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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

Global technical regulation No. 10

OFF-CYCLE EMISSIONS (OCE)

(Established in the Global Registry on 24 June 2009)

Appendix

Proposal and report pursuant to Article 6, paragraph 6.3.7. of the Agreement

- Proposal to develop a global technical regulation concerning the heavy-duty off-cycle emissions vehicles (TRANS/WP.29/AC.3/12)
- Report on the development of the global technical regulation concerning off-cycle emissions vehicles (ECE/TRANS/WP.29/2009/72), adopted by AC.3 at its twenty-sixth session (ECE/TRANS/WP.29/1077, para. 83)

UNITED NATIONS

PROPOSAL TO DEVELOP A GLOBAL TECHNICAL REGULATION CONCERNING OFF-CYCLE EMISSIONS VEHICLES

I. OBJECTIVE OF THE PROPOSAL

1. The objective of the proposal is to establish a Global Technical Regulation for heavy-duty vehicle emissions. Over the last several years, it has become clear that in-use emissions might inappropriately exceed the applicable emission limits when engines were operated under conditions not found during traditional laboratory testing (i.e., off-cycle emissions). The basis will be harmonized procedures for ensuring that emission control technologies are actually effective under normal operating conditions because they test a broad range of normal driving conditions that are otherwise not subject to traditional emissions testing.

2. Trucks, like other motor vehicles, are driven over a wide variety of operating conditions, including starts, stops, accelerations, decelerations, steady cruises, and under varying loads and ambient conditions (e.g., variations in temperature, altitude, humidity and barometric pressure). Over many years of engineering study and development, manufacturers have developed sophisticated electronic and mechanical systems that control the performance of diesel truck engines over this wide variety of driving conditions. A central aspect of this sophisticated engineering is the constant monitoring of a wide range of engine operating parameters, including engine rotational speed, vehicle ground speed, and intake manifold pressure and temperature. Based on the monitored data, the engine computer is typically programmed to control the operation of the engine, by, for example, adjusting the timing and rate of fuel injection or the amount of air from a turbocharger.

3. For many years, the basic regulatory approach for heavy-duty diesel engine exhaust standards for NOx and PM relied on defeat device provisions and on a standardized test. The tests in various countries including the United States, Japan and the European Union are highly regimented laboratory test procedures. The engine is installed in a test cell and operated over the designated test cycles.

4. The test cycles are intended to simulate a representative driving regime, but a substantial portion of the wide variety of real world driving conditions are not incorporated into specific tests. For example, the U.S. FTP applies only at a specific temperature range and only at the specific speed and torque points and in the order specified in the FTP test cycle. This means that an engine might comply with the FTP in the laboratory, but not achieve FTP based emission reductions in real world driving.

5. The growing sophistication of engine technology has greatly increased the potential that the emission control system will be modified under conditions not included or underrepresented on the laboratory test procedures, resulting in substantially higher emission levels under actual driving conditions. For this reason, the proposed GTR is an important step forward to ensure that emission limits are met in-use, under a wide range of operating conditions.

II. DESCRIPTION OF THE PROPOSED REGULATION

6. The proposed regulation will be based on the additional requirements for both type-approval and certification that require adherence to a Not-to-exceed (NTE) protocol. The proposed GTR will be modelled after the United States NTE regulations developed to specifically address the need to better ensure that emission control technologies are actually effective under normal operating conditions because they test a broad range of normal driving conditions that are otherwise not subject to emissions testing. NTE protocols, in combination with the defeat device prohibition, and a steady state test common to all regulatory entities will ensure that engines will operate at or below the lawful emission limits on the road.

7. In the past, regulating entities have relied exclusively on the defeat device provisions to achieve this purpose. The defeat device prohibition, however, does not provide a quantified numerical emissions limit and associated test procedure for conditions not encountered on the laboratory tests, resulting in case-by-case decision making regarding whether a particular element of design constitutes a defeat device.

8 The proposed GTR will focus on the requirements needed to be met for the purposes of type approval and certification as an additional requirement to the harmonized WHTC and WHSC procedures, when adopted.

III. EXISTING REGULATIONS AND INTERNATIONAL STANDARDS

9. The following regulations and standards will be taken into account during development of the new gtr:

UNECE Regulation:
UN-ECE Regulation No. 49 -Uniform provisions concerning the approval of compression ignition (C.I.) and natural gas (NG) engines as well as positive-ignition (P.I.) engines fuelled with liquefied petroleum gas (LPG) and vehicles equipped with C.I. and NG engines and P.I. engines fuelled with LPG, with regard to the emissions of pollutants by the engine

EU:
Directive 1999/96/EC of the European Parliament and of the Council on the approximation of the laws of Member States relating to measures to be taken against emission of gaseous and particulate pollutants from compression ignition engines for the use in vehicles, and the emission of gaseous pollutants from positive ignition engines fuelled with natural gas or liquefied petroleum gas for use in vehicles and amending 88/77/EEC;

Directive 2001/27/EC of the Commission adapting to technical progress Council Directive 88/77/EEC on the approximation of the laws of Member States relating to measures to be taken against emission of gaseous and particulate pollutants from compression ignition engines for the use in vehicles, and the emission of gaseous pollutants from positive ignition engines fuelled with natural gas or liquefied petroleum gas for use in vehicles.

Japanese Regulation:
Road Vehicles Act, Law no.185 of June 1951, as last amended by law No. 100 of 2002, Article 41 "Systems and devices of Motor vehicles".

USA Laws and Regulation:
42 U.S.C. § 7522(a)(3)(B); U.S. Code of Federal Regulations Title 40 Part 86.094-2;

U.S. Code of Federal Regulations Title 40 Part 86 – "Emissions Control, Air Pollution From 2004 and Later Model Year Heavy-Duty Highway Engines and Vehicles; Light-Duty On-Board Diagnostics Requirements, Revision; Final Rule";

U.S. Code of Federal Regulations Title 40 Part 86 – "Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements; Final Rule".

FINAL REPORT ON THE DEVELOPMENT OF A GLOBAL TECHNICAL REGULATION CONCERNING OFF-CYCLE EMISSIONS VEHICLES

I. INTRODUCTION

10. Traditionally, vehicle emissions have been regulated by the use of standardised laboratory-based test cycles. Emissions which occur under conditions not well represented by the laboratory-based test cycles are called off-cycle emissions. The objective of this Off-Cycle Emissions (OCE) global technical regulation (gtr) is to establish a harmonized regulation which ensures that off-cycle emissions from heavy-duty engines and vehicles are appropriately controlled over a broad range of engine and ambient operating conditions encountered during normal in-use vehicle operation. This report documents the development of the gtr by the Working Party on Pollution and Energy (GRPE) and the OCE informal working group.

11. The OCE gtr is designed to be applicable to engines certified or type approved under the test procedures of the Worldwide harmonized Heavy-Duty Certification (WHDC) gtr. The intent behind the OCE gtr is to control emissions during engine and ambient operating conditions that are broader than those covered in emissions testing using the two components of the WHDC gtr, the World-Harmonized Transient Cycle and the World-Harmonized Steady-state Cycle.

12. This OCE gtr includes two components. First, it contains provisions that prohibit the use of defeat strategies. Second, it introduces a methodology, termed the World-Harmonized Not-to-Exceed (WNTE) methodology, for limiting off-cycle emissions. The WNTE includes harmonized off-cycle emissions factors, applicable under a broad range of engine and ambient operating conditions. When the emission factors are applied to the emission limits in force in a specific region, the resulting WNTE emission limits provide a level below which emissions from the tailpipe shall remain.

13. It is important to note that the WHDC gtr has been adopted as a global test procedure without emission limits as a first step towards the worldwide harmonization of cycle-based emission certification requirements for heavy-duty engines. During this first stage, Contracting Parties are expected to introduce the WHDC test procedures into their individual regional legislation. However, it is anticipated that there will continue to be a range of WHDC-based emission limits in effect in the various regions until such a time that world-wide emission limits are adopted as part of the WHDC gtr. This being the case, the WNTE-based emission limits defined in the OCE gtr relate directly to the emission limits to which a specific engine has been certified based on the WHDC test procedures. This structure enables regional authorities to implement a common approach to establishing WNTE-based emission limits, even in the period where global WHDC emission limits are not set out in the WHDC gtr. The eventual adoption of global WHDC-based emission limits will enable worldwide harmonized WNTE emission limits to be established.

14. It is also important to note that the WNTE does not cover all vehicle and ambient operating conditions. Therefore, Contracting Parties may wish to implement additional requirements and/or test procedures to address off-cycle conditions not represented adequately by the WNTE. These requirements could be set in regional legislation or by future amendments to this gtr.

II. BACKGROUND ON OFF-CYCLE EMISSIONS

15. The basic regulatory approach historically utilized by a number of countries to reduce exhaust emissions from heavy-duty engines was to use a combination of an emissions certification test cycle with an emissions limit (or standard) and a prohibition against the use of defeat strategies.

16. The test cycle for heavy-duty engines, while different among various countries, had a number of common characteristics. The test cycle was based on an engine test, performed in a laboratory, under a limited range of ambient conditions, and the test cycle contained a pre-defined set of speed and load points always run in the same order. The prohibition against the use of defeat strategies generally required that the engine could not operate differently in-use in a manner which reduced the effectiveness of the engine's emission control system.

17. Heavy-duty vehicles are driven over a wide variety of operating conditions (e.g. starts, stops, accelerations, decelerations, steady cruises) and under varying ambient conditions (e.g. temperature, humidity and barometric pressure). The WHDC gtr will result in a laboratory based test cycle which reflects worldwide on-road heavy-duty engine operation. However, as with any standardized test cycle, the wide variety of real world driving conditions cannot be fully incorporated within the WHDC.

18. Heavy-duty engines have progressed over the past decade to include very sophisticated electronic and mechanical systems. These systems are capable of controlling the performance of heavy-duty engines over a wide variety of driving conditions. A central aspect of this sophisticated engineering is the capability to continuously monitor a wide range of operating parameters, including engine rotational speed, vehicle ground speed, and intake manifold pressure and temperature, and to modify the performance of the engine and its emission control systems in real-time in response to the monitored data.

19. Defeat strategy (DS) provisions have not generally provided a quantified numerical emissions limit and associated test procedure for conditions outside of the regulatory test cycles. This has often resulted in the need for case-by-case decision making during the certification and type-approval process regarding whether a particular element of design constitutes a defeat strategy. These design-based reviews have become increasingly difficult as the engines and the emission control technologies have grown more complex.

20. The approach contained in the OCE gtr may reduce the reliance on case-by-case design reviews by requiring emission compliance during a wide range off-cycle operation. The provisions of this gtr supplement the prohibition against defeat strategies and can allow for a more efficient and objective performance-based means for evaluating off-cycle emissions behaviour.

21. When considered as a whole, the WHDC gtr and the OCE gtr promote global harmonization of regulations that reduce air pollution from heavy-duty vehicles and engines.

III. PROCEDURAL BACKGROUND AND DEVELOPMENT OF THE GLOBAL TECHNICAL REGULATION

22. The OCE gtr was developed by the GRPE informal working group on Off-Cycle Emissions (the OCE working group). The work to develop this gtr began with the establishment of the OCE working group. The OCE working group had its first meeting in December 2001.

23. As required by the 1998 Global Agreement, a formal proposal for the establishment of a gtr was proposed to the Executive Committee of the 1998 Agreement (AC.3) by the United States of America. At its session on 13th March 2005, the proposal from the United States of America was approved as a gtr project by AC.3 (TRANS/WP.29/AC.3/12) and assigned to GRPE.

24. One of the key issues discussed during the development of the OCE gtr was the scope of the gtr with respect to in-use, on-vehicle emissions testing. After considerable debate by the OCE working group and concurrence from GRPE, it was decided that the OCE gtr would not include specifications for in-use, on-vehicle emission measurement. However, the OCE gtr was developed with the specific intent of enabling the testing of compliance with the WNTE during in-use on-road operation. Therefore, it may be appropriate in the future to consider the development of a gtr which would include harmonized test procedures for in-use on vehicle emissions measurement.

25. The WNTE method originated as a concept that could be enforced using in-use, on-vehicle testing. In order to provide flexibility to Contracting Parties as how to implement the gtr into regional legislation, additional provisions were included so that the WNTE methodology could also be applied as a laboratory based test procedure. This laboratory procedure was developed explicitly for the OCE gtr and was not tested in a laboratory before inclusion in the legal text. For that reason, there remain uncertainties as to the effectiveness of the laboratory based test procedure in preventing defeat strategies, so the procedure may need to be updated in a future version of the OCE gtr. One of the aspects that will require future validation is the applicability of the same WNTE components to an in-use on-vehicle test and a laboratory based test. The rationale for components being introduced in the first place relates to the wide variation in vehicle and ambient operating conditions on the road. In the much more stable laboratory tests conditions, the same rationale does not exist for a WNTE component so no adjustment to the WHTC emission limit may be necessary.

IV. DOCUMENTATION

26. A large number of documents and meeting minutes of the OCE working group including a list of the OCE meetings as well as the representations provide a chronology of the development of the gtr. This documentation is available on the UNECE website at: http://www.unece.org/trans/main/wp29/wp29wgs/wp29grpe/oce.html.
