB To the standard of				Class III To the standard of			Class IV To the standard of			
			A	B1	B2	C	A	B1	B2	A	B1	B2	C
Before A	NO _x	(ESC)	-	-	-	-	5,0	3,5	2,0	5,0	3,5	2,0	2,0
		(ETC)	-	-	-	-	5,0	3,5	2,0	5,0	3,5	2,0	2,0
	PM	(ESC)	0,10 ⁽¹⁾	0,02	0,02	0,02	-	-	-	0,10 ⁽¹⁾	0,02	0,02	0,02
		(ETC)	0,16 ⁽²⁾	0,03	0,03	0,02	-	-	-	0,16 ⁽²⁾	0,03	0,03	0,02

⁽¹⁾ 0,13 g /kWh for engines having a swept volume of less than 0,75 dm³ per cylinder and a rated power speed of more than 3000 min⁻¹

⁽²⁾ 0,21 g /kWh for engines having a swept volume of less than 0,75 dm³ per cylinder and a rated power speed of more than 3000 min⁻¹

Baseline*	Component		Class I/IIA/IIB To the standard of			Class III To the standard of			Class IV To the standard of		
			B1	B2	C	B1	B2	C	B1	B2	C
A	NO _x	(ESC)	-	-	-	3,5	2,0	2,0	3,5	2,0	2,0
		(ETC)	-	-	-	3,5	2,0	2,0	3,5	2,0	2,0
	PM	(ESC)	0,02	0,02	0,02	-	-	-	0,02	0,02	0,02
		(ETC)	0,03	0,03	0,02	-	-	-	0,03	0,03	0,02

Baseline*	Component		Class I/IIA/IIB To the standard of			Class III To the standard of			Class IV To the standard of		
			B2	C	D	B2	C	D	B2	C	D
B1	NO _x	(ESC)	-	-	-	2,0	2,0		2,0	2,0	-
		(ETC)	-	-	-	2,0	2,0		2,0	2,0	-
		(WHSC)	-	-	-	-	-	0,4	-	-	0,4
		(WHTC)	-	-	-	-	-	0,46	-	-	0,46
	PM	(ESC)	0,02	0,02	-	-	-	-	0,02	0,02	-
		(ETC)	0,03	0,02	-	-	-	-	0,03	0,02	-
		(WHSC)	-	-	0,01	-	-	-	-	-	0,01
		(WHTC)	-	-	0,01	-	-	-	-	-	0,01

Baseline*	Component		Class I/IIA/IIB To the standard of			Class III To the standard of			Class IV To the standard of		
			C	D		C	D		C	D	
B2	NO _x	(ESC)	-	-		2,0	-		2,0	-	
		(ETC)	-	-		2,0	-		2,0	-	
		(WHSC)	-	-		-	0,4		-	0,4	
		(WHTC)	-	-		-	0,46		-	0,46	
	PM	(ESC)	0,02	-		-	-		0,02	-	
		(ETC)	0,02	-		-	-		0,02	-	
		(WHSC)	-	0,01		-	-		-	0,01	
		(WHTC)	-	0,01		-	-		-	0,01	

* Where A, B1, B2 and C correspond to the limit values in tables 1 and 2 of the 05 series of amendments to Regulation No. 49 and D corresponds to the limit values in the 06 series of amendments to Regulation No. 49.

..."

II. Justification

1. The document introduces modifications to the proposal for the UN Regulation on Retrofit Emission Control devices (REC). Like the REC Regulation in its

original form, the text aims to facilitate the improvement of the ambient air quality via the reduction of the emissions of particulate matter and/or NO_x.

2. In particular, the text includes a revision in the definitions of the REC devices, stricter limit values (reduction levels) for REC systems and transitional provisions for the sale of REC systems that meet the requirements of the REC Regulation in its original form. To assure coherence with the change in the definitions, the text also includes a revision of the test sequence for particulate reduction and the equivalence matrix for the Regulation No. 49 Standard series.
