



WWH-OBD

Progress Report #1 of the GRPE informal WWH-OBD group

Structure of Progress Report:

- A - Summary of the WWH-OBD action

- B - List of the OBD provisions considered as GENERIC provisions
 - Scope of the GTR
 - List of the Generic OBD provisions
 - List of the Generic Annexes

- C - Provisions of the Emission related OBD SPECIFIC module
 - Scope of the module: Heavy Duty Diesel engines
 - Emission related OBD provisions
 - Annexe to the emission related provisions
 - Annexe for specific provisions within the frame of the 1958 agreement

A SUMMARY OF THE WWH-OBD ACTION

1. Introduction

The World Forum for Harmonization of Vehicle Regulations (WP.29) requested that a global technical regulation be developed by an ad-hoc working group (WWH-OBD) that would concern:

- The exhaust emissions of regulated pollutants from Heavy Duty vehicles and engines that are homologated against regulative provisions requesting the measurement of their exhaust emissions on an engine test-bed.
- Diesel fuelled compression ignition engines.

Vehicles and/or engines fuelled with other fuels and other types of vehicles (incl. hybrids) may be addressed by further amendments to the gtr.

Upon request from AC3, WWH-OBD considered also the possibility that other vehicle systems - vehicle safety systems for example - might one day be included.

As a result of this thinking, the structure of the proposed gtr is readily scalable to other types of OBD systems.

This has been achieved by dividing the gtr into a set of generic OBD requirements to be followed by specific OBD requirements concerning any future desired OBD systems.

The first specific OBD section is the emissions-related one, which contains definitions and OBD regulatory elements specific to emissions-related OBD.

2. Procedural Background

During the one-hundred-and-twenty-sixth session of WP.29 of March 2002, the Executive Committee (AC.3) of the 1998 Global Agreement (1998 Agreement) adopted a Programme of Work, which includes the development of a global technical regulation (gtr) concerning onboard diagnostic systems for heavy-duty vehicles and engines.

An informal working group - the WWH-OBD working group - was actually established in September 2001 further to a proposal from the GRPE Chair in May 2001 to incorporate heavy-duty OBD into the GRPE agenda. Japan volunteered to lead the group.

The working group was instructed that the OBD system should detect failures from the engine itself, as well as from the exhaust after-treatment systems fitted downstream of the engine, and from the package of information exchanged between the engine electronic control unit(s) and the rest of vehicle and/or powertrain.

The working group was also instructed to base the OBD requirements on the technologies expected to be industrially available at the time the gtr would be enforced, and to take into account both the expected state of electronics in the years 2005-2008 and the expected newest engine and after-treatment technologies.

3. Technical Rationale and Justification for the Emissions-Related OBD Module

Onboard diagnostic (OBD) systems are of interest to regulators for many reasons:

- Upon detecting any problems, the driver would be notified of the need to seek repair and pertinent information would be stored in the engine computer for retrieval by the repair professional. As a result, emissions-related problems are identified, their presence is communicated to the driver, repair is sought out, and proper repair is completed.
- Without some form of onboard system capable of monitoring the most recent

systems for proper functioning, a driver could be completely unaware of a situation that might cause emissions to far exceed the regulatory requirements.

- The OBD systems are capable of identifying improper functioning and help to pinpoint where it is occurring. This serves to inform the repairer of the vehicle what needs to be repaired.
- Mandatory provisions for standardisation would build on the efforts already undertaken by industry to ensure that the diagnosis and repair of those components will be as efficient and cost effective as possible.
- Access to the class of severity of a failure enables the national/regional authorities to modulate accordingly their specific road-worthiness enforcement programme.

The requirements set forth in the emissions-related section of the gtr are believed to be technologically feasible thanks to the fact that the WWH-OBD working group consists of both regulators and industry representatives.

The specific air quality benefits expected to arise in regions that implement the emissions-related section of this gtr would be unique to each region. Effort will nevertheless result in increased costs to industry and the public. Therefore, an analysis of such costs weighed against the expected emissions reduced by the effort is important. Discussion should take place to decide whether such analyses may be best left to the regional authorities who have the in-depth knowledge required to determine the costs and emissions reductions in their specific regions. Consistency with the WMTC and WHDC gtrs to be achieved.

4. Proposed structure of the GTR

A - Statement of technical Rationale and justification

B - GENERIC provisions

- Scope of the GTR
- Generic OBD provisions
- Generic Annexes

C - Emission related module

- Scope of the module: Heavy Duty Diesel engines
- Emission related OBD provisions
- Annexe to the emission related provisions
- [Annexe for specific provisions within the frame of the 1958 agreement]

D - [Function 'YYY' related module]

E - [Function 'ZZZ' related module]

B LIST OF THE OBD PROVISIONS CONSIDERED AS GENERIC

The generic provisions will be contained in part B of the GTR

1. SCOPE AND APPLICATION

1.1. Scope

This GTR sets out the requirements for On Board Diagnostic systems to detect, record and communicate failures of specific vehicle and engine systems that affect the environmental or safety performance of these systems.

The current GTR addresses:

- emission related failures from heavy-duty diesel fuelled engines (see module C)

1.2. Application

This GTR applies to on-road vehicles.

The types of vehicles and vehicle systems addressed by this GTR are specified within each specific module.

2. LIST OF GENERIC OBD PROVISIONS

2.1. Definitions2.1.1. OBD2.1.2. Malfunction

- 2.1.2.1. Rationality failure
- 2.1.2.2. [Electrical] circuit failure
- 2.1.2.3. Functionality failure
- 2.1.2.4. System malfunction

2.1.3. Malfunction indicator2.1.4. Qualified Deteriorated Component or System2.2. GENERAL REQUIREMENTS2.2.1. Monitoring requirements2.2.2. Classification requirements2.2.3. Malfunction indication

- 2.2.3.1. MI specification
- 2.2.3.2. MI activation at "key-on"

2.2.4. Diagnosis information2.2.4.1. OBD information storage

- (i) Status of a malfunction
- (ii) Freeze frame data

2.2.4.2. Access to OBD information

- (i) Communication Protocols
- (ii) Diagnostic connector
- (iii) Scan Tool specifications
- (iv) Service requirements
- (v) On-Board visual display

2.2.5. Durability of the OBD system2.2.6. Electronic security2.3. PERFORMANCE REQUIREMENTS2.3.1. Monitoring requirements at key-on

- 2.3.2. Rationality / functionality checks
- 2.3.3. Continuous / Non continuous monitoring
- 2.4. demonstration requirements
- 2.5. Test procedures
 - 2.5.1. Test procedures considered in the emission related OBD of Diesel fuelled engine systems module
- 2.6. Documentation requirements
 - 2.6.1. Information for purpose of certification
 - 2.6.2. Service / repair OBD information to third parties
- 3. LIST OF THE GENERIC ANNEXES
 - 3.1. General Annex
 - 3.1.1. Documentation on the OBD system
 - 3.1.1.1. Description of the functional operation of the OBD system.
 - 3.1.2. Compliance certificate
 - 3.2. Specific annex (58 agreement)

C PROVISIONS OF THE EMISSION RELATED OBD SPECIFIC MODULE

The emission related OBD provisions will be contained in a specific module within the gtr, referenced as part C

1. SCOPE AND PURPOSE

1.1. Scope

This module sets out the requirements for On Board Diagnostic systems to detect, record and communicate emission related malfunctions from an on-road heavy-duty diesel fuelled engine system that would affect the environmental performance of that system. The package of information exchanged with the vehicle and the powertrain will be part of the monitored elements.

1.2. General appraisal of OBD benefits

This module specifies the elements concerning the OBD system to facilitate the diagnosis and maintenance of the emission related engine system and the possible enforcement of road-worthiness measures. A quick and effective repair of emission related failures will result in environmental benefits.

2. APPLICATION

2.1. Application

This module applies to Heavy Duty Diesel fuelled compression ignition engine systems that are certified to regulated emission standards requiring the measurement of their exhaust emissions on an engine test-bed.

The provisions of this module are limited to the responsibilities of the engine manufacturer.

The approval of the installation of a certified emission-OBD system is not part of this module.

Nevertheless Annex 2 to this module ("Specific annex - 1958 agreement") could specify the requirements to be met by the vehicle manufacturer when it applies for a certification of OBD system the of the complete vehicle instead of applying for both a certification of the engine-system OBD and a certification of its installation.

2.2. Vehicle entities subject to certification2.2.1. certification of an individual OBD system2.2.2. certification of an Emission-OBD family2.2.3. certification of OBD system as member of a certified Emission-OBD family2.3. Applicable conditions (temperature, altitude, etc...)

3. Definitions

3.1. Deficiency

'deficiency' means that up to two separate components or systems that are monitored contain temporary or permanent operating characteristics that impair the otherwise efficient OBD monitoring or do not meet all the other detailed requirements for OBD.

3.2. emission control system

'emission control system' means the electronic management controller(s) of the engine system and any emission-related component of the engine system in the exhaust which supplies an input to or receives an output from this (these) controller(s), and the communication interface (hardware and messages) between the engine system electronic control unit(s) (ECU) and any other power train or vehicle control unit when the exchanged information has an influence on the correct functioning of the emission control system;

3.3. [Emission]-OBD family

'Emission OBD family' means a manufacturer's grouping of engine systems having common methods of monitoring / diagnosing emission related malfunctions;

3.4. [Emission]-OBD system3.5. Engine System

"Engine system" means the engine as configured on a test-bench during the "engine" certification process, including the communication interface (hardware and messages) between the EECU and any other powertrain or vehicle control unit if the exchanged information has an influence on the control of emissions.

3.6. [Emission related] Malfunction3.7. [emission related] electrical malfunctions3.8. Operating sequence

"An operating sequence" means the sequence used for determining the conditions for activating and/or extinguishing the MI.

3.9. [emission related] OBD test-cycle

"OBD test-cycle" means the operation of the engine system on an engine test-bed for demonstrating the conformity of the its Emission-OBD system to the requirements of this;

3.10. Parent engine system [of an Emission-OBD family]

"Parent engine system" means an engine system selected from an Emission-OBD family in such a way that its OBD elements of design are representative from that OBD family.

3.11. Definition to be adopted from other GTRs

Link to definitions already used in WHDC and WWH-oc.

Examples: After treatment system - DPF - DeNOx - DeNOx/SCR type - NOx trap - Combined DeNox / DPF, etc..

4. GENERAL REQUIREMENTS

4.1. Monitoring requirements

Like in all the existing or proposed OBD regulations, the malfunctions that shall be monitored are associated with a list of components / subsystems. This section provides this list.

On the contrary to some existing or proposed regulations, WWH-OBD considered that it would not be realistic to draft an exhaustive list of the components or systems that need to be monitored, that may be obsolete at the time the gtr will be enforced.

This section provides accordingly only representative examples of what should be monitored. These examples will serve as guidelines when dealing with the details to be considered by the OBD system.

Manufacturers may demonstrate to the authority that certain components or systems included in the engine system do not need to be monitored if, in the event of their total failure or removal, emissions do not exceed the OBD thresholds limits.

Nevertheless, emission related electrical failures, as well as the presence of some important components have to be monitored in any case.

4.1.1. Replacement Engine Control Strategies (RECS)

4.2. Classification of the malfunctions

The failure classification specifies into which class a failures has to be assigned.

4.2.1. Class A malfunction

Class A malfunction means a failure or deterioration of the emission control system or its components where the OBD threshold limits (OTL) are assumed to be exceeded.

4.2.2. Class B1 malfunction

Class B1 malfunction means a failure or deterioration of the emission control system or its components which has the potential to lead to emissions above the OTLs but for which the exact influence on emission cannot be estimated and thus the actual emissions according to circumstances may be above or below the OTL

4.2.3. Class B2 malfunction

Class B2 malfunction means a failure or deterioration of the emission control system or its components which, according to circumstances, are assumed to influence the emissions but not to a level that exceeds the OTL

4.2.4. Class C malfunction

Class C malfunction means a failure or deterioration of the emission control system or its components which, if monitored, is thereby assumed to influence the emissions but to a level that would not exceed the regulated emission limits.

4.3. Malfunction indication

4.3.1. MI specification

The malfunction indicator shall comprise a yellow warning signal identified by the ISO F22 symbol.

Failure or deterioration of components of the engine system that do not lead directly to an increase in emissions may be indicated by a separate warning signal (for ex. The ISO F01 symbol)

4.3.2. MI activation at "key-on"

The malfunction indicator(s) shall light up at "key-on" / "engine-off". After engine -starting the MI shall indicate as specified in this module the presence of a Class A or Class B failure.

4.3.3. MI illumination schemes

The control of the malfunction indicator shall be designed to provide both a discriminatory display and a non-discriminatory display in accordance with paragraphs 3.5.2.2. and 3.5.2.3. below.

The discriminatory display permits to illuminate the MI according to the class in which a malfunction has been classified
The non-discriminatory display permits only a single illumination mode.

The default method shall be the discriminatory display. At the request of a Contracting Party, the manufacturer may enable the non-discriminatory display. In this instance, the market selection of the discriminatory display or the non-discriminatory display shall be possible from the scan tool.

4.3.3.1. Discriminatory Display

(i) Malfunctions of category A

The malfunction indicator shall show a permanent steady light as soon as the malfunction is confirmed.

(ii) Malfunctions of category B

The malfunction indicator shall show a steady light as soon as the malfunction is confirmed and shall remain lit for a period of [60s] before extinguishing.

In addition, where a malfunction of category B1 has been identified as existing for a period of more than [xx] operational hours, the malfunction indicator shall show a permanent steady light.

(iii) Malfunctions of category C

The malfunction indicator shall show a steady light in response to a manual demand when such a malfunction is confirmed. The indicator is deactivated when the vehicle is moving.

4.3.3.2. Non-discriminatory Display

The malfunction indicator shall show a permanent steady light as soon as the malfunction of any category is confirmed.

4.3.4. MI De-Activation (OBD fault history)

4.4. Diagnosis information

4.4.1. Information Storage

4.4.1.1. Information storage

4.4.1.2. Information erasing

4.4.2. Access to OBD information

4.4.2.1. Readiness information

4.4.2.2. Diagnostic information (fault codes, freeze frame, etc...)

4.4.2.3. When and how the information should be available

4.4.2.4. Hours counted with DTC

4.5. Durability of the OBD system

The OBD system shall be designed to operate, for the actual life of the engine in which it is installed. In achieving this objective, the approval authority accepts that engines which have been used in excess of their regulatory useful life may show some deterioration in OBD system performance such that the OBD thresholds may be exceeded before the OBD system signals a failure to the driver of the vehicle.

This section is not intended to extend the engine manufacturer's compliance liability for an engine beyond its regulated useful life (i.e., the time period during which emissions standards or emissions limits apply), except where an engine has been programmed or otherwise designed so that an OBD system deactivates based on age and/or mileage of the engine as prohibited under section 4.5 of the generic part of this GTR.

5. Performance requirements

5.1. THRESHOLDS

In case the regional test-cycles (for emissions and OBD) are still applicable there are not any harmonisation of the OTLs

- In that case the OTLs would be selected within one of the EU, Japanese, US sets of OTLs, expressed according to the regional test-cycles

In case the test-cycles are harmonised, then the process for defining the

OTLS on the basis of regional emission limits is world harmonised.

- In that case the OTLS would be selected within one of the EU, Japanese, US sets of OTLS, expressed according to the world-wide test-cycle

An empty table is prepared for the ultimate case the emissions limits are also World Harmonised, thereby enabling harmonised OTLS

5.2. temporary disablement of the OBD system

- ambient temperature and altitude conditions
- low fuel level
- vehicle battery or system voltage levels.
- active PTO

6. Demonstration requirements

6.1. Emission-OBD family

The manufacturer is responsible for determining the composition of an emission-OBD family.

Grouping engine systems within an Emission-OBD family shall be based on good engineering judgement and be subject to approval by the certification authority.

Engines that do not belong to the same engine family may still belong to the same Emission-OBD family.

6.1.1. Parameters defining an Emission-OBD family

The Emission-OBD family may be defined by basic design parameters that shall be common / equivalent to engine systems within the family.

- the methods of OBD monitoring,
- the methods of malfunction detection,

6.1.2. Parent engine system of an Emission-OBD family

The selection of the parent engine is made by the manufacturer and subject to the approval of the certification authority.

6.2. Demonstration of the failure classification

The manufacturer shall present the documentation justifying the proper classification of each DTC. The documentation shall include a failure analysis and such elements as, for instance:

- simulation results
- test results
- reference to previously approved classification,

6.2.1. Demonstration of classification into A

If the authority disagrees with a manufacturer classification of a failure as class A, the authority may demand reclassification of that failure into class B1, B2 or C, as appropriate.

In that case the certification document shall record that the failure classification has been done under request of the certification authority.

6.2.2. Demonstration of classification into B1 (Distinguishing between A and B1)

In order to justify the classification of a failure into class B1 the documentation shall show that in some circumstances emissions in the case of such a failure are lower than the OTLs.

In case the authority is requesting an emission test for demonstrating the classification of a failure into class B1 the manufacturer shall demonstrate that the emissions due to the failure are in some circumstances below the OTL.:

- the manufacturer selects these circumstances of test in agreement with the certification authority

If the manufacturer fails in demonstrating the classification as class B1, the failure is classified as class A.

6.2.3. Demonstration of classification into B1 (Distinguishing between B2 and B1)

If the authority disagrees with a manufacturers classification of a failure as class B1, because they consider the OTLs are not exceeded, the authority may demand reclassification of that failure into class B2 or C. In that case the certification documents shall record that the failure classification has been done under request of the certification authority.

6.2.4. Demonstration of classification into B2 (Distinguishing between B2 and B1)

In order to justify the classification of a failure into class B2 the documentation shall show that emissions are lower than the OTLs. In case the authority disagrees with the classification of a failure as class B2, because they consider the OTLs are exceeded, the manufacturer may be requested to demonstrate by testing that the emissions due to the failure are below the OTLs. If the test fails, then the authority shall request reclassification of that failure into A or B1 and the manufacturer shall subsequently demonstrate the appropriate reclassification and the documentation be updated.

6.2.5. Demonstration of classification into B2 (Distinguishing between B2 and C)

If the authority disagrees with a manufacturers classification of a failure as class B2, because they consider the emission limits are not exceeded, the authority may demand reclassification of that failure into class C. In that case the certification documents shall record that the failure classification has been done under request of the certification authority.

6.2.6. Demonstration of classification into C

In order to justify the classification of a failure into class C the documentation shall show that emissions are lower than the regulated emission limits. In case the authority disagrees with the classification of a failure as class C the manufacturer may be requested to demonstrate by testing that the emissions

due to the failure are below the regulated emission limits.
If the test fails, then the authority shall request reclassification of that failure and the manufacturer shall subsequently demonstrate the appropriate reclassification and the documentation be updated.

6.3. Demonstration of the OBD performance

6.3.1. Selection of malfunctions

6.3.2. Qualification of ad-hoc deteriorated components

6.3.3. Preconditioning

6.3.4. Testing of the OBD system and evaluation of the test results

6.3.5. Test Protocol

6.4. Small batch production

6.5. Certification of an OBD system containing deficiencies

A manufacturer may request to the authority that an OBD system be accepted for certification even though the system contains one or more deficiencies such that the specific requirements of this module are not fully met.

In considering the request, the authority shall determine whether compliance with the requirements of this Module is feasible or unreasonable (e.g. deficiency request that includes the complete lack of a required diagnostic monitor, that does not respect the specified OTLs, would not be acceptable).

6.5.1. Deficiency period

A deficiency may be carried-over for a period of two years after the date of certification of the engine system.
If necessary, the deficiency may be carried-out for a period not exceeding three years.

A manufacturer may request that the original certification authority grant a deficiency retrospectively when such a deficiency is discovered after the original certification.

7. Test procedures

7.1. Test procedure for demonstrating the failure classification

When applicable, should be WHTC.
Otherwise the regional transient test-cycle applies

7.2. Test procedure for demonstrating the OBD performance

When applicable, should be WHOC - World Harmonised OBD Test Cycle = WHTC.
Otherwise the regional OBD test-cycle applies

7.3. Test operating conditions

7.4. Test measurement devices and procedures

8. Documentation requirements

8.1. Information for certification

8.2. Documentation for installing in a vehicle an OBD equipped engine system

The engine manufacturer shall include in the installation documents of its engine system the appropriate requirements that will ensure the vehicle on the road to comply with the requirements of this GTR. This documentation shall include but is not limited to:

the detailed technical requirements, including the provisions ensuring the compatibility with the OBD system of the engine system
the verification procedure to be completed

Section xxx.yyy of Annex 2 to this module ("Specific annex - 1958 agreement") could consider the case the vehicle manufacturer applies directly for the certification of the Emission-OBD system of the complete vehicle instead of applying for both a certification of the engine-system and a certification of its installation. In this specific case, the vehicle manufacturer would not be subject to the requirements of this section, but to those of section xxx.yyy of Annex 2 to this module.

8.3. Availability of information

9. Annex

9.1. General Annex9.1.1. Documentation on the OBD system9.1.2. Conformity of production of the OBD system9.1.3. Compliance certificate9.2. Specific annex (58 agreement)9.2.1. Marking etc...9.2.2. Penalties in case of non CoP9.2.3. Experimental demonstration of the failure classification

Could specify the overall maximum and minimum number of tests to be performed in the case the certification authority disagrees with a classification and requests the manufacturer to demonstrate by testing this classification.

9.2.4. Experimental demonstration of the diagnosis performance

Could specify the overall maximum and minimum number of tests to be performed to demonstrate by testing the diagnosis performance.

9.2.5. Direct certification of a vehicle equipped with an Emission-OBD system.

This section could consider the case the vehicle manufacturer directly applies for a certification of the complete vehicle Emission-OBD system instead of applying for both a certification of the engine-system and a certification of its installation.

In this case, and in addition to the general requirements of this module, a demonstration of the correct installation may be required. This demonstration would be done on the basis of appropriate element of design, results of verification tests, etc...and address the conformity of the following elements to the requirements of this GTR:

- the installation on-board the vehicle as regards its compatibility with the OBD system of the engine-system.
- the MI and, where appropriate, the additional warning modes;
- when applicable, the wired communication interface.
- when applicable, the wireless communication interface.