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**1958 Agreement – Consideration of draft amendments
to existing Regulations submitted by GRPE****Proposal for Supplement 1 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-first session to introduce the new reference fuels required by Directive 2004/26/EC for the three steps-stages IIIA, IIIB and IV. It is based on ECE/TRANS/WP.29/GRPE/2011/3, not amended (ECE/TRANS/WP.29/GRPE/61, para. 22). 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 5.2.3.4., amend to read:

"5.2.3.4. For compression-ignition engines:

The fuel used shall be the reference fuel specified in Annex 7.

The choice of the test fuel shall be made based on the exhaust limit values that the engine type or the engine family is intended to comply with. Based on the power bands described in the Regulation setting uniform provisions concerning the approval of compression ignition (C.I.) engines to be installed in agricultural and forestry tractors and in non-road mobile machinery with regard to the emissions of pollutants by the engine, the reference fuel shall be selected as follows:

Annex 7 Table 1 for power bands D to G

Annex 7 Table 2 for power bands H to K

Annex 7 Table 3 for power bands L to R

Optionally, the reference fuel specified in Annex 7 Table 1 may be used for power bands H to K."

Annex 7, paragraph 4, amend to read:

"4. Reference fuel for compression-ignition engines

Table 1 ^{1,11}**Agricultural and forestry tractor and non-road mobile machinery reference fuel for CI engines type approved to meet limit values of power bands D to G**

	<i>Limits and units</i> ²	<i>Test method</i>
Cetane number ⁴	Minimum 45 ⁷ Maximum 50	ISO 5165
Density at 15 °C	Minimum 835 kg/m ³ Maximum 845 kg/m ³ ¹⁰	ISO 3675, ASTM D 4052
Distillation ³ - 95 per cent point	Maximum 370 °C	ISO 3405
Viscosity at 40 °C	Minimum 2.5 mm ² /s Maximum 3.5 mm ² /s	ISO 3104
Sulphur content	Minimum 0.1 per cent mass ⁹ Maximum 0.2 per cent mass ⁸	ISO 8754, EN 24260
Flash point	Minimum 55 °C	ISO 2719
CFPP	Minimum — Maximum +5 °C	EN 116
Copper corrosion	Maximum 1	ISO 2160
Conradson carbon residue (10 per cent DR)	Maximum 0.3 per cent mass	ISO 10370
Ash content	Maximum 0.01 per cent mass	ASTM D 482 ¹²
Water content	Maximum 0.05 per cent mass	ASTM D 95, D 1744
Neutralization(strong acid) number	Minimum 0.20 mg KOH/g	
Oxidation stability ⁵	Maximum 2.5 mg/100 ml	ASTM D 2274
Additives ⁶		

¹ If it is required to calculate thermal efficiency of an engine or vehicle, the calorific value of the fuel can be calculated from:

$$\text{Specific energy (calorific value) (net) MJ/kg} = (46.423 - 8.792 * d^2 + 3.17 * d) * (1 - (x + y + s)) + 9.42 * s - 2.499 * x$$

where:

d = is the density at 288 K (15 °C)

x = is the proportion by mass of water (%/100)

y = is the proportion by mass of ash (%/100)

s = is the proportion by mass of sulphur (%/100).

² The values quoted in the specification are 'true values'. In establishment of their limit values the terms of ASTM D 3244 'Defining a basis for petroleum produce quality disputes' have been applied and in fixing a minimum value, a minimum difference of 2R above zero has been taken into account; in fixing a maximum and minimum value, the minimum difference is 4R (R = reproducibility).

Notwithstanding this measure, which is necessary for statistical reasons, the manufacturer of fuel should nevertheless aim at a zero value where the stipulated maximum value is 2R and the mean value in the case of quotations of maximum and minimum limits. Should it be necessary to clarify the question as to whether a fuel meets the requirements of the specifications, the terms of ASTM D 3244 should be applied.

³ The figures quoted show the evaporated quantities (percentage recovered + percentage loss).

⁴ The range of cetane is not in accordance with the requirement of a minimum range of 4R. However, in cases of dispute between fuel supplier and fuel user, the terms in ASTM D 3244 can be used to resolve such disputes provided replicate measurements, of sufficient number to achieve the necessary precision, are made in preference to single determinations.

⁵ Even though oxidation stability is controlled, it is likely that shelf life will be limited. Advice should be sought from the supplier as to storage conditions and life.

⁶ This fuel should be based straight run and cracked hydrocarbon distillate components only; desulphurization is allowed. It shall not contain any metallic additives or cetane improver additives.

⁷ Lower values are permitted, in which case the cetane number of the reference fuel used is to be reported.

⁸ Higher values are permitted, in which case the sulphur content of the reference fuel used is to be reported.

⁹ To be kept under constant review in the light of trends in the markets. For the purpose of the initial approval of an engine with no exhaust gas after treatment on request of the applicant a 0.050 per cent mass sulphur minimum is permissible, in which case the measured particulate level shall be corrected upward to the average value that is nominally specified for fuel sulphur content (0.150 per cent mass) per the equation below:

$$PT_{adj} = PT + [SFC * 0.0917 * (NSLF - FSF)]$$

where:

PT_{adj} = adjusted PT value (g/kWh)

PT = measured weighted specific emission value for particulate emission (g/kWh)

SFC = weighted specific fuel consumption (g/kWh) calculated according to the formula as below

NSLF = average of the nominal specification of sulphur content mass fraction (i.e. 0.15 %/100)

FSF = fuel sulphur content mass fraction (%/100)

Equation for the calculation of the weighted specific fuel consumption:

$$SFC = \frac{\sum_{i=1}^n G_{FUEL,i} * WF_i}{\sum_{i=1}^n P_i * WF_i}$$

where:

$$P_i = P_{m,i} + P_{AE,i}$$

For the purpose of conformity of production assessments in accordance with paragraph 6. the requirements shall be met using reference fuel with a sulphur content which complies with the minimum/maximum level of 0.1/0.2 per cent mass.

¹⁰ Higher values are permitted up to 855 kg/m³, in which case the density of the reference fuel used is to be reported. For the purpose of conformity of production assessments in accordance with paragraph 6, the requirements shall be met using reference fuel which complies with the minimum/maximum level of 835/845 kg/m³.

¹¹ All fuel characteristics and limit values are to be kept under review in light of trends in the markets.

¹² To be replaced by EN/ISO 6245 with effect of the date of implementation.

Table 2
**Agricultural and forestry tractor and non-road mobile machinery reference fuel for
 CI engines type approved to meet limit values of power bands H to K**

<i>Parameter</i>	<i>Unit</i>	<i>Limits</i> ¹		<i>Test Method</i>
		<i>Minimum</i>	<i>Maximum</i>	
Cetane number ²		52.0	54.0	EN-ISO 5165
Density at 15°C	kg/m ³	833	837	EN-ISO 3675
Distillation:				
50 per cent point	°C	245	—	EN-ISO 3405
95 per cent point	°C	345	350	EN-ISO 3405
Final boiling point	°C	—	370	EN-ISO 3405
Flash point	°C	55	—	EN 22719
CFPP	°C	—	-5	EN 116
Viscosity at 40 °C	mm ² /s	2.5	3.5	EN-ISO 3104
Polycyclic aromatic hydrocarbons	per cent m/m	3.0	6.0	IP 391
Sulphur content ³	mg/kg	—	300	ASTM D 5453
Copper corrosion		—	class 1	EN-ISO 2160
Conradson carbon residue (10 per cent DR)	per cent m/m	—	0.2	EN-ISO 10370
Ash content	per cent m/m	—	0.01	EN-ISO 6245
Water content	per cent m/m	—	0.05	EN-ISO 12937
Neutralization (strong acid) number	mg KOH/g	—	0.02	ASTM D 974
Oxidation stability ⁴	mg/ml	—	0.025	EN-ISO 12205

¹ The values quoted in the specifications are “true values”. In establishment of their limit values the terms of ISO 4259 "Petroleum products – Determination and application of precision data in relation to methods of test" have been applied and in fixing a minimum value, a minimum difference of 2R above zero has been taken into account; in fixing a maximum and minimum value, the minimum difference is 4R (R = reproducibility).

Notwithstanding this measure, which is necessary for technical reasons, the manufacturer of fuels should nevertheless aim at a zero value where the stipulated maximum value is 2R and at the mean value in the case of quotations of maximum and minimum limits. Should it be necessary to clarify the questions as to whether a fuel meets the requirements of the specifications, the terms of ISO 4259 should be applied.

² The range for the cetane number is not in accordance with the requirements of a minimum range of 4R. However, in the case of a dispute between fuel supplier and fuel user, the terms of ISO 4259 may be used to resolve such disputes provided replicate measurements, of sufficient number to archive the necessary precision, are made in preference to single determinations.

³ The actual sulphur content of the fuel used for the test shall be reported.

⁴ Even though oxidation stability is controlled, it is likely that shelf life will be limited. Advice should be sought from the supplier on storage conditions and shelf life.

Table 3

Agricultural and forestry tractor and non-road mobile machinery reference fuel for CI engines type approved to meet limit values of power bands L to R

<i>Parameter</i>	<i>Unit</i>	<i>Limits</i> ¹		<i>Test method</i>
		<i>Minimum</i>	<i>Maximum</i>	
Cetane number ²			54.0	EN-ISO 5165
Density at 15 °C	kg/m ³	833	865	EN-ISO 3675
Distillation:				
50 per cent point	°C	245	—	EN-ISO 3405
95 per cent point	°C	345	350	EN-ISO 3405
— Final boiling point	°C	—	370	EN-ISO 3405
Flash point	°C	55	—	EN 22719
CFPP	°C	—	-5	EN 116
Viscosity at 40 °C	mm ² /s	2.3	3.3	EN-ISO 3104
Polycyclic aromatic hydrocarbons	per cent m/m	3.0	6.0	IP 391
Sulphur content ³	mg/kg	—	10	ASTM D 5453
Copper corrosion		—	class 1	EN-ISO 2160
Conradson carbon residue (10 per cent DR)	per cent m/m	—	0.2	EN-ISO 10370
Ash content	per cent m/m	—	0.01	EN-ISO 6245
Water content	per cent m/m	—	0.02	EN-ISO 12937
Neutralization (strong acid) number	mg KOH/g	—	0.02	ASTM D 974
Oxidation stability ⁴	mg/ml	—	0.025	EN-ISO 12205
Lubricity (HFRR wear scar diameter at 60 °C)	µm	—	400	CEC F-06-A-96
FAME	prohibited			

¹ The values quoted in the specifications are 'true values'. In establishment of their limit values the terms of ISO 4259 'Petroleum products – Determination and application of precision data in relation to methods of test' have been applied and in fixing a minimum value, a minimum difference of 2R above zero has been taken into account; in fixing a maximum and minimum value, the minimum difference is 4R (R = reproducibility).

Notwithstanding this measure, which is necessary for technical reasons, the manufacturer of fuels should nevertheless aim at a zero value where the stipulated maximum value is 2R and at the mean value in the case of quotations of maximum and minimum limits. Should it be necessary to clarify the questions as to whether a fuel meets the requirements of the specifications, the terms of ISO 4259 should be applied.

² The range for cetane number is not in accordance with the requirements of a minimum range of 4R. However, in the case of a dispute between fuel supplier and fuel user, the terms of ISO 4259 may be used to resolve such disputes provided replicate measurements, of sufficient number to archive the necessary precision, are made in preference to single determinations.

³ The actual sulphur content of the fuel used for the Type I test shall be reported.

⁴ Even though oxidation stability is controlled, it is likely that shelf life will be limited. A device should be sought from the supplier as to storage conditions and life."
