Submitted by the expert from OICA

Informal document **GRPE-80-25**
80th GRPE,14-17 January 2020
Agenda item 4.(b)

Proposal for corrigendum to UN GTR No. 4

(ECE/TRANS/180/Add.4/Amend.3)

I. Proposal

Paragraph 7.8.8., Table 4*, amend to read:*

"7.8.8. Validation statistics of the test cycle

Table 4

Permitted point omissions from regression analysis

Event	*Conditions*	*Permitted point omissions*
Minimum operator demand (idle point)	n_{ref} = 0 per cent ~~and~~ **or** M_{ref} = 0 per cent ~~and~~ **or** $M_{act} > (M_{ref} - 0.02\ M_{max.\ mapped\ torque})$ ~~and~~ **or** $m_{at} < (M_{ref} + 0.02\ M_{max.\ mapped\ torque})$	speed and power
Minimum operator demand (motoring point)	M_{ref} < 0 per cent	power and torque
Minimum operator demand	$n_{act} \leq 1.02\ n_{ref}$ and $M_{act} > M_{ref}$ ~~and~~ **or** $n_{act} > n_{ref}$ and $M_{act} \leq M_{ref}$ ~~and~~ **or** $n_{act} > 1.02\ n_{ref}$ and $M_{ref} < M_{act} \leq (M_{ref} + 0.02\ M_{max.\ mapped\ torque})$	power and either torque or speed
Maximum operator demand	$n_{act} < 1.02\ n_{ref}$ and $M_{act} \geq M_{ref}$ ~~and~~ **or** $n_{act} \geq 0.98\ n_{ref}$ and $M_{act} < M_{ref}$ ~~and~~ **or** $n_{act} < 0.98\ n_{ref}$ and $M_{ref} > M_{act} \geq (M_{ref} - 0.02\ M_{max.\ mapped\ torque})$	power and either torque or speed

Paragraph 8.1.1., Equation (15)*, amend to read:*

"8.1.1. Raw exhaust

$$k_{w,a} = \left(1 - \frac{1.2442 \times H_a + 111.19 \times w_{ALF} \times \frac{q_{mf,i}}{q_{mad,i}}}{773.4 + 1.2442 \times H_a + \frac{q_{mf,i}}{q_{mad,i} \times \cancel{k_f} \boldsymbol{k_{f,w}} \times 1{,}000}}\right) \times 1.008 \qquad (15)$$

…"

Paragraph 8.1.1, Equation (16), , *amend to read:*

"8.1.1. Raw exhaust

$$k_{w,a} = \left(1 - \frac{1.2442 \times H_a + 111.19 \times w_{ALF} \times \frac{q_{mf,i}}{q_{mad,i}}}{773.4 + 1.2442 \times H_a + \frac{q_{mf,i}}{q_{mad,i} \times \cancel{k_f}\boldsymbol{k_{f,w}} \times 1{,}000}}\right) \Bigg/ \left(1 - \frac{p_r}{p_b}\right) \quad (16)$$

…"

Paragraph 8.4.2.3., Equation (35)*, amend to read:*

"8.4.2.3. Calculation of mass emission based on tabulated values

$$m_{gas} = u_{gas} \times \sum_{i=1}^{i=n} \left(\boldsymbol{c_{gas,i}} \times \boldsymbol{q_{mew,i}} \times \frac{\mathbf{1}}{\boldsymbol{f}}\right) \quad (35)$$

…"

Paragraph 8.4.2.4., Equation (36) *, amend to read:*

"8.4.2.4. Calculation of mass emission based on exact equations

$$m_{gas} = \sum_{i=1}^{i=n} \left(\boldsymbol{u_{gas,i}} \times \boldsymbol{c_{gas,i}} \times \boldsymbol{q_{mew,i}} \times \frac{\mathbf{1}}{\boldsymbol{f}}\right) \quad (36)$$

…"

Paragraph 8.5.2.3.1., Equation (59) *, amend to read:*:

"8.5.2.3.1. Systems with constant mass flow

$$u_{gas} = \frac{M_{gas}}{M_d \times \left(1 - \frac{1}{D}\right) + M_e \times \left(\frac{1}{D}\right)} \times \frac{\mathbf{1}}{\mathbf{1000}} \quad (59)$$

…"

Paragraph 8.6.1.*, amend to read:*

"8.6.1. Drift correction

Depending on the measurement system and calculation method used, the uncorrected emissions results shall be calculated with equations 38, 39, 58, ~~59~~**60** or 64, respectively. For calculation of the corrected emissions, c_{gas} in equations 38, 39, 58, ~~59~~**60** or 64, respectively, shall be replaced with c_{cor} of equation 68. If instantaneous concentration values $c_{gas,i}$ are used in the respective equation, the corrected value shall also be applied as instantaneous value $c_{cor,i}$. In equation **60,** 64, the correction shall be applied to both the measured and the background concentration.

…"

Paragraph 8.5.1.4., Equation (56)*, amend to read:*

"8.5.1.4. SSV-CVS system

$$Q_{SSV} = \frac{A_0}{\mathbf{60}} d_V^2 C_d p_p \sqrt{\left[\frac{1}{T}\left(r_p^{1.4286} - r_p^{1.7143}\right) \cdot \left(\frac{1}{1 - r_D^4 r_p^{1.4286}}\right)\right]} \qquad (56)$$

Where:

A₀ is ~~0.006111~~ **0.005692** in SI units of $\left(\frac{m^3}{min}\right)\left(\frac{K^{\frac{1}{2}}}{kPa}\right)\left(\frac{1}{mm^2}\right)$

d_V is the diameter of the SSV throat, ~~m~~**mm**

…"

Paragraph 9.5.4.1., *amend to read:*

"9.5.4.1. Data analysis

…

$$C_d = \frac{Q_{ssv}}{\frac{\boldsymbol{A_0}}{\mathbf{60}} \times d_V^2 \times p_p \times \sqrt{\left[\frac{1}{T} \times \left(r_p^{1.4286} - r_p^{1.7143}\right) \times \left(\frac{1}{1 - r_D^4 \times r_p^{1.4286}}\right)\right]}} \qquad (93)$$

Q_{ssv} is the airflow rate at standard conditions (101.3 kPa, 273 K), m^3/s

T is the temperature at the venturi inlet, K

d_V is the diameter of the SSV throat, ~~m~~**mm**

…

$$\mathrm{Re} = A_1 \times \mathbf{60} \times \frac{q_{SSV}}{d_V \times \mu} \qquad (94)$$

…

Where:

A_1 is ~~25.55152~~ **27.43831** in SI units of $\left(\frac{\cancel{1}\boldsymbol{kg}}{m^3}\right)\left(\frac{min}{s}\right)\left(\frac{mm}{m}\right)$

Q_{ssv} is the airflow rate at standard conditions (101.3 kPa, 273 K), m^3/s

d_V is the diameter of the SSV throat, ~~m~~**mm**

…"

Annex 3, paragraph 1.3., *amend to read:*

"A.3.1.3. Components of Figures 9 and 10

EP Exhaust pipe

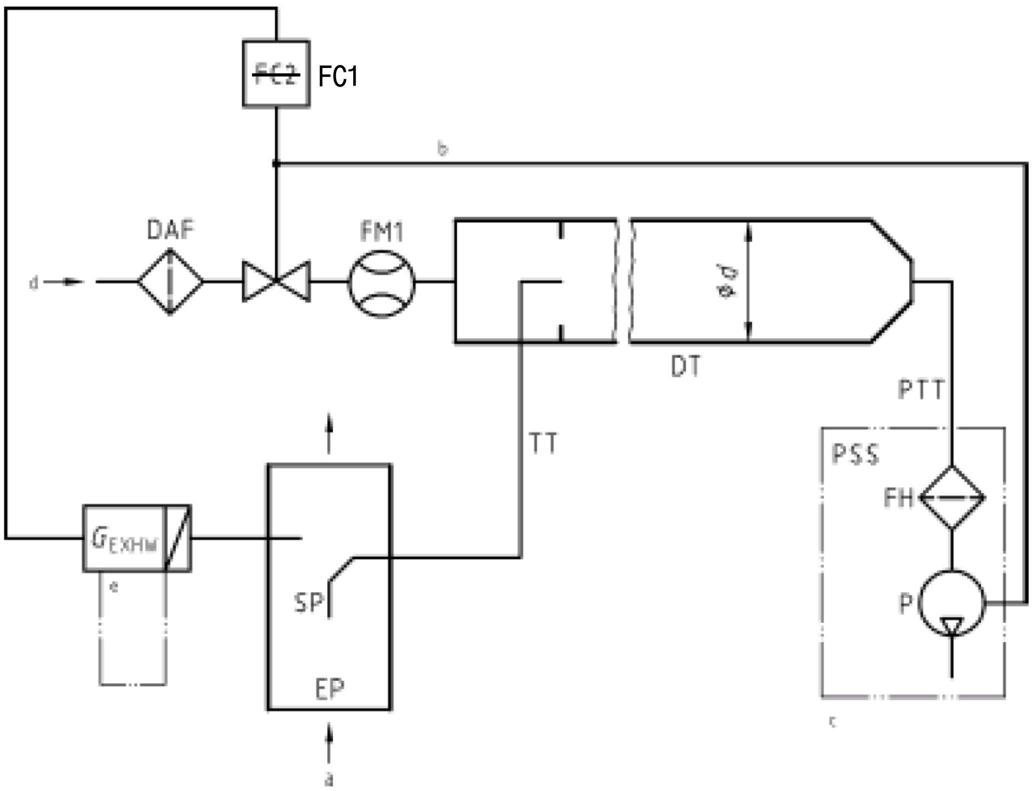
SP**1** Raw exhaust gas sampling probe (Figure 9 only)

…"

Annex 3, paragraph 2.1. Figure 12, *amend to read:*

Figure 12

Scheme of partial flow dilution system (total sampling type)



a = exhaust b = optional c = details see Figure 16

…"

Annex 3, paragraph 2.5., *amend to read:*

"A.3.2.5. Description of particulate sampling system

For a partial flow dilution system, a sample of the diluted exhaust gas is taken from the Dilution Tunnel (DT) through the Particulate Sampling Probe (PSP) and the Particulate Transfer Tube (PTT) by means of the sampling pump P, as shown in Figure 16. The sample is passed through the Filter Holder(s) (FH) that contain the particulate sampling filters. The sample flow rate is controlled by the flow controller FC~~3~~**2**.

For of full flow dilution system, a double dilution particulate sampling system shall be used, as shown in Figure 17. A sample of the diluted exhaust gas is transferred from the Dilution Tunnel (DT) through the Particulate Sampling Probe (PSP) and the Particulate Transfer Tube (PTT) to the Secondary Dilution Tunnel (SDT), where it is diluted once more. The sample is then passed through the Filter Holder(s) (FH) that contain the particulate sampling filters. The diluent flow rate is usually constant whereas the sample flow rate is controlled by the flow controller FC~~3~~**2**. If Electronic Flow Compensation (EFC) (see Figure 15) is used, the total diluted exhaust gas flow is used as command signal for FC~~3~~**2**.

…"

Annex 4, Equation (100)*, amend to read:*

"A.4.2. Regression analysis

$$SEE = \sqrt{\frac{\sum_{i=1}^{n}\left[y_i - a_0 - \left(a_1 \times x_i\right)\right]^2}{n-2}} \qquad (100)$$

…"

II. Justification

1. Paragraph 7.8.8. Table 4

Each condition in Table 4 is not determined based on all the conditions, but needs to be determined based on individual conditions. In other words, it is necessary to modify it to "or" instead of "and" that connects the conditions.

2. Paragraph 8.1.1.

In equations (15) and (16), the coefficient to be referenced is incorrect. That is, the volume of exhaust gas added by combustion in a wet state needs to be expressed not by k_f but by $k_{f,w}$.

3. Paragraph 8.4.2.3. /8.4.2.4.

In equations (35) and (36), all the calculation equations after Sigma need to be performed in Sigma. Therefore, parentheses are added to calculations after sigma.

4. Paragraph 8.5.2.3.1.

Equation (59) needs to be multiplied by 1/1000 to adjust the number of digits. The number of digits is correctly adjusted in the equations (40) and (41), and the number of digits is similarly adjusted in the equation (59).

5. Paragraph 8.6.1.

In the text, the equation to be referenced is incorrect. It is equation (60) that needs to be referenced.

6. Paragraph 8.1.1.

In the dimension of the volume flow equation, the coefficient A_0 must be divided by 60. Similarly, the coefficient A_0 must be 0.005692 in the standard conditions (273K, 101.3kPa). In addition, the unit of the SSV throat diameter d_V must be (mm).

7. Paragraph 9.5.4.1.

The discharge coefficient of the SSV needs to be correlated with the SSV mass flow rate calculation formula. Therefore, the coefficient A_0 divided by 60 is added. In addition, the unit of the SSV throat diameter d_V must be (mm).

Reynolds number must be multiplied by 60.

The coefficient A_1 must be 27.43831 in the standard state (273K, 101.3kPa).

In addition, the coefficient A_1 needs (kg) when converted to SI units.

8. Annex 3, paragraph 1.3.

In Figure 9, raw exhaust gas sampling probe is represented by “SP1”, whereas “SP” is indicated in the text. Therefore, it is necessary correctly set “SP1” in the text.

9. Annex 3, paragraph 2.1.

In the text, the flow controller is represented by “FC1”, whereas in Figure 12, it is “FC2”. Therefore, it is necessary to correctly set “FC1” in Figure 12.

10. Annex 3, paragraph 2.5.

In Figure 16 and Figure 17, the sample flow controller is represented as “FC2”, whereas in the text, it is “FC3”. Therefore, it is necessary correctly set “FC2” in the text.

11. Annex 4.2.

In equation (100), it is correct that the square root of the standard error is included up to the denominator. It was corrected in UN GTR No.4 Amendment 1 – Corrigendum 1, but was not reflected when UN GTR No.4 Amendment 3 was issued. Therefore, it is necessary to reflect correctly.