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1958 Agreement:
Consideration of draft amendments
to existing Regulations submitted by GRPE

Proposal for Supplement 9 to the 05 series of amendments to UN Regulation No. 49 (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 seventy-fifth session (ECE/TRANS/WP.29/GRPE/75, para. 22). It is based on GRPE-74-08 as reproduced in Annex VI to 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 2017 sessions.

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[*] In accordance with the programme of work of the Inland Transport Committee for 2016–2017 (ECE/TRANS/254, para. 159 and ECE/TRANS/2016/28/Add.1, cluster 3.1), 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.

Proposal for Supplement 9 to the 05 series of amendments to UN Regulation No. 49 (Compression ignition and positive ignition (LPG and CNG) engines))

Annex 4B, paragraph 7.8.4., amend to read:

"7.8.4.   Drift verification

As soon as practical but no later than 30 minutes after the test cycle is complete or during the soak period (for (b) only), the zero and span responses of the gaseous analyser ranges used shall be determined. For the purpose of this paragraph, test cycle is defined as follows:

(a)   For the WHTC: the complete sequence cold – soak – hot;

(b)   For the WHTC hot start test (paragraph 6.6.): the sequence soak – hot;

(c)   For the multiple regeneration WHTC hot start test (paragraph 6.6.): the total number of hot start tests;

(d)   For the WHSC: the test cycle.

The following provisions apply for analyzer drift:

(a)   The pre-test zero and span and post-test zero and span responses may be directly inserted into equation 66 of paragraph 8.6.1. without determining the drift;

(b)   If the drift between the pre-test and post-test results is less than 1 per cent of full scale, the measured concentrations may be used uncorrected or may be corrected for drift according to paragraph 8.6.1. of this annex;

(c)   If the drift difference between the pre-test and post-test results is equal to or greater than 1 per cent of full scale, the test shall be voided or the measured concentrations shall be corrected for drift according to paragraph 8.6.1. of this annex."

Annex 4B, paragraph 8.4.1.7., amend to read:

"8.4.1.7.   Carbon balance method

This involves exhaust mass calculation from the fuel flow and the gaseous exhaust components that include carbon. The calculation of the instantaneous exhaust gas mass flow is as follows:

$$q_{mew,i} = q_{mf,i} \times \left(\frac{w_{BET}^2 \times 1.4}{(1.0828 \times w_{BET} + k_{fd} \times k_c) \times k_c} \left(1 + \frac{H_a}{1000} \right) + 1 \right) \quad (33)$$

With

$$k_c = (c_{CO2d} - c_{CO2d,a}) \text{ x } 0,5441 + c_{COd}/18522 + c_{HCw}/17355 \quad (34)$$

And

$$k_{fd} = -0,055586 \text{ x } w_{ALF} + 0,0080021 \text{ x } w_{DEL} + 0,0070046 \text{ x } w_{EPS} \quad (35)$$

Where:

$q_{mf,i}$ is the instantaneous fuel mass flow rate, kg/s

H_a is the intake air humidity, g water per kg dry air

w_{BET} is the carbon content of the fuel, per cent mass

w_{ALF} is the hydrogen content of the fuel, per cent mass

w_{DEL} is the nitrogen content of the fuel, per cent mass

w_{EPS} is the oxygen content of the fuel, per cent mass

c_{CO2d} is the dry CO_2 concentration, per cent

$c_{CO2d,a}$ is the dry CO_2 concentration of the intake air, per cent

c_{COd} is the dry CO concentration, ppm

c_{HCw} is the wet HC concentration, ppm"

Annex 4B, paragraph 9.3.9.4.1., amend to read:

"9.3.9.4.1.   Sample dryer efficiency

For dry CLD analyzers, it shall be demonstrated that for the highest expected water vapour concentration Hm (see paragraph 9.3.9.2.2.), the sample dryer maintains CLD humidity at ≤ 5 g water/kg dry air (or about 0.8 volume per cent H_2O), which is 100 per cent relative humidity at 3.9 °C and 101.3 kPa. This humidity specification is also equivalent to about 25 per cent relative humidity at 25 °C and 101.3 kPa. This may be demonstrated by measuring the temperature at the outlet of a thermal dehumidifier, or by measuring humidity at a point just upstream of the CLD. Humidity of the CLD exhaust might also be measured as long as the only flow into the CLD is the flow from the dehumidifier."

Annex 4B, paragraph 9.4.2., amend to read:

"9.4.2.   General requirements of the dilution system

The determination of the particulates requires dilution of the sample with filtered ambient air, synthetic air or nitrogen (the diluent). The dilution system shall be set as follows:

(a)   Completely eliminate water condensation in the dilution and sampling systems;

(b)   Maintain the temperature of the diluted exhaust gas between 315 K (42 °C) and 325 K (52 °C) within 20 cm upstream or downstream of the filter holder(s);

(c)   The diluent temperature shall be between 293 K and 325 K (20 °C to 52 °C) in close proximity to the entrance into the dilution tunnel;

(d)   The minimum dilution ratio shall be within the range of 5:1 to 7:1 and at least 2:1 for the primary dilution stage based on the maximum engine exhaust flow rate;

(e)   For a partial flow dilution system, the residence time in the system from the point of diluent introduction to the filter holder(s) shall be between 0.5 and 5 seconds;

(f)   For a full flow dilution system, the overall residence time in the system from the point of diluent introduction to the filter holder(s) shall be between 1 and 5 seconds, and the residence time in the secondary dilution system, if used, from the point of secondary diluent introduction to the filter holder(s) shall be at least 0.5 seconds.

Dehumidifying the diluent before entering the dilution system is permitted, and especially useful if diluent humidity is high."

Annex 4B, paragraph 9.5.5., amend to read:

"9.5.5.   Total system verification

The total accuracy of the CVS sampling system and analytical system shall be determined by introducing a known mass of a pollutant gas into the system while it is being operated in the normal manner. The pollutant is analyzed, and the mass calculated according to paragraph 8.5.2.3. except in the case of propane where a *u* factor of 0.000507 is used in place of 0.000483 for HC. Either of the following two techniques shall be used."

Annex 4B, Appendix 4, paragraph A.4.2., amend to read:

"A.4.2.   Regression analysis

The slope of the regression shall be calculated as follows:

$$a_1 = \frac{\sum_{i=1}^{n}(y_i - \bar{y}) \times (x_i - \bar{x})}{\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

(94)

The y intercept of the regression shall be calculated as follows:

$$a_0 = \bar{y} - (a_1 \times \bar{x})$$

(95)

The standard error of estimate (SEE) shall be calculated as follows:

$$SEE = \sqrt{\frac{\sum_{i=1}^{n}[y_i - a_0 - (a_1 \times x_i)]^2}{n-2}}$$

(96)

The coefficient of determination shall be calculated as follows:

$$r^2 = 1 - \frac{\sum_{i=1}^{n}[y_i - a_0 - (a_1 \times x_i)]^2}{\sum_{i=1}^{n}(y_i - \bar{y})^2}$$

(97)"