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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. 5

TECHNICAL REQUIREMENTS FOR ON-BOARD DIAGNOSTIC SYSTEMS (OBD) FOR ROAD VEHICLES
(Established in the Global Registry on 15 November 2006)

Appendix

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

- Proposal to develop a global technical regulation concerning on-board diagnostic system for heavy-duty vehicles and engines (TRANS/WP.29/AC.3/1)
- Report on the development of a global technical regulation concerning on-board diagnostic systems (OBD) for road vehicles (ECE/TRANS/WP.29/2006/131), adopted by AC.3 at its eighteenth session (ECE/TRANS/WP.29/1056, para. 92)

UNITED NATIONS

PROPOSAL TO DEVELOP A GLOBAL TECHNICAL REGULATION CONCERNING ON-BOARD DIAGNOSTIC SYSTEM FOR HEAVY-DUTY VEHICLES AND ENGINES

Objective of the proposal

The advent of computer controlled drive trains in automobiles has lead to the development and widespread use of sophisticated electronic systems that detect emission related malfunctions and alert the vehicle operator by the illumination of a light on the vehicle control panel, thereby helping to ensure that emissions reductions from in-use vehicles are maintained. These systems, commonly referred to as On-Board Diagnostic (OBD) systems, also assist the repair technicians in the identification and repair of the problem thereby reducing overall repair time.

Different OBD systems for light-duty vehicles exist throughout the world. The United States of America and the European Community are currently investigating the possible use of OBD systems on heavy-duty vehicles and engines. The United States of America believes that efforts to develop a harmonized OBD system for light-duty vehicles, heavy-duty vehicles, or both, would be beneficial. This proposal addresses the necessary elements to develop a global technical regulation (gtr) for heavy-duty vehicles and engines under Article 6.3 of the 1998 Global Agreement.

Description of the proposed regulation

To meet customer demands, manufacturers of heavy-duty engines use on-board diagnostics to electronically monitor engine parameters to ensure proper engine performance and to assist in malfunction diagnostics and repair. To meet future heavy-duty engine standards, it is likely that manufacturers will implement electronically controlled emission control strategies such as exhaust gas recirculation (EGR) and fuel injection rate shaping. The technology to perform OBD on these emission control systems is available today.

Diesel oxidation catalysts are being used to provide a reduction in particulate matter (PM) on some light- and heavy-duty vehicles. In addition, PM traps and lean NO_x catalysts may appear in the fleet in response to increasingly stringent standards around the world. Back-pressure sensors (soon to be available in the market) can monitor for complete failure of PM traps, and either a chemical sensor or potentially a temperature sensor could be used to monitor the performance of a lean NO_x catalyst.

Direct emission measurement may be an important technology to achieve diesel engine closed-loop feedback and to monitor after-treatment devices. Researchers have achieved promising results on a compact NO_x sensor that is capable of measuring NO_x with reasonable accuracy under a wide range of operating conditions. Other potential technologies include in-cylinder measurement devices, on-board PM measurement devices, and predictive emission measurement systems such as neural networks.

The proposed gtr would require that manufacturers monitor emission related power train components to assure that malfunctions, which would cause emissions to exceed standards by a

specified amount are detected, and the vehicle operator is alerted to the need for maintenance or repair.

Existing regulations

Though there are no regulations currently contained in the Compendium of Candidates, the following regulations contain relevant applications of OBD requirements for light- and medium-duty vehicles which are available for technical reference in developing a new gtr:

U.S. Code of Federal Regulations (CFR) Title 40: Protection of the Environment; Part 86.005-17: On-board diagnostics.

40 CFR Part 86.094-17: Emission control diagnostic system for 1994 and later light-duty vehicles and light-duty trucks.

UNECE Regulation No. 83; Annex 11: On-board Diagnostics for Motor Vehicles

California Code of Regulations (CCR) Title 13, Section 1968.1: Malfunction and Diagnostic System Requirements - 1994 and Subsequent Model -Year passenger Cars, Light-duty Trucks, and Medium-duty Vehicles and Engines (OBDII).

International Voluntary Standards

Society of Automotive Engineers (SAE) J1850 "Class B Data Communication Network Interface" (August 1991)

SAE J1979	"E/E Diagnostic Test Modes" (December 1991)
SAE J2012	"Recommended Format and Messages for Diagnostic Trouble Code ISO DIS 15031-6 Definitions" (March 1992)
SAE J1962	"Diagnostic Connector" (June 1992)
ISO 2575-1982	"Road vehicles: Symbols for control indicators and tell-tales"
ISO 9142-2	"Road Vehicles' Diagnostic Systems' CARB Requirements for the Interchange of Digital Information"
ISO 11519-4	"Road Vehicles' Low Speed Serial Data Communication, Part 4: Class B Data Communication Interface (SAE J1850)
ISO DIS 14230 Part 4:	"Road Vehicles' Diagnostic Systems Keyword protocol 2000"

REPORT ON THE DEVELOPMENT OF A GLOBAL TECHNICAL REGULATION CONCERNING: ON-BOARD DIAGNOSTIC SYSTEMS (OBD) FOR ROAD VEHICLES (Worldwide harmonized Heavy-duty On-Board Diagnostics, WWH-OBD)

1. OBJECTIVE OF THE REGULATION

The objective of the regulation is to establish a set of worldwide harmonized requirements for on-board diagnostic systems on heavy-duty vehicles. On-board diagnostic (OBD) systems are of interest to regulators for many reasons. The advent of electronic controls in the 1990s made the diagnosis of improperly operating engine systems and emissions control systems very difficult. Furthermore, the addition of exhaust gas recirculation (EGR) systems and exhaust after-treatment devices are expected to provide 50 to 99 per cent control of pollutant emissions. Without some form of on-board system capable of monitoring the performance of these devices for proper functioning, a driver could be completely unaware of a situation that might cause emissions to far exceed the applicable regulatory requirements.

Because computer and electronic systems are difficult to diagnose and repair when not functioning properly, most manufacturers of vehicles, trucks, and engines have incorporated OBD systems into their products. These OBD systems are capable of identifying improper functioning and help to pinpoint where the malfunction is occurring. This serves to inform both, the driver of the vehicle that repair is needed, and the repairer of the vehicle what needs to be repaired.

2. DESCRIPTION OF THE REGULATION

The global technical regulation (gtr) is directed only at OBD requirements for heavy-duty engines/vehicles necessary to maintain emissions-related performance (i.e. emissions-OBD). Nonetheless, the gtr has been structured in a manner that facilitates a wider application of OBD to other vehicle systems in the future. In brief, the gtr sets forth OBD performance requirements to which engine manufacturers shall demonstrate compliance to certification authorities. The gtr also sets forth a basic set of demonstration requirements for manufacturers, so that compliance can be demonstrated in a consistent manner. Also included are requirements to standardize the communication of on-board information to off-board devices to assist in maintenance of the increasingly complex modern diesel engines, and to facilitate the future use of OBD as a roadworthiness indicator for heavy-duty vehicles.

Of particular importance with respect to the use of OBD as a roadworthiness indicator is the introduction, with this gtr, of a failure severity indication via the dashboard malfunction warning signal (malfunction indicator). The failure severity indication is achieved in two ways. Firstly, the gtr requires the use of a separate and dedicated malfunction indicator to indicate a malfunction in the engine and emissions control system that results in an increase in emissions. Other failures that previously may have been communicated via a shared indicator shall now use a separate and discreet indicator. Secondly, the gtr requires that the effect of malfunctions be assessed as part of the design function and that their effect be designated to a specific level within a 3-tier classification. Upon malfunction detection, the malfunction indicator is required

to communicate in a unique way depending on which of the three tiers to which the detected malfunction has been designated. While the requirements for the malfunction indicator provide for each of these failure levels to be discernible, only the upper two failure levels are automatically indicated to the driver. This has been termed a "discriminatory display" strategy as it discriminates between three possible severities of malfunctions when indicating them via the malfunction indicator. This new requirement is intended to allow vehicle operators, maintenance staff, inspectors and enforcement authorities to make an informed decision with regard the roadworthiness of the vehicle. Nevertheless, not all Contracting Parties may wish to apply this approach. Therefore, the gtr provides for a malfunction indicator that would use a non-discriminatory display strategy (i.e. one that would communicate all malfunctions regardless of their severity in the same manner via the malfunction indicator) for regions that may find it more suitable than this new discriminatory display model.

The gtr recognizes that it is not always possible to know precisely the impact of a failure or deterioration of a system or its component parts on the actual emissions from the vehicle. Therefore, the gtr minimizes the burden on the manufacturer in this regard by allowing the classification of malfunctions to be achieved, as far as is reasonable, by engineering analysis. Inevitably, certification authorities will require validation of the engineering analysis and, therefore, the gtr provides for testing using deteriorated components to assess the OBD system performance. The gtr does not require testing to determine whether malfunctions should be placed in a lower level in the classification than that proposed by the manufacturer at the time of certification or type approval. However, the expectation is that manufacturers will apply best practice to achieve correct classification of malfunctions and evidence of this effort will be assessed, in part, from the engineering analysis provided as part of the certification process. Where experience or testing in the market indicates a significant malfunction misclassification, the gtr provides for its re-classification.

3. EXISTING REGULATIONS AND INTERNATIONAL STANDARDS

In the United States of America:

40 CFR 86.005-17 and 40 CFR 86.1806-05 contain OBD requirements for vehicles and engines fitted in vehicles less than 14,000 pounds gross vehicle weight 1/. The United States Environmental Protection Agency is developing proposed OBD requirements for engines fitted in vehicles over 14,000 pounds gross vehicle weight.

Also, 13 CCR 1968.2, 13 CCR 1971 and 13 CCR 1971.1 contain OBD requirements for California vehicles up to 14,000 pounds gross vehicle weight and engines fitted in vehicles over 14,000 pounds gross vehicle weight, respectively.

In Europe:

The European Union (EU) Directive 98/69/EC 2/ (amending Directive 70/220/EEC 3/)

1/ See 58 FR 9468 and 65 FR 59896.
2/ See Official Journal of the European Communities, L350, 28.12.1998, p.1.
3/ See Official Journal of the European Communities, L76, 6.4.1970, p.1.

introduced, for the first time, emission-related OBD requirements applicable to petrol and diesel passenger cars and light-commercial vehicles (nominally up to 3.5 t gross vehicle mass).

EU Directive 1999/102/EC 4/ introduced, amongst other things, revised provisions for misfire monitoring, adoption of the CAN protocol and provisions for deficiencies. These requirements applied from the same dates as given in EU Directive 98/69/EC.

EU Directive 2005/55/EC 5/ lays down the fundamental elements relating to OBD for heavy-duty vehicles and engines.

In Japan:

Safety Regulations for Road Vehicles, Article 31 (Emission Control Device), Attachment 48 Technical Standard for On-Board Diagnostic (OBD) System for Exhaust Emission Control Devices for Motor Vehicles.

4. ADVANTAGES OF THE GTR

Designing and developing OBD systems that meet the emissions-OBD requirements of this gtr will cost industry considerable money. The cost of maintaining and repairing malfunctions identified by the OBD system will impact on industry, operators of heavy-duty vehicles and the general public. As noted in paragraph 3. above, many Contracting Parties have or are developing OBD requirements analogous to those in this gtr. Having one set of OBD requirements that would apply to all regions represented by the Contracting Parties would save industry considerable money relative to the situation they face currently with separate requirements in each region.

The specific air quality benefits expected to arise in Contracting Parties that implement the emissions-OBD paragraph of this gtr will be unique to each region. However, in general, the expectation is that properly operating emissions control systems will result in cleaner air regardless of the region being considered. Any effort to ensure that emissions control systems will operate properly during their real world lifetime is of value.

5. COST EFFECTIVENESS

Specific cost effectiveness values for this gtr have not been calculated. The decision by the Executive Committee (AC.3) of the 1998 Agreement to move forward with this gtr without specific emissions threshold levels (i.e. the emissions level at which a malfunction is indicated) is the key reason why this analysis has not been completed. This agreement has been made knowing that specific cost effectiveness values are not immediately available. However, it is fully expected that this information will be developed, generally in response to the adoption of this gtr in the national or regional requirements of the Contracting Parties and also in support of developing harmonized limit values for the next step in this gtr's development. E.g., each Contracting Party adopting this gtr into its national or regional legislation will be expected to

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4/ See Official Journal of the European Communities, L334, 28.12.1999, p.43.
5/ See Official Journal of the European Communities, L275,20.10.2005, p.1.

determine the appropriate emission threshold levels associated with these OBD requirements. Experience will be gained by industry as to any costs and savings associated with these worldwide harmonized requirements. These costs and savings data and emissions performance data can then be analyzed as part of the next step in this regulation development to determine the cost effectiveness values of world harmonized OBD when matched with new harmonized limit values. While costs per tonne of pollutant reduced have not been calculated, the belief of the technical group is that there are clear benefits associated with this gtr.

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