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Item 4.9.3 of the provisional agenda

**1958 Agreement – Consideration of draft amendments
to existing Regulations submitted by GRPE****Proposal for the 01 series of amendments to Regulation No.
120 (Net power for tractors and non-road mobile machinery)****Submitted by the Working Party on Pollution and Energy***

The text reproduced below was adopted by the Working Party on Pollution and Energy (GRPE) at its sixty-second session to align the provisions of Regulation No. 120 with those of Global Technical Regulation No. 11 and Regulation No. 96. It is based on ECE/TRANS/WP.29/GRPE/2011/12, as amended by paragraph 29 of the report (ECE/TRANS/WP.29/GRPE/62, paras. 28-29). It is submitted to the World Forum for Harmonization of Vehicle Regulations (WP.29) and to the Administrative Committee (AC.1) for consideration.

* In accordance with the programme of work of the Inland Transport Committee for 2010–2014 (ECE/TRANS/208, para. 106 and ECE/TRANS/2010/8, 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.

Paragraph 1.1.1., footnote ¹, amend to read:

"¹ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3) (ECE/TRANS/WP.29/78/Rev.2)."

Paragraph 1.1.2., amend to read (inserting also a reference to the existing footnote ¹):

"1.1.2. In non-road mobile machinery¹, operated under variable or constant speed."

Paragraph 2.3., amend to read:

"2.3. "Engine type" means a category of engines which do not differ in such essential engine characteristics as defined in Annex 1 – Appendix 3 to this Regulation;"

Paragraph 2.9., amend to read:

"2.9. "Rated speed" means the maximum full load speed allowed by the governor, as designed by the manufacturer, or, if such a governor is not present, the speed at which the maximum power is obtained from the engine, as specified by the manufacturer;"

Paragraphs 5.3.1. and 5.3.2., amend to read:

"5.3.1. Net power

The net power declared by the manufacturer for the type of engine (or parent engine) shall be accepted if it does not differ by more than the values indicated in the table below, from the corrected values measured by the technical service on the engine submitted for testing.

<i>Engine Type</i>	<i>Rated net power [%]</i>	<i>Other measurement points on the curve [%]</i>	<i>Tolerance for engine speed [%]</i>
General	±2	±4	±1.5
Petrol fuelled spark ignited engines with governor	±4	±6	±4
Petrol fuelled spark ignited engines without governor	±4	±10	±4

5.3.2. Rated speed

The rated speed declared by the manufacturer shall not deviate by more than 100 min⁻¹ from the value measured by the technical service on the engine submitted for testing. For spark ignited petrol fuelled engines, the rated speed declared by the manufacturer shall not deviate from the value measured by the technical service on the engine submitted for testing by more than 150 min⁻¹ for engines provided with governor and for engines without governor 350 min⁻¹ or 4 per cent, whichever is smaller."

Annex 1, Appendix 1

Items 2. and 2.1., amend to read (inserting also a reference to the existing footnote ¹):

"2. Measures taken against air pollution

2.1. Device for recycling crankcase gases: yes/no¹"

Insert new items 2.2. to 2.2.6.1., to read (inserting also several references to the existing footnote ¹):

- "2.2. Additional anti-pollution devices (if any, and if not covered by another heading)
- 2.2.1. Catalytic converter: yes/no¹
- 2.2.1.1. Make(s):.....
- 2.2.1.2. Type(s):.....
- 2.2.1.3. Number of catalytic converters and elements.....
- 2.2.1.4. Dimensions- and volume of the catalytic converter(s):
- 2.2.1.5. Type of catalytic action:
- 2.2.1.6. Total charge of precious metals:
- 2.2.1.7. Relative concentration:
- 2.2.1.8. Substrate (structure and material):
- 2.2.1.9. Cell density:.....
- 2.2.1.10. Type of casing for the catalytic converter(s):
- 2.2.1.11. Location of the catalytic converter(s) (place(s) and maximum/minimum distance(s) from engine):
- 2.2.1.12. Normal operating range (K):.....
- 2.2.1.13. Consumable reagent (where appropriate):
- 2.2.1.13.1. Type and concentration of reagent needed for catalytic action:.....
- 2.2.1.13.2. Normal operational temperature range of reagent:
- 2.2.1.13.3. International standard (where appropriate):
- 2.2.1.14. NO_x sensor: yes/no¹
- 2.2.2. Oxygen sensor: yes/no¹
- 2.2.2.1. Make(s):.....
- 2.2.2.2. Type:.....
- 2.2.2.3. Location:.....
- 2.2.3. Air injection: yes/no¹
- 2.2.3.1. Type (pulse air, air pump, etc.):.....
- 2.2.4. EGR: yes/no¹
- 2.2.4.1. Characteristics (cooled/uncooled, high pressure/low pressure, etc.):
- 2.2.5. Particulate trap: yes/no¹
- 2.2.5.1. Dimensions and capacity of the particulate trap:
- 2.2.5.2. Type and design of the particulate trap:.....
- 2.2.5.3. Location (place(s) and maximum/minimum distance(s) from engine):.....
- 2.2.5.4. Method or system of regeneration, description and/or drawing:
- 2.2.5.5. Normal operating temperature (K) and pressure (kPa) range:

- 2.2.6. Other systems: yes/no¹
- 2.2.6.1. Description and operation:..... "

Annex 1, Appendix 3

Items 2. and 2.1., amend to read (inserting also a reference to the existing footnote¹):

"2. Measures taken against air pollution

2.1. Device for recycling crankcase gases: yes/no^{1"}

Insert new items 2.2. to 2.2.6.1., to read (inserting also several references to the existing footnote¹):

"2.2. Additional anti-pollution devices (if any, and if not covered under another heading)

2.2.1. Catalytic converter: yes/no¹

2.2.1.1. Make(s):.....

2.2.1.2. Type(s):.....

2.2.1.3. Number of catalytic converters and elements.....

2.2.1.4. Dimensions and volume of the catalytic converter(s):.....

2.2.1.5. Type of catalytic action:

2.2.1.6. Total charge of precious metals:

2.2.1.7. Relative concentration:

2.2.1.8. Substrate (structure and material):.....

2.2.1.9. Cell density:.....

2.2.1.10. Type of casing for the catalytic converter(s):

2.2.1.11. Location of the catalytic converter(s) (place(s) and maximum/minimum distance(s) from engine):

2.2.1.12. Normal operating range (K):.....

2.2.1.13. Consumable reagent (where appropriate):

2.2.1.13.1. Type and concentration of reagent needed for catalytic action:.....

2.2.1.13.2. Normal operational temperature range of reagent:

2.2.1.13.3. International standard (where appropriate):.....

2.2.1.14. NO_x sensor: yes/no¹

2.2.2. Oxygen sensor: yes/no¹

2.2.2.1. Make(s):.....

2.2.2.2. Type:.....

2.2.2.3. Location:.....

2.2.3. Air injection: yes/no¹

2.2.3.1. Type (pulse air, air pump, etc.):.....

2.2.4. EGR: yes/no¹

2.2.4.1. Characteristics (cooled/uncooled, high pressure/low pressure, etc.):

- 2.2.5. Particulate trap: yes/no¹
- 2.2.5.1. Dimensions and capacity of the particulate trap:
- 2.2.5.2. Type and design of the particulate trap:.....
- 2.2.5.3. Location (place(s) and maximum/minimum distance(s) from engine):
- 2.2.5.4. Method or system of regeneration, description and/or drawing:
- 2.2.5.5. Normal operating temperature (K) and pressure (kPa) range:
- 2.2.6. Other systems: yes/no¹
- 2.2.6.1. Description and operation:....."

Annex 2, item 11.1.4., should be deleted.

Annex 4

Paragraph 2.3.2., amend to read:

"2.3.2. Auxiliaries and equipment to be removed

Certain auxiliaries whose definition is linked with the operation of the machine and which may be mounted on the engine shall be removed for the test. The following non-exhaustive list is given as a sample:

- (i) Air compressor for brakes
- (ii) Power steering compressor
- (iii) Suspension compressor
- (iv) Air-conditioning system

Where auxiliaries cannot be removed, the power they absorb in the unloaded condition may be determined and added to the measured engine power (see note h of Table 1). If this value is greater than 3 per cent of the maximum power at the test speed it may verified by the test authority."

Table 1, amend to read:

"Table 1

Equipment and auxiliaries to be installed for the test to determine engine power

<i>Number</i>	<i>Equipment and auxiliaries</i>	<i>Fitted for emission test</i>
1	Inlet system	
	Inlet manifold	Yes
	Crankcase emission control system	Yes
	Air flow meter	Yes
	Air filter	Yes ^a
	Inlet silencer	Yes ^a
	Induction-heating device of inlet manifold	Yes, standard production equipment. If possible to be set in the most favourable condition
2	Exhaust system	
	Exhaust aftertreatment	Yes, standard production equipment
	Exhaust manifold	Yes, standard production equipment
	Connecting pipes	Yes ^b
	Silencer	Yes ^b
	Tail pipe	Yes ^b
	Exhaust brake	No ^c
	Pressure charging device	Yes
3	Fuel supply pump	Yes
4	Carburation equipment	
	Carburettor	Yes
	Electronic control system, air flow meter, etc.	Yes
	Equipment for gas engines	
	Pressure reducer	Yes
	Evaporator	Yes
	Mixer	Yes
5	Fuel injection equipment (petrol and diesel)	
	Pre-filter	Yes
	Filter	Yes
	Pump	Yes
	High-pressure pipe	Yes
	Injector	Yes
	Electronic control system, sensors, etc.	Yes

	Governor/control system	Yes
	Automatic full-load stop for the control rack depending on atmospheric conditions	Yes
6	Liquid-cooling equipment	
	Radiator	No
	Fan	No
	Fan cowl	No
	Water pump	Yes ^e
	Thermostat	Yes ^f
7	Air cooling	
	Cowl	No ^g
	Fan or Blower	No ^g
	Temperature-regulating device	No
8	Electrical equipment	
	Generator	Yes ^h
	Spark distribution system	Yes
	Coil or coils	Yes
	Wiring	Yes
	Spark plugs	Yes
	Electronic control system including knock sensor/spark retard system	Yes
9	Pressure charging equipment	
	Compressor driven either directly by the engine and/or by the exhaust gases	Yes
	Charge air cooler	Yes ^{g, i}
	Coolant pump or fan (engine-driven)	No ^g
	Coolant flow control device	Yes
10	Auxiliary test-bed fan	Yes, if necessary
11	Anti-pollution device	Yes, standard production equipment ^j
12	Starting equipment	Yes or test bed equipment ^k
13	Lubricating oil pump	Yes

^a The complete inlet system shall be fitted as provided for the intended application:

- (i) Where there is a risk of an appreciable effect on the engine power;
- (ii) In the case of naturally aspirated spark ignition engines;

(iii) When the manufacturer requests that this should be done.

In other cases, an equivalent system may be used and a check should be made to ascertain that the intake pressure does not differ by more than 100 Pa from the upper limit specified by the manufacturer for a clean air filter.

^b The complete exhaust system shall be fitted as provided for the intended application:

(i) Where there is a risk of an appreciable effect on the engine power;

(ii) In the case of naturally aspirated spark ignition engines;

(iii) When the manufacturer requests that this should be done.

In other cases, an equivalent system may be installed provided the pressure measured does not differ by more than 1,000 Pa from the upper limit specified by the manufacturer.

^c If an exhaust brake is incorporated in the engine, the throttle valve shall be fixed in the fully open position.

^d The fuel feed pressure may be adjusted, if necessary, to reproduce the pressure existing in the particular engine application (particularly when a "fuel return" system is used).

^e The cooling-liquid circulation shall be operated by the engine water pump only. Cooling of the liquid may be produced by an external circuit, such that the pressure loss of this circuit and the pressure at the pump inlet remain substantially the same as those of the engine cooling system.

^f The thermostat may be fixed in the fully open position.

^g When the cooling fan or blower is fitted for the test, the power absorbed shall be added to the results, except for engines where such auxiliaries are an integral part of the engine (i.e.: cooling fans of air cooled engines directly fitted on the crankshaft). The fan or blower power shall be determined at the speeds used for the test either by calculation from standard characteristics or by practical tests.

^h Minimum power of the generator: the electrical power of the generator shall be limited to that necessary for operation of auxiliaries which are indispensable for engine operation. If the connection of a battery is necessary, a fully charged battery in good condition shall be used.

ⁱ Charge air-cooled engines shall be tested with charge air cooling, whether liquid - or air-cooled, but if the manufacturer prefers, a test bench system may replace the air cooler. In either case, the measurement of power at each speed shall be made with the maximum pressure drop and the minimum temperature drop of the engine air across the charge air cooler on the test bench system as those specified by the manufacturer.

^j These may include, for example, exhaust-gas recirculation (EGR system), catalytic converter, thermal reactor, secondary air-supply system and fuel evaporation protecting system.

^k The power for electrical or other starting systems shall be provided from the test bed."

Paragraph 5.4.1., amend to read:

"5.4.1. Naturally aspirated or pressure charged positive ignition engine

...

For a test to be valid, the correction factor must be such that

$$0.93 < \alpha_a < 1.07$$

If these limits are exceeded, the corrected value obtained shall be given and the test conditions (temperature and pressure) precisely stated in the test report."

Paragraph 5.4.2.2., amend to read:

"5.4.2.2. Engine factor f_m

f_m is a function of q_c (fuel flow corrected) as follows:

$$f_m = 0.036 q_c - 1.14$$

and

$$q_c = q/r$$

Where:

q is the fuel flow in milligram per cycle per litre of total swept volume (mg/(l.cycle))

r is the pressure ratio of compressor outlet and compressor inlet in case of multiple turbochargers r represents the total compression ratio ($r = 1$ for naturally aspirated engines)

..."

Appendix, item 4., amend to read (including the existing footnote*):

"4. Detailed results of measurements*

...		
Power correction factor		
Corrected power, kW		
Corrected torque, Nm		
Corrected specific fuel...		
...		

* The characteristic curves of the net power and the net torque shall be drawn as a function of the engine speed."

Annex 5, amend to read:

"Annex 5

Essential characteristics of the engine family

1. General

An engine family is characterized by design parameters. These shall be common to all engines within the family. The engine manufacturer may decide which engines belong to an engine family, as long as the membership criteria listed in paragraph 1.3. are respected. The engine family shall be approved by the type approval authority. Since the choice of the engine family has significant implications on the engine exhaust emissions, paragraph 1.2. reports additional information (03 series of amendments to Regulation No. 96), useful for the manufacturer and the type approval authority when evaluating the engine family and choosing the parent engine.

2. Special cases

2.1. Interactions between parameters

In some cases there may be interaction between parameters, which may cause emissions to change. This shall be taken into consideration to ensure that only engines with similar exhaust emission characteristics are included within the same engine family. These cases shall be identified by the manufacturer and notified to the type approval authority. It shall then be taken into account as a criterion for creating a new engine family.

2.2. Devices or features having a strong influence on emissions

In case of devices or features, which are not listed in paragraph 1.3. and which have a strong influence on the level of emissions, this equipment shall be identified by the manufacturer using good engineering judgment, and shall be notified to the type approval authority. It shall then be taken into account as a criterion for creating a new engine family.

2.3. Additional criteria

In addition to the parameters listed in paragraph 1.3., the manufacturer may introduce additional criteria allowing the definition of families of more restricted size. These parameters are not necessarily parameters that have an influence on the level of emissions.

3. Parameters defining the engine family

3.1. Combustion cycle:

- (a) 2-stroke cycle;
- (b) 4-stroke cycle;
- (c) Rotary engine;
- (d) Others.

3.2. Fuel type:

- (a) Diesel;

- (b) Petrol;
 - (c) Gaseous (NG or LPG).
- 3.3. Configuration of the cylinders
 - 3.3.1. Position of the cylinders in the block:
 - (a) V;
 - (b) In-line;
 - (c) Radial;
 - (d) Others (F, W, etc.).
 - 3.3.2. Relative position of the cylinders

Engines with the same block may belong to the same family as long as their bore centre-to-centre dimensions are the same.
- 3.4. Main cooling medium:
 - (a) Air;
 - (b) Water;
 - (c) Oil.
- 3.5. Individual cylinder displacement

Within 85 per cent and 100 per cent for engines with a unit cylinder displacement $\geq 0.75 \text{ dm}^3$ of the largest displacement within the engine family.

Within 70 per cent and 100 per cent for engines with a unit cylinder displacement $< 0.75 \text{ dm}^3$ of the largest displacement within the engine family.
- 3.6. Method of air aspiration:
 - (a) Naturally aspirated;
 - (b) Pressure charged;
 - (c) Pressure charged with charge cooler.
- 3.7. Combustion chamber type/design:
 - (a) Open chamber;
 - (b) Divided chamber;
 - (c) Other types.
- 3.8. Valves and porting:
 - (a) Configuration;
 - (b) Number of valves per cylinder;
 - (c) Cylinder wall;
 - (d) Crankcase.
- 3.9. Fuel supply type
 - 3.9.1. For compression ignition engines:

- (a) Pump, (high pressure) line and injector;
- (b) In-line pump or distributor pump;
- (c) Unit injector;
- (d) Common rail.

3.9.2. For positive ignition engines:

- (a) Carburettor;
- (b) Port fuel injection;
- (c) Direct injection.

3.10. Miscellaneous devices:

- (a) Exhaust gas recirculation (EGR);
- (b) Water injection;
- (c) Air injection;
- (d) Others.

3.11. Electronic control strategy

The presence or absence of an Electronic Control Unit (ECU) on the engine is regarded as a basic parameter of the family.

In the case of electronically controlled engines, the manufacturer shall present the technical elements explaining the grouping of these engines in the same family, i.e. the reasons why these engines can be expected to satisfy the same emission requirements.

The electronic governing of speed does not need to be in a different family from those with mechanical governing. The need to separate electronic engines from mechanical engines should only apply to the fuel injection characteristics, such as timing, pressure, rate shape, etc.

3.12. Exhaust after-treatment systems

The function and combination of the following devices are regarded as membership criteria for an engine family:

- (a) Oxidation catalyst;
- (b) DeNO_x system with selective reduction of NO_x (addition of reducing agent);
- (c) Other DeNO_x systems;
- (d) Particulate trap with passive regeneration;
- (e) Particulate trap with active regeneration;
- (f) Other particulate traps;
- (g) Other devices.

When an engine has been certified without an after-treatment system, whether as a parent engine or as a member of the family, then this engine, when equipped with an oxidation catalyst (not with particulate trap), may be included in the same engine family, if it does not require different fuel characteristics.

If it requires specific fuel characteristics (e.g. particulate traps requiring special fuel additives to ensure the regeneration process), the decision to include it in the same family shall be based on technical elements provided by the manufacturer. These elements shall indicate that the expected emission level of the equipped engine complies with the same limit value as the non-equipped engine.

When an engine has been certified with an after-treatment system, whether as a parent engine or as a member of a family, where the parent engine is equipped with the same after-treatment system, then this engine, when equipped without an after-treatment system, shall not be added to the same engine family."

Annex 6, paragraph 4.1., amend to read:

"4.1. Net power and specific fuel consumption of internal combustion engine

Measurements shall be taken at a sufficient number of engine speeds to define correctly the power, torque and specific fuel consumption curves between the lowest and the highest engine speeds recommended by the manufacturer as defined in paragraphs 2.9. and 2.11. of this Regulation.

The corrected values measured for the engine sampled shall not differ by more than the values indicated in the table below and ± 10 per cent for the specific fuel consumption.

<i>Engine Type</i>	<i>Rated net power (torque) [%]</i>	<i>Other measurement points on the curve [%]</i>	<i>Tolerance for engine speed [%]</i>
General	± 5	± 10	± 5
Petrol fuelled spark ignited engines with governor	± 8	± 12	± 8
Petrol fuelled spark ignited engines without governor	± 8	± 20	± 8

"