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World Forum for Harmonization of Vehicle Regulations
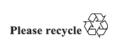
185th session
Geneva, 23-25 November 2021
Item 4.9.2. of the provisional agenda
1958 Agreement:
Consideration of draft amendments to existing
UN Regulations submitted by GRPE

Proposal for Supplement 11 to the 05 series of amendments to UN Regulation No. 49 (Emissions of compression ignition and positive ignition (LPG and CNG) engines)

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 eighty-third session (ECE/TRANS/WP.29/GRPE/83, para. 22). It is based on ECE/TRANS/WP.29/GRPE/2021/13, as amended by Annex IX of the report. It is submitted to the World Forum for Harmonization of Vehicle Regulations (WP.29) and to the Administrative Committee (AC.1) for consideration at their November 2021 sessions.

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* In accordance with the programme of work of the Inland Transport Committee for 2021 as outlined in proposed programme budget for 2021 (A/75/6 (part V sect. 20) para 20.51), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

Annex 4B

Paragraph 8.2.; amend to read:

"8.2.   NOx correction for humidity

As the NOx emission depends on ambient air conditions, the NOx concentration shall be corrected for humidity with the factors given in paragraph 8.2.1. or 8.2.2. The intake air humidity Ha may be derived from relative humidity measurement, dew point measurement, vapour pressure measurement or dry/wet bulb measurement using generally accepted equations.

For all humidity calculations (for example Ha, Hd) using generally accepted equations the saturation vapour pressure is required. For calculating the saturation vapour pressure which is in general a function of the temperature (at the humidity measurement point) the equation D.15 specified in Annex D to ISO Standard 8178-4:2020 should be used."

Paragraph 9.2.; amend to read:

"9.2.   Linearity requirements

…..

Table 7
Linearity requirements of instruments and measurement systems

Measurement system	$\chi_{min} \times$ *(a1 − 1)+ a0/*	*Slope a1*	*Standard error SEE*	*Coefficient of Determination r²*
Engine speed	≤ 0.05 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Engine torque	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Fuel flow	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Airflow	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Exhaust gas flow	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Diluent flow	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Diluted exhaust gas flow	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Sample flow	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Gas analyzers	≤ 0.5 % max	0.99 - 1.01	≤ 1 % max	≥ 0.998
Gas dividers	≤ 0.5 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Temperatures	≤ 1 % max	0.99 - 1.01	≤ 1 % max	≥ 0.998
Pressures	≤ 1 % max	0.99 - 1.01	≤ 1 % max	≥ 0.998
PM balance	≤ 1 % max	0.99 - 1.01	≤ 1 % max	≥ 0.998
Humidity measurement device	≤ 2 % max.	0.98 – 1.02	≤ 2 %	≥ 0.95

"

Annex 4A, Appendix 1

Paragraph 5.3.; amend to read:

"5.3.   NOx correction for humidity and temperature

As the NOx emission depends on ambient air conditions, the NOx concentration shall be corrected for ambient air temperature and humidity with the factors given in the following formulae. The factors are valid in the range between 0 and 25 g/kg dry air.

(a)   For compression ignition engines:

$$k_{h,D} = \frac{1}{1 - 0.0182 \times (H_a - 10.71) + 0.0045 \times (T_a - 298)}$$

With:

Ta = temperature of the intake air, K

Ha = humidity of the intake air, g water per kg dry air

Where:

Ha may be derived from relative humidity measurement, dewpoint measurement, vapour pressure measurement or dry/wet bulb measurement using the generally accepted formulae.

(b) For spark ignition engines

$k_{h.G}$ $= 0.6272 + 44.030 \times 10^{-3} \times H_a - 0.862 \times 10^{-3} \times H_a{}^2$

Where:

Ha may be derived from relative humidity measurement, dew point measurement, vapour pressure measurement or dry/wet bulb measurement using the generally accepted formulae.

For all humidity calculations (for example Ha, Hd) using generally accepted equations the saturation vapour pressure is required. For calculating the saturation vapour pressure which is in general a function of the temperature (at the humidity measurement point) the equation D.15 specified in Annex D to ISO Standard 8178-4:2020 should be used."

Annex 4A. Appendix 5

Paragraph 1.2.1., amend to read:

"1.2.1.   Pure gas

……………………………………

Hydrogen mixture (FID burner fuel)

(40 ± 1 per cent hydrogen, balance helium or alternatively nitrogen)

(Contamination ≤ 1 ppm C1, ≤ 400 ppm CO_2)"

Paragraph 1.7.2., amend to read:

"1.7.2.   Calibration

The CLD and the HCLD shall be calibrated in the most common operating range following the manufacturer's specifications using zero and span gas (the NO content of which shall amount to about 80 per cent of the operating range and the NO2 concentration of the gas mixture to less than 5 per cent of the NO concentration). With the ozonator deactivated, the NOx analyzer shall be in the NO mode so that the span gas does not pass through the converter. The indicated concentration has to be recorded."

Paragraph 1.7.8., amend to read:

"1.7.8.   NOx mode

Keeping NOx mode with the ozonator deactivated, the flow of oxygen or synthetic air is also shut off. The NOx reading of the analyzer shall not deviate by more than ±5 per cent from the value measured according to paragraph 1.7.2. (the analyzer is in the NOx mode)."