16 September 2021

Global Registry

Created on 18 November 2004, pursuant to Article 6 of the Agreement concerning the establishing of global technical regulations for wheeled vehicles, equipment and parts which can be fitted and/or be used on wheeled vehicles (ECE/TRANS/132 and Corr.1) done at Geneva on 25 June 1998

Addendum 4: United Nations Global Technical Regulation No. 4

United Nations Global Technical Regulation on Test procedure for compression-ignition (C.I.) engines and positive-ignition (P.I.) engines fuelled with natural gas (NG) or liquefied petroleum gas (LPG) with regard to the emission of pollutants (WHDC)

(Established in the Global Registry on 22 June 2021)

Amendment 4 - Appendix 1

Proposal and report pursuant to Article 6, paragraph 6.2.7. of the Agreement

- Proposal to amend UN Global Technical Regulation No. 4 (WHDC) (ECE/TRANS/WP.29/AC.3/20)
- Technical report on the development of Amendment 4 to UN Global Technical Regulation No. 4 (WHDC) (ECE/TRANS/WP.29/2021/80).

UNITED NATIONS

Proposal to amend UN Global Technical Regulation No. 4

I. Objective of the proposal

1. The objective of this proposal is to introduce an amendment to the UN Global Technical Regulation for heavy-duty vehicle emissions (UN GTR No. 4). This amendment is introduced with the aim of removing the options contained in document ECE/TRANS/180/Add.4 established in the Global Registry on 15 November 2006. The options refer to:

(a) Hot soak period;

(b) Weighting factors for hot and cold phases;

(c) Particulate sampling filter size and material;

(d) Engine power definition.

2. Regulations governing exhaust-emissions from all vehicles have been in use for many years but the methods of measurement vary. To ensure the maximum benefit to the environment as well as the efficient use of energy, it is desirable that as many countries as possible use the same high standards of emission control. In that context, this UN GTR is an important step forward.

3. Manufacturers of heavy-duty vehicles are already operating in a world market and it is economically inefficient for manufacturers to have to prepare different models in order to meet different emission regulations and methods of measuring CO_2/fuel consumption, which are, in principle, aimed at achieving the same objective. This UN GTR will enable vehicle manufacturers to develop new models in the most effective way.

II. Description of the UN Global Technical Regulation

4. The regulation is based on research into the world-wide pattern of real heavy commercial vehicle use. From the collected data, two representative test cycles, one transient test cycle (WHTC) and one steady state test cycle (WHSC), have been created covering typical driving conditions in the European Union, the United States of America and Japan. Based on real life data a model was developed for translating the vehicle cycle into an engine cycle. The general laboratory conditions for the emission test and the engine family concept have been brought up to date by expert committees in the International Organization for Standardization (ISO) and reflect the latest technologies.

5. The WHTC and WHSC test procedures reflect world-wide on-road heavy-duty engine operation as closely as possible and provide a marked improvement in the test procedure for measuring the emission performance of existing and future heavy-duty engines.

6. The next phase of work on this global technical regulation aims at eliminating the above-mentioned options in order to achieve a fully harmonised test procedure. AC.3 is therefore requested to agree that UN GTR No. 4 be amended and that the informal group established for the development of the UN GTR under the Working Party on Pollution and Energy (GRPE) continues its work on the amendment of the UN GTR.

7. While it is difficult to foresee a deadline, it is expected that phase 2 will be completed in two years.

Technical report on the development of Amendment 4 to UN GTR No. 4 on World-wide harmonized Heavy Duty Certification procedure (WHDC)

I. Mandate

1. Amendment 4 to UN GTR No. 4 was developed by the representative from Japan to correct errors found in several formulas. The Executive Committee (AC.3) of the 1998 Agreement adopted the authorisation to develop GTR No. 4 at its November 2007 session (ECE/TRANS/WP.29/AC.3/20).

II. Objectives

2. 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.

3. 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 $k_{f,w}$.

4. Paragraph 8.4.2.3. and 8.4.2.4.

In equations (38) and (39), all the calculation equations after Sigma need to be performed in Sigma. Therefore, parentheses are added to calculations after sigma.

5. Paragraph 8.5.1.4.

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).

6. 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).

7. Paragraph 8.6.1.

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

8. 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.

9. 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.

10. 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.

11. 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.

12. 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.