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PROPOSAL FOR DRAFT SUPPLEMENT 3 TO THE 05 SERIES  
OF AMENDMENTS TO REGULATION No. 83

(Emissions of M<sub>1</sub> and N<sub>1</sub> categories of vehicles)

Transmitted by the Working Party on Pollution and Energy (GRPE)

Note : The text reproduced below was adopted by GRPE at its forty-fifth session, and is transmitted for consideration to WP.29 and AC.1. It is based on document TRANS/WP.29/GRPE/2003/5, not amended (TRANS/WP.29/GRPE/45, para. 39).

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List of contents, annexes,

Add new annex 14, to read:

"Annex 14: EMISSIONS TEST PROCEDURE FOR HYBRID ELECTRIC VEHICLES

Appendix 1: Electric energy/power storage device SOC profile for OVC HEV Type I test."

Text of the Regulation,

Insert new paragraphs 1.1.3. and 1.1.4., to read (scope):

"1.1.3. Exhaust emissions at normal and low ambient temperature, evaporative emissions, emissions of crankcase gases, the durability of pollution control exhaust devices and on-board diagnostic (OBD) systems of hybrid electric vehicles (HEV) equipped with positive-ignition (P.I.) engines and having at least four wheels.

1.1.4. Exhaust emissions, the durability of anti-pollution devices and on-board diagnostic (OBD) systems of hybrid electric vehicles (HEV) of categories M<sub>1</sub> and N<sub>1</sub> equipped with compression-ignition (C.I.) engines, having at least four wheels and a maximum mass not exceeding 3,500 kg."

Paragraphs 1.1.3. to 1.1.5. (former), renumber as paragraphs 1.1.5. to 1.1.7.

Insert new paragraphs 2.21. to 2.21.2., to read (definitions):

"2.21. Hybrid vehicles (HV)

2.21.1. General definition of hybrid vehicles (HV):

"Hybrid vehicle (HV)" means a vehicle with at least two different energy converters and two different energy storage systems (on vehicle) for the purpose of vehicle propulsion.

2.21.2. Definition of hybrid electric vehicles (HEV):

"Hybrid electric vehicle (HEV)" means a vehicle that, for the purpose of mechanical propulsion, draws energy from both of the following on-vehicle sources of stored energy/power:

- a consumable fuel
- an electrical energy/power storage device (e.g.: battery, capacitor, flywheel/generator etc.)"

Insert new paragraph 5.1.6., to read:

"5.1.6. It shall be possible to inspect the vehicle for roadworthiness test in order to determine its performance in relation to the data collected in accordance with paragraph 5.3.7. to this Regulation. If this inspection requires a special procedure, this shall be detailed in the service manual (or equivalent media). This special procedure shall not require the use of special equipment other than that provided with the vehicle."

Paragraph 5.2.1., amend to read (test procedure):

"5.2.1. Positive ignition engine-powered vehicles and hybrid electric vehicles equipped with a positive-ignition engine shall be subject to the following tests:  
....."

Paragraph 5.2.2., amend to read:

"5.2.2. Positive-ignition engine-powered vehicles and hybrid electric vehicles equipped with a positive-ignition engine fuelled with LPG or NG only shall be subject to the following tests:  
....."

Paragraph 5.2.3., amend to read:

"5.2.3. Compression ignition engine-powered vehicles and hybrid electric vehicles equipped with a compression ignition engine shall be subject to the following tests:  
....."

Paragraph 8.2.3.1., amend to read (C.O.P.):

"8.2.3.1. .... any adjustment to the vehicles selected.

For hybrid electric vehicles (HEV), the tests shall be carried out under the conditions determined in annex 14:

- For OVC vehicles, the measurements of emissions of pollutants shall be carried out with the vehicle conditioned according to condition B of the Type I test for OVC hybrid vehicles.
- For NOVC vehicles, the measurements of emissions of pollutants shall be carried out under the same conditions as in the Type I test for NOVC vehicles."

Paragraph 8.2.3.2.3., amend to read:

"8.2.3.2.3. .... in annex 10 may be used:

- (i) If a Type III test is to be carried out, it shall be conducted on all vehicles selected for the Type I COP test. The conditions laid down in paragraph 5.3.3.2. shall be complied with. For hybrid electric vehicles (HEV),

the tests shall be carried out under the conditions determined in annex 14 paragraph 5.

- (ii) If a Type IV test is to be ....."

Paragraph 8.2.6.1., amend to read:

"8.2.6.1 ..... to the tests described in annex 11, Appendix 1.

For hybrid electric vehicles (HEV), the tests shall be carried out under the conditions determined in annex 14, paragraph 9."

Insert new subparagraphs (d) and (e) in paragraph 11.1.5.1., to read (special provisions for OBD systems):

"(d) Hybrid electric vehicles (HEV) equipped with positive-ignition engines, hybrid electric vehicles (HEV) of category M<sub>1</sub> equipped with compression-ignition engines and whose maximum mass does not exceed 2,500 kg, and hybrid electric vehicles (HEV) of category N<sub>1</sub> (Class I) equipped with compression ignition engines, from 1 January 2005 for new types and from 1 January 2006 for all types.

(e) Hybrid electric vehicles (HEV) of category N<sub>1</sub> (Classes II and III), equipped with compression-ignition engines, and hybrid electric vehicles (HEV) of category M<sub>1</sub> equipped with compression-ignition engines and whose maximum mass exceeds 2,500 kg, from 1 January 2006 for new types and from 1 January 2007 for all types."

Annex 1 (ENGINE AND VEHICLE CHARACTERISTICS),

Items 4. to 4.1., amend to read :

"4. DESCRIPTION OF ENERGY CONVERTERS

4.1. Engine manufacturer:

4.1.1. Manufacturer's engine code ....."

Insert new items 4.3. to 4.3.8., to read:

"4.3.	Hybrid Electric Vehicle	: yes/no <u>1/</u>
4.3.1.	Category of Hybrid Electric vehicle	: Off Vehicle Charging/Not Off
	Vehicle Charging <u>1/</u>	
4.3.2.	Operating mode switch	: with/without <u>1/</u>
4.3.2.1.	Selectable modes	
4.3.2.1.1.	Pure electric	: yes/no <u>1/</u>
4.3.2.1.2.	Pure fuel consuming	: yes/no <u>1/</u>
4.3.2.1.3.	Hybrid modes	: yes/no <u>1/</u>
		(if yes, short description)
4.3.3.	Description of the energy storage device: (battery, capacitor, flywheel/generator ...)	

- 4.3.3.1. Make: .....
- 4.3.3.2. Type: .....
- 4.3.3.3. Identification number: .....
- 4.3.3.4. Kind of electrochemical couple: .....
- 4.3.3.5. Energy: ..... (for battery: voltage and capacity Ah in 2 h, for capacitor: J, ...)
- 4.3.3.6. Charger: on board/ external/ without 1/
- 4.3.4. Electric machines (describe each type of electric machine separately)
- 4.3.4.1. Make: .....
- 4.3.4.2. Type: .....
- 4.3.4.3. Primary use: traction motor / generator
- 4.3.4.3.1. When used as traction motor: monomotor/ multimotors (number):
- 4.3.4.4. Maximum power: ..... kW
- 4.3.4.5. Working principle:
  - 4.3.4.5.1. direct current/ alternating current/ number of phases:
  - 4.3.4.5.2. separate excitation/ series/ compound 1/
  - 4.3.4.5.3. synchronous / asynchronous 1/
- 4.3.5. Control unit
- 4.3.5.1. Make: .....
- 4.3.5.2. Type: .....
- 4.3.5.3. Identification number: .....
- 4.3.6. Power controller
- 4.3.6.1. Make: .....
- 4.3.6.2. Type: .....
- 4.3.6.3. Identification number: .....
- 4.3.7. Vehicle electric range ..... km (according annex 7 of Regulation No. 101):
- 4.3.8. Manufacturer's recommendation for preconditioning : ..... "

Insert new items 5.4. to 5.4.2., to read:

- "5.4. Hybrid electric vehicle
- 5.4.1. Drawing of the hybrid powertrain system layout (engine/ motor/ transmission combination):
- 5.4.2. Description of the general hybrid powertrain working principle: ..... "

Annex 2, (COMMUNICATION),

Insert new items 1.1. to 1.1.2., to read:

- "1.1. Hybrid electric vehicle : yes/no 2/
- 1.1.1. Category of Hybrid Electric vehicle : Off Vehicle Charging/  
Not Off Vehicle Charging 2/
- 1.1.2. Operating mode switch : with/without 2/ "

Insert new items 16.1.2. to 16.1.2.2., to read:

- "16.1.2. In the case of externally chargeable (OVC) Hybrid Electric Vehicle:
- 16.1.2.1. Repeat the table for the both test conditions specified in paragraphs 3.1. and 3.2. of annex 14.
- 16.1.2.2. Repeat the table for the weighted values determined according to paragraphs 3.1.4 or 3.2.4 of annex 14."

Annex 4, Appendix 3 (Coast down),

Add a footnote in paragraph 4., to read:

- "4. VEHICLE PREPARATION 1/
- 1/ For HEV, and until uniform technical provisions have been established, the manufacturer will agree with the technical service concerning the status of the vehicle when performing the test as defined in this Appendix."

Add a new annex 14, to read (including Appendix 1):

"Annex 14

EMISSIONS TEST PROCEDURE FOR HYBRID ELECTRIC VEHICLES (HEV)

- 1. INTRODUCTION
  - 1.1. This annex defines the specific provisions regarding type-approval of a hybrid electric vehicle (HEV) as defined in paragraph 2.21.2. of this Regulation.
  - 1.2. As a general principle, for the tests of Type I, II, III, IV, V, VI and OBD, hybrid electric vehicles shall be tested according to annex 4, 5, 6, 7, 9, 8 and 11 respectively, unless modified by this annex.
  - 1.3. For the Type I test only, OVC vehicles (as categorized in paragraph 2) shall be tested according to condition A and to condition B. The test results under both conditions A and B and the weighted values shall be reported in the communication form.
  - 1.4. The emissions test results shall comply with the limits under all specified test conditions of this Regulation.
- 2. CATEGORIES OF HYBRID ELECTRIC VEHICLES

Vehicle charging	Off-Vehicle Charging (1) (OVC)		Not Off-Vehicle Charging (2) (NOVC)	
	Without	With	Without	With
Operating mode switch				

(1) also known as "externally chargeable"

(2) also known as "not externally chargeable"

3. TYPE I TEST METHODS

3.1. EXTERNALLY CHARGEABLE (OVC HEV) WITHOUT AN OPERATING MODE SWITCH

3.1.1. Two tests shall be performed under the following conditions:

Condition A: test shall be carried out with a fully charged electrical energy/power storage device.

Condition B: test shall be carried out with an electrical energy/power storage device in minimum state of charge (maximum discharge of capacity).

The profile of the state of charge (SOC) of the electrical energy/power storage device during different stages of the Type I test is given in Appendix 1.

3.1.2. Condition A

3.1.2.1. The procedure shall start with the discharge of the electrical energy/power storage device of the vehicle while driving (on the test track, on a chassis dynamometer, etc.):

- at a steady speed of 50 km/h until the fuel consuming engine of the HEV starts up,
- or, if a vehicle cannot reach a steady speed of 50 km/h without starting up the fuel consuming engine, the speed shall be reduced until the vehicle can run a lower steady speed where the fuel consuming engine does not start up for a defined time/distance (to be specified between technical service and manufacturer),
- or with manufacturer's recommendation.

The fuel consuming engine shall be stopped within 10 seconds of it being automatically started.

3.1.2.2. Conditioning of vehicle

3.1.2.2.1. For compression-ignition engines the Part Two cycle described in Appendix 1 of annex 4 shall be used. Three consecutive cycles shall be driven according to paragraph 3.1.2.5.3. below.

3.1.2.2.2. Vehicles fitted with positive-ignition engines shall be preconditioned with one Part One and two Part Two driving cycles according to paragraph 3.1.2.5.3. below.

3.1.2.3. After this preconditioning, and before testing, the vehicle shall be kept in a room in which the temperature remains relatively constant between 293 and 303 K (20°C and 30°C). This conditioning shall be carried out for at least six hours and continue until the engine oil temperature and coolant, if any, are within  $\pm 2$  K of the temperature of

the room, and the electrical energy/power storage device is fully charged as a result of the charging prescribed in paragraph 3.1.2.4. below.

3.1.2.4. During soak, the electrical energy/power storage device shall be charged:

- (a) with the on board charger if fitted, or
- (b) with an external charger recommended by the manufacturer, using the normal overnight charging procedure.

This procedure excludes all types of special charges that could be automatically or manually initiated like, for instance, the equalization charges or the servicing charges.

The manufacturer shall declare that during the test, a special charge procedure has not occurred.

3.1.2.5. Test procedure

3.1.2.5.1. The vehicle shall be started up by the means provided for normal use to the driver. The first cycle starts on the initiation of the vehicle start-up procedure.

3.1.2.5.2. Sampling shall begin (BS) before or at the initiation of the vehicle start up procedure and end on conclusion of the final idling period in the extra-urban cycle (Part Two, end of sampling (ES)).

3.1.2.5.3. The vehicle shall be driven according to annex 4, or in case of special gear shifting strategy according to the manufacturer's instructions, as incorporated in the drivers' handbook of production vehicles and indicated by a technical gear shift instrument (for drivers information). For these vehicles the gear shifting points prescribed in annex 4, Appendix 1 are not applied. For the pattern of the operating curve the description according to paragraph 2.3.3. in annex 4 shall apply.

3.1.2.5.4. The exhaust gases shall be analyzed according to annex 4.

3.1.2.6. The test results shall be compared to the limits prescribed in paragraph 5.3.1.4. of this Regulation and the average emission of each pollutant for Condition A shall be calculated ( $M1_i$ ).

3.1.3. Condition B

3.1.3.1. Conditioning of vehicle

3.1.3.1.1. For compression-ignition engines the Part Two cycle described in Appendix 1 of annex 4 shall be used. Three consecutive cycles shall be driven according to paragraph 3.1.3.4.3. below.

3.1.3.1.2. Vehicles fitted with positive-ignition engines shall be preconditioned with one Part One and two Part Two driving cycles according to paragraph 3.1.3.4.3. below.

- 3.1.3.2. The electrical energy/power storage device of the vehicle shall be discharged while driving (on the test track, on a chassis dynamometer, etc.):
- at a steady speed of 50 km/h until the fuel consuming engine of the HEV starts up,
  - or if a vehicle can not reach a steady speed of 50 km/h without starting up the fuel consuming engine, the speed shall be reduced until the vehicle can run a lower steady speed where the fuel consuming engine just does not start up for a defined time/distance (to be specified between technical service and manufacturer),
  - or with manufacturer's recommendation.

The fuel consuming engine shall be stopped within 10 seconds of it being automatically started.

- 3.1.3.3. After this preconditioning, and before testing, the vehicle shall be kept in a room in which the temperature remains relatively constant between 293 and 303 K (20°C and 30° C). This conditioning shall be carried out for at least six hours and continue until the engine oil temperature and coolant, if any, are within  $\pm 2$  K of the temperature of the room.

- 3.1.3.4. Test procedure

- 3.1.3.4.1. The vehicle shall be started up by the means provided for normal use to the driver. The first cycle starts on the initiation of the vehicle start-up procedure.

- 3.1.3.4.2. Sampling shall begin (BS) before or at the initiation of the vehicle start up procedure and end on conclusion of the final idling period in the extra-urban cycle (Part Two, end of sampling (ES)).

- 3.1.3.4.3. The vehicle shall be driven according to annex 4, or in case of special gear shifting strategy according to the manufacturer's instructions, as incorporated in the drivers' handbook of production vehicles and indicated by a technical gear shift instrument (for drivers information). For these vehicles the gear shifting points prescribed in annex 4, Appendix 1 are not applied. For the pattern of the operating curve the description according to paragraph 2.3.3. in annex 4 shall apply.

- 3.1.3.4.4. The exhaust gases shall be analyzed according to annex 4.

- 3.1.3.5. The test results shall be compared to the limits prescribed in paragraph 5.3.1.4. of this Regulation and the average emission of each pollutant for Condition B shall be calculated ( $M_{2i}$ ).

- 3.1.4. Test results

- 3.1.4.1. For communication, the weighted values shall be calculated as below:

$$M_i = ( De \cdot M1_i + Dav \cdot M2_i ) / ( De + Dav )$$

Where:

- $M_i$  = mass emission of the pollutant i in grams per kilometre.  
 $M1_i$  = average mass emission of the pollutant i in grams per kilometre with a fully charged electrical energy/power storage device calculated in paragraph 3.1.2.6.  
 $M2_i$  = average mass emission of the pollutant i in grams per kilometre with an electrical energy/power storage device in minimum state of charge (maximum discharge of capacity) calculated in paragraph 3.1.3.5.  
 $De$  = vehicle electric range, according to the procedure described in Regulation No. 101, annex 7, where the manufacturer must provide the means for performing the measurement with the vehicle running in pure electric mode.  
 $Dav$  = 25 km (average distance between two battery recharges)

### 3.2. EXTERNALLY CHARGEABLE (OVC HEV) WITH AN OPERATING MODE SWITCH

3.2.1. Two tests shall be performed under the following conditions:

3.2.1.1. Condition A: test shall be carried out with a fully charged electrical energy/power storage device.

3.2.1.2. Condition B: test shall be carried out with an electrical energy/power storage device in minimum state of charge (maximum discharge of capacity)

3.2.1.3. The operating mode switch shall be positioned according the table below:

Hybrid-modes Battery state of charge	-Pure electric -Hybrid Switch in position	-Pure fuel consuming -Hybrid Switch in position	-Pure electric -Pure fuel consuming -Hybrid Switch in position	-Hybrid mode n (1) ..... -Hybrid mode m (1) Switch in position
Condition A Fully charged	Hybrid	Hybrid	Hybrid	Most electric hybrid mode (2)
Condition B Min. state of charge	Hybrid	Fuel consuming	Fuel consuming	Most fuel consuming mode (3)

(1) For instance: sport, economic, urban, extra-urban position ...

(2) Most electric hybrid mode:

The hybrid mode which can be proven to have the highest electricity consumption of all selectable hybrid modes when tested in accordance with condition A of paragraph 4. of annex 10 to Regulation No. 101, to be established based on information provided by the manufacturer and in agreement with the technical service.

(3) Most fuel consuming mode:

The hybrid mode which can be proven to have the highest fuel consumption of all selectable hybrid modes when tested in accordance with condition B of paragraph 4. of annex 10 to Regulation No. 101, to be established based on information provided by the manufacturer and in agreement with the technical service.

3.2.2. Condition A

3.2.2.1. If the pure electric range of the vehicle is higher than one complete cycle, on the request of the manufacturer, the Type I test may be carried out in pure electric mode. In this case, engine preconditioning prescribed in paragraph 3.2.2.3.1. or 3.2.2.3.2. can be omitted.

3.2.2.2. The procedure shall start with the discharge of the electrical energy/power storage device of the vehicle while driving with the switch in pure electric position (on the test track, on a chassis dynamometer, etc.) at a steady speed of 70 per cent  $\pm$  5 per cent of the maximum thirty minutes speed of the vehicle (determined according to Regulation No. 101).

Stopping the discharge occurs:

- when the vehicle is not able to run at 65 per cent of the maximum thirty minutes speed; or
- when an indication to stop the vehicle is given to the driver by the standard on-board instrumentation, or

- after covering the distance of 100 km.

If the vehicle is not equipped with a pure electric mode, the electrical energy/power storage device discharge shall be achieved by driving the vehicle (on the test track, on a chassis dynamometer, etc.):

- at a steady speed of 50 km/h until the fuel consuming engine of the HEV starts up, or
- if a vehicle cannot reach a steady speed of 50 km/h without starting up the fuel consuming engine, the speed shall be reduced until the vehicle can run a lower steady speed where the fuel consuming engine does not start up for a defined time/distance (to be specified between technical service and manufacturer), or
- with manufacturer's recommendation.

The fuel consuming engine shall be stopped within 10 seconds of it being automatically started.

### 3.2.2.3. Conditioning of vehicle

3.2.2.3.1. For compression-ignition engines the Part Two cycle described in Appendix 1 to the annex 4 shall be used. Three consecutive cycles shall be driven according to paragraph 3.2.2.6.3. below.

3.2.2.3.2. Vehicles fitted with positive-ignition engines shall be preconditioned with one Part One and two Part Two driving cycles according to paragraph 3.2.2.6.3. below.

3.2.2.4. After this preconditioning, and before testing, the vehicle shall be kept in a room in which the temperature remains relatively constant between 293 and 303 K (20°C and 30°C). This conditioning shall be carried out for at least six hours and continue until the engine oil temperature and coolant, if any, are within  $\pm 2$  K of the temperature of the room, and the electrical energy/power storage device is fully charged as a result of the charging prescribed in paragraph 3.2.2.5.

3.2.2.5. During soak, the electrical energy/power storage device shall be charged:

- (a) with the on board charger if fitted, or
- (b) with an external charger recommended by the manufacturer, using the normal overnight charging procedure.

This procedure excludes all types of special charges that could be automatically or manually initiated like, for instance, the equalisation charges or the servicing charges.

The manufacturer shall declare that during the test, a special charge procedure has not occurred.

### 3.2.2.6. Test procedure

- 3.2.2.6.1. The vehicle shall be started up by the means provided for normal use to the driver. The first cycle starts on the initiation of the vehicle start-up procedure.
- 3.2.2.6.2. Sampling shall begin (BS) before or at the initiation of the vehicle start up procedure and end on conclusion of the final idling period in the extra-urban cycle (Part Two, end of sampling (ES)).
- 3.2.2.6.3. The vehicle shall be driven according to annex 4, or in case of special gear shifting strategy according to the manufacturer's instructions, as incorporated in the drivers' handbook of production vehicles and indicated by a technical gear shift instrument (for drivers information). For these vehicles the gear shifting points prescribed in annex 4, Appendix 1 are not applied. For the pattern of the operating curve the description according to paragraph 2.3.3. in annex 4 shall apply.
- 3.2.2.6.4. The exhaust gases shall be analysed according to annex 4.
- 3.2.2.7 The test results shall be compared to the limits prescribed in paragraph 5.3.1.4. of this Regulation and the average emission of each pollutant for Condition A shall be calculated ( $M1_i$ ).
- 3.2.3. Condition B
  - 3.2.3.1. Conditioning of vehicle
    - 3.2.3.1.1. For compression-ignition engines the Part Two cycle described in Appendix 1 to the annex 4 shall be used. Three consecutive cycles shall be driven according to paragraph 3.2.3.4.3. below.
    - 3.2.3.1.2. Vehicles fitted with positive-ignition engines shall be preconditioned with one Part One and two Part Two driving cycles according to paragraph 3.2.3.4.3. below.
  - 3.2.3.2. The electrical energy/power storage device of the vehicle shall be discharged according to paragraph 3.2.2.2.
  - 3.2.3.3. After this preconditioning, and before testing, the vehicle shall be kept in a room in which the temperature remains relatively constant between 293 and 303 K (20°C and 30°C). This conditioning shall be carried out for at least six hours and continue until the engine oil temperature and coolant, if any, are within  $\pm 2$  K of the temperature of the room.
- 3.2.3.4. Test procedure
  - 3.2.3.4.1. The vehicle shall be started up by the means provided for normal use to the driver. The first cycle starts on the initiation of the vehicle start-up procedure.
  - 3.2.3.4.2. Sampling shall begin (BS) before or at the initiation of the vehicle start up procedure and end on conclusion of the final idling period in the extra-urban cycle (Part Two, end of sampling (ES)).

3.2.3.4.3. The vehicle shall be driven according to annex 4, or in case of special gear shifting strategy according to the manufacturer's instructions, as incorporated in the drivers' handbook of production vehicles and indicated by a technical gear shift instrument (for drivers information). For these vehicles the gear shifting points prescribed in annex 4, Appendix 1 are not applied. For the pattern of the operating curve the description according to paragraph 2.3.3. in annex 4 shall apply.

3.2.3.4.4. The exhaust gases shall be analysed according to annex 4.

3.2.3.5. The test results shall be compared to the limits prescribed in paragraph 5.3.1.4. of this Regulation and the average emission of each pollutant for Condition B shall be calculated ( $M_{2i}$ ).

3.2.4. Test results

3.2.4.1. For communication, the weighted values shall be calculated as below:

$$M_i = (D_e \cdot M_{1i} + D_{av} \cdot M_{2i}) / (D_e + D_{av})$$

Where :

$M_i$  = mass emission of the pollutant  $i$  in grams per kilometre

$M_{1i}$  = average mass emission of the pollutant  $i$  in grams per kilometre with a fully charged electrical energy/power storage device calculated in paragraph 3.2.2.7.

$M_{2i}$  = average mass emission of the pollutant  $i$  in grams per kilometre with an electrical energy/power storage device in minimum state of charge (maximum discharge of capacity) calculated in paragraph 3.2.3.5.

$D_e$  = vehicle electric range with the switch in pure electric position, according to the procedure described in Regulation No. 101, annex 7. If there is not a pure electric position, the manufacturer must provide the means for performing the measurement with the vehicle running in pure electric mode.

$D_{av}$  = 25 km (average distance between two battery recharge)

3.3. NOT EXTERNALLY CHARGEABLE (NOTOVC HEV) WITHOUT AN OPERATING MODE SWITCH

3.3.1. These vehicles shall be tested according to annex 4.

3.3.2. For preconditioning, at least two consecutive complete driving cycles (one Part One and one Part Two) are carried out without soak.

3.3.3. The vehicle shall be driven according to annex 4, or in case of special gear shifting strategy according to the manufacturer's instructions, as incorporated in the drivers' handbook of production vehicles and indicated by a technical gear shift instrument (for drivers information). For these vehicles the gear shifting points prescribed in annex 4, Appendix 1 are not applied. For the pattern of the operating curve the description according to paragraph 2.3.3. in annex 4 shall apply.

- 3.4. NOT EXTERNALLY CHARGEABLE (NOTOVC HEV) WITH AN OPERATING MODE SWITCH
  - 3.4.1. These vehicles are preconditioned and tested in hybrid mode according to annex 4. If several hybrid modes are available, the test shall be carried out in the mode that is automatically set after turn on of the ignition key (normal mode). On the basis of information provided by the manufacturer, the Technical Service will make sure that the limit values are met in all hybrid modes.
  - 3.4.2. For preconditioning, at least two consecutive complete driving cycles (one Part One and one Part Two) shall be carried out without soak.
  - 3.4.3. The vehicle shall be driven according to annex 4, or in case of special gear shifting strategy according to the manufacturer's instructions, as incorporated in the drivers' handbook of production vehicles and indicated by a technical gear shift instrument (for drivers information). For these vehicles the gear shifting points prescribed in annex 4, Appendix 1 are not applied. For the pattern of the operating curve the description according to paragraph 2.3.3. in annex 4 shall apply.
4. TYPE II TEST METHODS
  - 4.1. The vehicles shall be tested according to annex 5 with the fuel consuming engine running. The manufacturer shall provide a "service mode" that makes execution of this test possible.

If necessary, the special procedure provided for in paragraph 5.1.6. to the Regulation shall be used.
5. TYPE III TEST METHODS
  - 5.1. The vehicles shall be tested according to annex 6 with the fuel consuming engine running. The manufacturer shall provide a "service mode" that makes execution of this test possible.
  - 5.2. The tests shall be carried out only for conditions 1 and 2 of the paragraph 3.2. of annex 6. If for any reasons it is not possible to test on condition 2, alternatively another steady speed condition (with fuel consuming engine running under load) should be carried out.
6. TYPE IV TEST METHODS
  - 6.1. The vehicles shall be tested according to annex 7.
  - 6.2. Before starting the test procedure (paragraph 5.1. of annex 7), the vehicles shall be preconditioned as follows:
    - 6.2.1. For OVC vehicles:

6.2.1.1. OVC vehicles without an operating mode switch: the procedure shall start with the discharge of the electrical energy/power storage device of the vehicle while driving (on the test track, on a chassis dynamometer, etc.):

- at a steady speed of 50 km/h until the fuel consuming engine of the HEV starts up, or
- if a vehicle cannot reach a steady speed of 50 km/h without starting up the fuel consuming engine, the speed shall be reduced until the vehicle can run a lower steady speed where the fuel consuming engine just does not start up for a defined time/distance (to be specified between technical service and manufacturer), or
- with manufacturer's recommendation.

The fuel consuming engine shall be stopped within 10 seconds of it being automatically started.

6.2.1.2. OVC vehicles with an operating mode switch: the procedure shall start with the discharge of the electrical energy/power storage device of the vehicle while driving with the switch in pure electric position (on the test track, on a chassis dynamometer, etc.) at a steady speed of 70 per cent  $\pm$  5 per cent from the maximum thirty minutes speed of the vehicle.

Stopping the discharge occurs:

- when the vehicle is not able to run at 65 per cent of the maximum thirty minutes speed, or
- when an indication to stop the vehicle is given to the driver by the standard on-board instrumentation, or
- after covering the distance of 100 km.

If the vehicle is not equipped with a pure electric mode, the electrical energy/power storage device discharge shall be conducted with the vehicle driving (on the test track, on a chassis dynamometer, etc.):

- at a steady speed of 50 km/h until the fuel consuming engine of the HEV starts up, or
- if a vehicle cannot reach a steady speed of 50 km/h without starting up the fuel consuming engine, the speed shall be reduced until the vehicle can run a lower steady speed where the fuel consuming engine does not start up for a defined time/distance (to be specified between technical service and manufacturer), or
- with manufacturer's recommendation.

The engine shall be stopped within 10 seconds of it being automatically started.

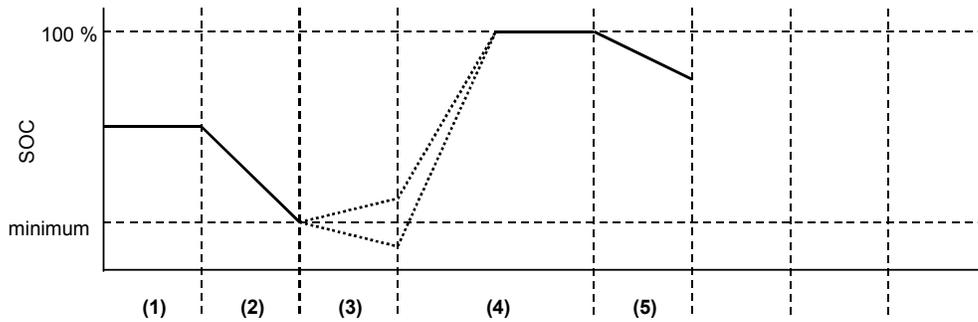
- 6.2.2. For NOVC vehicles:
- 6.2.2.1. NOVC vehicles without an operating mode switch: the procedure shall start with a preconditioning of at least two consecutive complete driving cycles (one Part One and one Part Two) without soak.
- 6.2.2.2. NOVC vehicles with an operating mode switch: the procedure shall start with a preconditioning of at least two consecutive complete driving cycles (one Part One and one Part Two) without soak, performed with the vehicle running in hybrid mode. If several hybrid modes are available, the test shall be carried out in the mode which is automatically set after turn on of the ignition key (normal mode).
- 6.3. The preconditioning drive and the dynamometer test shall be carried out according to paragraphs 5.2. and 5.4. of annex 7:
- 6.3.1. For OVC vehicles: under the same conditions as specified by condition B of the Type I test (paragraphs 3.1.3. and 3.2.3.).
- 6.3.2. For NOVC vehicles: under the same conditions as in the Type I test.
7. TYPE V TEST METHODS
- 7.1. The vehicles shall be tested according to annex 9.
- 7.2. For OVC vehicles:
- It is allowed to charge the electrical energy/power storage device twice a day during mileage accumulation.  
For OVC vehicles with an operating mode switch, mileage accumulation should be driven in the mode which is automatically set after turn on of the ignition key (normal mode).  
During the mileage accumulation a change into another hybrid mode is allowed if necessary in order to continue the mileage accumulation after agreement of the technical service.  
The measurements of emissions of pollutants shall be carried out under the same conditions as specified by condition B of the Type I test (paragraphs 3.1.3. and 3.2.3.).
- 7.3. For NOVC vehicles:
- For NOVC vehicles with an operating mode switch, mileage accumulation shall be driven in the mode which is automatically set after turn on of the ignition key (normal mode).  
The measurements of emissions of pollutants shall be carried out in the same conditions as in the Type I test.
8. TYPE VI TEST METHODS

- 8.1. The vehicles shall be tested according to annex 8.
- 8.2. For OVC vehicles, the measurements of emissions of pollutants shall be carried out under the same conditions as specified for condition B of the Type I test (paragraphs 3.1.3. and 3.2.3.).
- 8.3. For NOVC vehicles, the measurements of emissions of pollutants shall be carried out under the same conditions as in the Type I test.
9. ON BOARD DIAGNOSTICS (OBD) TEST METHODS
- 9.1. The vehicles shall be tested according to annex 11.
- 9.2. For OVC vehicles, the measurements of emissions of pollutants shall be carried out under the same conditions as specified for condition B of the Type I test (paragraphs 3.1.3. and 3.2.3.).
- 9.3. For NOVC vehicles, the measurements of emissions of pollutants shall be carried out under the same conditions as in the Type I test.

Annex 14, Appendix 1,

Electrical energy/power storage device State Of Charge (SOC) profile for OVC HEV Type I test

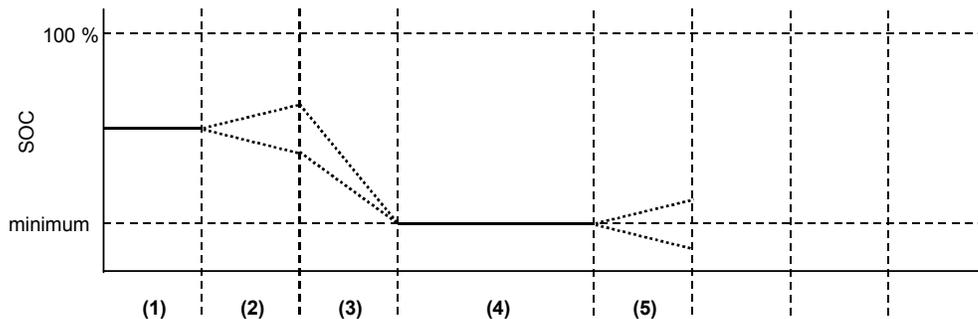
Condition A of the Type I test



Condition A:

- (1) initial electrical energy/power storage device state of charge
- (2) discharge according to paragraph 3.1.2.1. or 3.2.2.1.
- (3) vehicle conditioning according to paragraph 3.1.2.2. or 3.2.2.2.
- (4) charge during soak according to paragraphs 3.1.2.3. and 3.1.2.4., or paragraphs 3.2.2.3. and 3.2.2.4.
- (5) test according to paragraph 3.1.2.5. or 3.2.2.5.

Condition B of the Type I test



Condition B:

- (1) initial state of charge
- (2) vehicle conditioning according to paragraph 3.1.3.1. or 3.2.3.1.
- (3) discharge according to paragraph 3.1.3.2. or 3.2.3.2.
- (4) soak according to paragraph 3.1.3.3. or 3.2.3.3.
- (5) test according to paragraph 3.1.3.4. or 3.2.3.4.

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