ANNEX XI

ON-BOARD DIAGNOSTICS (OBD) FOR MOTOR VEHICLES

1. INTRODUCTION

1.1. This Annex sets out the functional aspects of on-board diagnostic (OBD) systems for the control of emissions from motor vehicles.

2. REQUIREMENTS AND TESTS

2.1. The requirements and tests for OBD systems are those specified in Section 3 of Annex 11 to UN/ECE Regulation 83. The exceptions to these requirements as well as additional requirements are described in the following sections.

2.2. The durability distance mentioned in section 3.1 and 3.3.1 of Annex 11 to UN/ECE Regulation 83 shall be understood as reference to the requirements of Annex VII to this Regulation.

2.3. The threshold limits specified in section 3.3.2 of Annex 11 to UN/ECE Regulation 83 shall be understood as reference to the tables below:

2.3.1. The OBD thresholds limits for vehicles that are type approved according to the emission limits set out in Table 1 of Annex I of the Regulation (EC) No 715/2007 are contained in the following table.

EURO 5 OBD THRESHOLD LIMITS

		Reference mass (RW) (kg)	Mass of carbon monoxide (CO) (mg/km)		Mass of non-methane hydrocarbons (NMHC) (mg/km)		Mass of oxides of nitrogen (NO_x) (mg/km)		Mass of particulates (PM) (mg/km)	
Category	**Class**		**PI**	**CI**	**PI**	**CI**	**PI**	**CI**	**PI**[a]	**CI**[b]
M	—	All	1 900	1 900	250	320	300	540	50	50
N_1[c]	I	RW ≤ 1 305	1 900	1 900	250	320	300	540	50	50
	II	1 305 < RW ≤ 1 760	3 400	2 400	330	360	375	705	50	50
	III	1 760 < RW	4 300	2 800	400	400	410	840	50	50
N_2	—	All	4 300	2 800	400	400	410	840	50	50

a Positive ignition particulate mass standards apply only to vehicles with direct injection engines

b Until the dates set out in Article 17 a PM threshold limit of 80 mg/km shall apply to vehicles of categories M and N with a reference mass greater than 1 760 kg

c Includes M_1 vehicles that meet the 'special social needs' definition of Regulation (EC) No 715/2007

Key: PI = Positive Ignition, CI = Compression Ignition

2.3.2. The OBD thresholds limits for compression ignition vehicles that comply with the Euro 6 emission limit values set out in Table 2 of Annex 1 of the Regulation (EC) No 715/2007 and type-approved before the dates given in Article 10(4) of Regulation (EC) No 715/2007 are contained in the following table. These threshold limits shall cease to apply from the dates set out in Article 10(5) of Regulation (EC) No 715/2007 for new vehicles to be registered, sold or entered into service.

INTERIM EURO 6 OBD THRESHOLD LIMITS

		Reference mass(RW) (kg)	**Mass of carbon monoxide**	**Mass of non-methane hydrocarbons**	**Mass of oxides of nitrogen**	**Mass of particulates**
			(CO)(mg/km)	**(NMHC)(mg/km)**	**(NO_x)(mg/km)**	**(PM)(mg/km)**
Category	**Class**		**CI**	**CI**	**CI**	**CI**
M	—	All	1900	320	240	50
N_1	I	RW ≤ 1 305	1900	320	240	50
	II	1 305 < RW ≤ 1 760	2 400	360	315	50
	III	1 760 < RW	2 800	400	375	50
N_2	—	All	2 800	400	375	50

Key: CI = Compression Ignition

[F1 2.3.3. The OBD thresholds limits for vehicles that are type approved according to the Euro 6 emission limits set out in Table 2 of Annex I to Regulation (EC) No 715/2007 from three years after the dates given in Article 10(4) and 10(5) of that Regulation are given in the following table:

[F2 FINAL EURO 6 OBD THRESHOLD LIMITS

		Reference mass(RW) (kg)	**Mass of carbon monoxide**		**Mass of non-methane hydrocarbons**		**Mass of oxides of nitrogen**		**Mass of particulate matter[a]**		**Number of particles[a]**	
			(CO)(mg/km)		**(NMHC)(mg/km)**		**(NO_x)(mg/km)**		**(PM)(mg/km)**		**(PN)(#/km)**	
Category	**Class**		**PI**	**CI**	**PI**	**CI**	**PI**	**CI**	**CI**	**PI**	**CI**	**PI**
M	—	All	1 900	1 750	170	290	90	140	12	12		

a Positive ignition particulate mass and number limits apply only to vehicles with direct injection engines.

Key: PI = Positive Ignition, CI = Compression Ignition.]

N_1	I	RM ≤ 1 305	1 900	1 750	170	290	90	140	12	12		
	II	1 305 < RM ≤ 1 760	3 400	2 200	225	320	110	180	12	12		
	III	1 760 < RM	4 300	2 500	270	350	120	220	12	12		
N_2	—	All	4 300	2 500	270	350	120	220	12	12		

a Positive ignition particulate mass and number limits apply only to vehicles with direct injection engines.

Key: PI = Positive Ignition, CI = Compression Ignition.]

Textual Amendments

F2 Substituted by Commission Regulation (EU) No 136/2014 of 11 February 2014 amending Directive 2007/46/EC of the European Parliament and of the Council, Commission Regulation (EC) No 692/2008 as regards emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and Commission Regulation (EU) No 582/2011 as regards emissions from heavy duty vehicles (Euro VI) (Text with EEA relevance).

Explanatory note:

The OBD thresholds set out in the table are subject to a review to be conducted by the Commission by 1 September 2014. Where the thresholds appear to be not technically feasible, their values or the mandatory date of application are to be amended accordingly, considering the effects of other new requirements and tests that will be introduced for Euro 6 vehicles. Where the review shows an environmental need as well as technical feasibility and a net monetised benefit, more stringent values need to be adopted and OBD threshold limits for particle numbers or, where applicable, other regulated pollutants introduced. In doing so, appropriate lead time for introducing the technical developments has to be given to the industry.

Textual Amendments

F1 Inserted by Commission Regulation (EU) No 459/2012 of 29 May 2012 amending Regulation (EC) No 715/2007 of the European Parliament and of the Council and Commission Regulation (EC) No 692/2008 as regards emissions from light passenger and commercial vehicles (Euro 6) (Text with EEA relevance).

2.3.4. Until three years after the dates specified in Article 10(4) and (5) of Regulation (EC) No 715/2007 for new type approvals and new vehicles respectively, the following OBD threshold limits shall be applied to vehicles that are type approved according to the Euro 6 emission limits set out in Table 2 of Annex I to Regulation (EC) No 715/2007, upon the choice of the manufacturer:

[F2PRELIMINARY EURO 6 OBD THRESHOLD LIMITS

		Reference mass (RM) (kg)	Mass of carbon monoxide		Mass of non-methane hydrocarbons		Mass of oxides of nitrogen		Mass of particulate matter[a]	
			(CO) (mg/km)		(NMHC) (mg/km)		(NOx) (mg/km)		(PM) (mg/km)	
Category	Class		PI	CI	PI	CI	PI	CI	CI	PI
M	—	All	1 900	1 750	170	290	150	180	25	25
N_1	I	RM ≤ 1 305	1 900	1 750	170	290	150	180	25	25
	II	1 305 < RM ≤ 1 760	3 400	2 200	225	320	190	220	25	25
	III	1 760 < RM	4 300	2 500	270	350	210	280	30	30
N_2	—	All	4 300	2 500	270	350	210	280	30	30

a Positive ignition particulate mass limits apply only to vehicles with direct injection engines.

Key: PI = Positive Ignition, CI = Compression Ignition**]**

2.4. In addition to the provisions of section 3.2.1 of Annex 11 to UN/ECE Regulation 83 the manufacturer may temporarily disable the OBD system in the following conditions:

(a) For flex fuel or mono/bi fuel gas vehicles during 1 minute after re-fuelling to allow for the recognition of fuel quality and composition by the ECU;

(b) For bi fuel vehicles during 5 seconds after fuel switching to allow for readjusting engine parameters.

The manufacturer may deviate from these time limits if it can demonstrate that stabilisation of the fuelling system after re-fuelling or fuel switching takes longer for justified technical reasons. In any case, the OBD system shall be re-enabled as soon as either the fuel quality and composition is recognised or the engine parameters are readjusted.

[F2 2.5. Section 3.3.3.1 of Annex 11 to UNECE Regulation No 83 shall be understood as:

The OBD system shall monitor the reduction in the efficiency of the catalytic converter with respect to emissions of NMHC and NOx. Manufacturers may monitor the front catalyst alone or in combination with the next catalyst(s) downstream. Each monitored catalyst or catalyst combination shall be considered malfunctioning when the emissions exceed the NMHC or NOx threshold limits provided for in Section 2.3 of this Annex. By way of derogation, the requirement of monitoring the reduction in the efficiency of the catalytic converter with respect to NOx emissions shall only apply as from the dates set out in Article 17.**]**

2.6. Section 3.3.3.3 of Annex 11 to UN/ECE Regulation 83 shall mean that the deterioration of all oxygen sensors fitted and used for monitoring malfunctions of the catalytic converter according to the requirements of this Annex shall be monitored.

2.7. In addition to the requirements of section 3.3.3 of Annex 11 to UN/ECE Regulation 83, for direct injection positive ignition engines any malfunction, which may lead to emissions exceeding the particulate threshold limits provided for by section 2.3 of this Annex and which has to be monitored according to the requirements of this Annex for compression ignition engines, shall be monitored.

2.8. In addition to the requirements of section 3.3.4 of Annex 11 to UN/ECE Regulation 83, malfunctions and the reduction in efficiency of the EGR system shall be monitored.

2.9. In addition to the requirements of section 3.3.4 of Annex 11 to UN/ECE Regulation 83, malfunctions and the reduction in efficiency of a NO_x aftertreatment system using a reagent and the reagent dosing sub-system shall be monitored.

2.10. In addition to the requirements of section 3.3.4 of Annex 11 to UN/ECE Regulation 83, malfunctions and the reduction in efficiency of NO_x aftertreatment not using a reagent shall be monitored.

2.11. In addition to the requirements of section 6.3.2 of Appendix 1 to Annex 11 to UN/ECE Regulation 83, the manufacturer shall demonstrate that malfunctions of the EGR flow and cooler are detected by the OBD system during its approval test.

2.12. References to 'HC' (hydrocarbons) shall be read as 'NMHC' (non-methane hydrocarbons) in section 6.4.1.2 of Appendix 1 to Annex 11 to UN/ECE Regulation 83.

2.13. In addition to the requirements of section 6.5.1.3 of Appendix 1 to Annex 11 of UN/ECE Regulation 83, all data required to be stored in relation to OBD in-use performance according to the provisions of section 3.6 of Appendix 1 of this Annex shall be available through the serial data port on the standardised data link connector according to the specifications given in section 6.5.3 of Appendix 1 to Annex 11 of UN/ECE Regulation 83.

[[F3]2.14. Contrary to point 3.3.5 of Annex 11 to UN/ECE Regulation No 83, the following devices shall be monitored for total failure or removal if the latter resulted in exceeding the applicable emission limits:

— as from 1 September 2011, a particulate trap fitted to compression ignition engines as a separate unit or integrated into a combined emission control device,

— for vehicles certified against either the OBD threshold limits shown in the tables set out in point 2.3.3 or 2.3.4, a NO_x aftertreatment system fitted to compression ignition engines as a separate unit or integrated into a combined emission control device,

— for vehicles certified against either the OBD threshold limits shown in the tables set out in point 2.3.3 or 2.3.4, a diesel oxidation catalyst (DOC) fitted to compression ignition engines as a separate unit or integrated into a combined emission control device.

The devices referred to in the first paragraph shall also be monitored for any failure that would result in exceeding the applicable OBD threshold limits.**]**

Textual Amendments

F3 Substituted by Commission Regulation (EU) No 459/2012 of 29 May 2012 amending Regulation (EC) No 715/2007 of the European Parliament and of the Council and Commission Regulation (EC) No 692/2008 as regards emissions from light passenger and commercial vehicles (Euro 6) (Text with EEA relevance).

3. ADMINISTRATIVE PROVISIONS FOR DEFICIENCIES OF OBD SYSTEMS

3.1. In considering the request for granting type-approval to a vehicle with a deficiency or deficiencies as set out in Article 6(2), the approval authority shall determine whether compliance with the requirements of this Annex is infeasible or unreasonable.

3.2. The approval authority shall take into consideration data from the manufacturer that details such factors as, but not limited to, technical feasibility, lead time and production cycles including phase-in or phase-out of engines or vehicle designs and programmed upgrades of computers, the extent to which the resultant OBD system will be effective in complying with the requirements of this Regulation and that the manufacturer has demonstrated an acceptable level of effort toward compliance with the requirements of this Regulation.

[F4 3.3. The approval authority shall not accept any deficiency request that includes the complete lack of a required diagnostic monitor or of mandated recording and reporting of data related to a monitor.]

Textual Amendments

F4 Substituted by Commission Regulation (EU) No 566/2011 of 8 June 2011 amending Regulation (EC) No 715/2007 of the European Parliament and of the Council and Commission Regulation (EC) No 692/2008 as regards access to vehicle repair and maintenance information (Text with EEA relevance).

3.4. The approval authority will not accept any deficiency request that does not respect the OBD threshold limits in Section 2.3.

3.5. In determining the identified order of deficiencies, deficiencies relating to sections 3.3.3.1, 3.3.3.2 and 3.3.3.3 of Annex 11 of UN/ECE Regulation 83 for positive-ignition engines and sections 3.3.4.1, 3.3.4.2 and 3.3.4.3 of Annex 11 of UN/ECE Regulation 83 for compression-ignition engines shall be identified first.

3.6. Prior to or at the time of type-approval, no deficiency shall be granted in respect of the requirements of section 6.5, except section 6.5.3.4 of Appendix 1 to Annex 11 of UN/ECE Regulation 83.

3.6. Deficiency period

3.6.1. A deficiency may be carried-over for a period of two years after the date of type-approval of the vehicle type unless it can be adequately demonstrated that substantial vehicle hardware modifications and additional lead-time beyond two years would be necessary to correct the deficiency. In such a case, the deficiency may be carried-over for a period not exceeding three years.

3.6.2. A manufacturer may request that the approval authority grant a deficiency retrospectively when such a deficiency is discovered after the original type-approval. In this case, the deficiency may be carried-over for a period of two years after the date of notification to the approval authority unless it can be adequately demonstrated that substantial vehicle hardware modifications and additional lead-time beyond two years would be necessary to correct the deficiency. In such a case, the deficiency may be carried-over for a period not exceeding three years.

3.7. The approval authority shall notify its decision in granting a deficiency request in accordance with Article 6(2).

4. ACCESS TO OBD INFORMATION

4.1. Requirements for access to OBD information are specified in section 5 of Annex 11 to UN/ECE Regulation 83. The exceptions to these requirements are described in the following sections.

4.2. References to Appendix 1 of Annex 2 to UN/ECE Regulation 83 shall be understood as references to Appendix 5 to Annex I to this Regulation.

4.3. References to section 4.2.11.2.7.6 of Annex 1 to UN/ECE Regulation 83 shall be understood as references to 3.2.12.2.7.6 of Appendix 3 to Annex I to this Regulation.

4.4. References to ‘contracting parties’ shall be understood as references to ‘member states’.

4.5. References to approval granted under Regulation 83 shall be understood as references to type-approval granted under this Regulation and Council Directive 70/220/EEC[(1)].

4.6. UN/ECE type-approval shall be understood as EC type-approval.

Appendix 1

FUNCTIONAL ASPECTS OF ON-BOARD DIAGNOSTIC (OBD) SYSTEMS

1. INTRODUCTION

1.1. This Appendix describes the procedure of the test according to section 2 of this Annex.

2. TECHNICAL REQUIREMENTS

2.1. The technical requirements and specifications shall be those set out in Appendix 1 to Annex 11 to UN/ECE Regulation No 83 with the exceptions and additional requirements as described in the following sections.

2.2. The references to the OBD threshold limits set out in paragraph 3.3.2 to Annex 11 of UN/ECE Regulation 83 shall be understood as references to the limits set out in section 2.3 of this Annex.

2.3. The reference fuels specified in paragraph 3.2 of Appendix 1 of Annex 11 of UN/ECE Regulation No 83 shall be understood as reference to the appropriate reference fuel specifications in Annex IX to this Regulation.

2.4. The reference to Annex 11 in paragraph 6.5.1.4 of Appendix 1 of Annex 11 of UN/ECE Regulation No 83 shall be understood as reference to Annex XI to this Regulation.

2.5. For vehicles approved to Euro 6 limit values contained in Table 2 of Annex 1 of Regulation (EC) No 715/2007, Section 6.5.3.1 of Appendix 1 of Annex 11 of UN/ECE Regulation 83 shall be replaced by:

For emissions-related diagnostics, the following standard shall be used as the on-board to off-board communications link:

ISO 15765-4 “Road vehicles — Diagnostics on Controller Area Network (CAN) — Part 4: Requirements for emissions-related systems” dated 10 January 2005

3. IN-USE PERFORMANCE

3.1. General Requirements

3.1.1. Each monitor of the OBD system shall be executed at least once per driving cycle in which the monitoring conditions as specified in section 3.2 are met. Manufacturers may not use the calculated ratio (or any element thereof) or any other indication of monitor frequency as a monitoring condition for any monitor.

3.1.2. The in-use performance ratio (IUPR) of a specific monitor M of the OBD system referred to in Article 5(3) shall be:

$IUPR_M = Numerator_M/Denominator_M$

3.1.3. Comparison of Numerator and Denominator gives an indication of how often a specific monitor is operating relative to vehicle operation. To ensure all manufacturers are tracking $IUPR_M$ in the same manner, detailed requirements are given for defining and incrementing these counters.

3.1.4. If, according to the requirements of this Annex, the vehicle is equipped with a specific monitor M, $IUPR_M$ shall be greater or equal to the following minimum values:

(i) 0,260 for secondary air system monitors and other cold start related monitors

(ii) 0,520 for evaporative emission purge control monitors

(iii) 0,336 for all other monitors

3.1.5. Vehicles shall comply with the requirements of section 3.1.4 for a mileage of at least 160 000 km. By way of derogation, vehicles type approved, registered, sold or entered into service before the relevant dates given in Article 10(4), (5) of Regulation (EC) No 715/2007, shall have an $IUPR_M$ greater or equal 0,1 for all monitors M. **[**[F1]For new type approvals and new vehicles the monitor required by point 2.9 of this Annex shall have an IUPR greater or equal to 0,1 until three years after the dates specified in Article 10(4) and (5) of Regulation (EC) No 715/2007 respectively.**]**

3.1.6. The requirements of this section are deemed to be met for a particular monitor M, if for all vehicles of a particular OBD family manufactured in a particular calendar year the following statistical conditions hold:

(a) The average $IUPR_M$ is equal or above the minimum value applicable to the monitor

(b) More than 50 % of all vehicles have an $IUPR_M$ equal or above the minimum value applicable to the monitor.

[[F4]3.1.7. The manufacturer shall demonstrate to the approval authority and, upon request, to the Commission that these statistical conditions are satisfied for all monitors required to be reported by the OBD system according to point 3.6 of this Appendix not later than 18 months after the entry onto the market of the first vehicle type with IUPR in an OBD family and every 18 months thereafter. For this purpose, for OBD families consisting of more than 1 000 registrations in the Union, that are subject to sampling within the sampling period, the process described in Annex II shall be used without prejudice to the provisions of point 3.1.9 of this Appendix.

In addition to the requirements set out in Annex II and regardless of the result of the audit described in Section 2 of Annex II, the authority granting the approval shall apply the in-service conformity check for IUPR described in Appendix 1 to Annex II in an appropriate number of randomly determined cases. ‘In an appropriate number of randomly determined cases’ means, that this measure has a dissuasive effect on non-compliance with the requirements of Section 3 of this Annex or the provision of manipulated, false or non-representative data for the audit. If no special circumstances apply and can be demonstrated by the type-approval authorities, random application of the in-service conformity check to 5 % of the type approved OBD families shall be considered as sufficient for compliance with this requirement. For this purpose, type-approval authorities may find arrangements with the manufacturer for the reduction of double testing of a given OBD family as long as these arrangements do not harm the dissuasive effect of the type-approval authority’s own in-service conformity check on non-compliance with the requirements of Section 3 of this Annex. Data collected by Member States during surveillance testing programmes may be used for in-service conformity checks. Upon request, type-approval authorities shall provide data on the audits and random in-service conformity checks performed, including the methodology used for identifying those cases, which are made subject to the random in-service conformity check, to the Commission and other type-approval authorities.

3.1.8. For the entire test sample of vehicles the manufacturer must report to the relevant authorities all of the in-use performance data to be reported by the OBD system according to point 3.6 of this Appendix in conjunction with an identification of the vehicle being tested and the methodology used for the selection of the tested vehicles from the fleet. Upon request, the type-approval authority granting the approval

shall make these data and the results of the statistical evaluation available to the Commission and other approval authorities.**]**

3.1.9. Public authorities and their delegates may pursue further tests on vehicles or collect appropriate data recorded by vehicles to verify compliance with the requirements of this Annex.

[[F5]3.1.10. Non-compliance with the requirements of point 3.1.6 established by tests described in points 3.1.7 or 3.1.9 shall be considered as an infringement subject to the penalties set out in Article 13 of Regulation (EC) No 715/2007. This reference does not limit the application of such penalties to other infringements of other provisions of Regulation (EC) No 715/2007 or this Regulation, which do no explicitly refer to Article 13 of Regulation (EC) No 715/2007.**]**

Textual Amendments

F5 Inserted by Commission Regulation (EU) No 566/2011 of 8 June 2011 amending Regulation (EC) No 715/2007 of the European Parliament and of the Council and Commission Regulation (EC) No 692/2008 as regards access to vehicle repair and maintenance information (Text with EEA relevance).

3.2. Numerator_M

3.2.1. The numerator of a specific monitor is a counter measuring the number of times a vehicle has been operated such that all monitoring conditions necessary for the specific monitor to detect a malfunction in order to warn the driver, as they have been implemented by the manufacturer, have been encountered. The numerator shall not be incremented more than once per driving cycle, unless there is reasoned technical justification.

3.3. Denominator_M

3.3.1. The purpose of the denominator is to provide a counter indicating the number of vehicle driving events, taking into account special conditions for a specific monitor. The denominator shall be incremented at least once per driving cycle, if during this driving cycle such conditions are met and the general denominator is incremented as specified in section 3.5 unless the denominator is disabled according to section 3.7 of this Appendix.

3.3.2. In addition to the requirements of section 3.3.1:

(a) Secondary air system monitor denominator(s) shall be incremented if the commanded ‘on’ operation of the secondary air system occurs for a time greater than or equal to 10 seconds. For purposes of determining this commanded ‘on’ time, the OBD system may not include time during intrusive operation of the secondary air system solely for the purposes of monitoring;

(b) Denominators of monitors of systems only active during cold start shall be incremented if the component or strategy is commanded ‘on’ for a time greater than or equal to 10 seconds;

(c) The denominator(s) for monitors of Variable Valve Timing (VVT) and/or control systems shall be incremented if the component is commanded to function (e.g., commanded ‘on’, ‘open’, ‘closed’, ‘locked’, etc.) on two or more occasions during the driving cycle or for a time greater than or equal to 10 seconds, whichever occurs first;

(d) For the following monitors, the denominator(s) shall be incremented by one if, in addition to meeting the requirements of this section on at least one driving cycle, at least 800 cumulative kilometres of vehicle operation have been experienced since the last time the denominator was incremented:

(i) Diesel oxidation catalyst

(ii) Diesel particulate filter**[**[F5];**]**

(e) **[**[F5]Without prejudice to requirements for the increment of denominators of other monitors the denominators of monitors of the following components shall be incremented if and only if the driving cycle started with a cold start:

(i) liquid (oil, engine coolant, fuel, SCR reagent) temperature sensors;

(ii) clean air (ambient air, intake air, charge air, inlet manifold) temperature sensors;

(iii) exhaust (EGR recirculation/cooling, exhaust gas turbo-charging, catalyst) temperature sensors;

(f) The denominators of monitors of the boost pressure control system shall be incremented if the all of the following conditions are met:

(i) the general denominator conditions are fulfilled;

(ii) the boost pressure control system is active for a time greater than or equal to 15 seconds.**]**

3.3.3. For hybrid vehicles, vehicles that employ alternative engine start hardware or strategies (e.g. integrated starter and generators), or alternative fuel vehicles (e.g. dedicated, bi-fuel, or dual-fuel applications), the manufacturer may request the approval of the approval authority to use alternative criteria to those set forth in this section for incrementing the denominator. In general, the approval authority shall not approve alternative criteria for vehicles that only employ engine shut off at or near idle/vehicle stop conditions. Approval by the approval authority of the alternative criteria shall be based on the equivalence of the alternative criteria to determine the amount of vehicle operation relative to the measure of conventional vehicle operation in accordance with the criteria in this section.

3.4. Ignition Cycle Counter

3.4.1. The ignition cycle counter indicates the number of ignition cycles a vehicle has experienced. The ignition cycle counter may not be incremented more than once per driving cycle.

3.5. General Denominator

3.5.1. The general denominator is a counter measuring the number of times a vehicle has been operated. It shall be incremented within 10 seconds, if and only if, the following criteria are satisfied on a single driving cycle:

— Cumulative time since engine start is greater than or equal to 600 seconds while at an elevation of less than 2 440 m above sea level and at an ambient temperature of greater than or equal to – 7 °C.,

— Cumulative vehicle operation at or above 40 km/h occurs for greater than or equal to 300 seconds while at an elevation of less than 2 440 m above sea level and at an ambient temperature of greater than or equal to – 7 °C.,

— Continuous vehicle operation at idle (i.e. accelerator pedal released by driver and vehicle speed less than or equal to 1,6 km/h) for greater than or equal to 30 seconds while at an elevation of less than 2 440 m above sea level and at an ambient temperature of greater than or equal to – 7 °C.

3.6. Reporting and increasing counters

3.6.1. The OBD system shall report in accordance with the ISO 15031-5 specifications the ignition cycle counter and general denominator as well as separate numerators and denominators for the following monitors, if their presence on the vehicle is required by this Annex:

— Catalysts (each bank to be reported separately),
— Oxygen/exhaust gas sensors, including secondary oxygen sensors (each sensor to be reported separately),
— Evaporative system,
— EGR system,
— VVT system,
— Secondary air system,
— Particulate filter,
— NO_x aftertreatment system (e.g. NO_x adsorber, NO_x reagent/catalyst system),
— Boost pressure control system,

[[F4]3.6.2. For specific components or systems that have multiple monitors, which are required to be reported by this point (e.g. oxygen sensor bank 1 may have multiple monitors for sensor response or other sensor characteristics), the OBD system shall separately track numerators and denominators for each of the specific monitors except those monitoring for short circuit or open circuit failures and report only the corresponding numerator and denominator for the specific monitor that has the lowest numerical ratio. If two or more specific monitors have identical ratios, the corresponding numerator and denominator for the specific monitor that has the highest denominator shall be reported for the specific component.**]**

3.6.3. All counters, when incremented, shall be incremented by an integer of one.

3.6.4. The minimum value of each counter is 0, the maximum value shall not be less than 65 535, notwithstanding any other requirements on standardised storage and reporting of the OBD system.

3.6.5. If either the numerator or denominator for a specific monitor reaches its maximum value, both counters for that specific monitor shall be divided by two before being incremented again according to the provisions set in sections 3.2 and 3.3. If the ignition cycle counter or the general denominator reaches its maximum value, the respective counter shall change to zero at its next increment according to the provisions set in sections 3.4 and 3.5, respectively.

3.6.6. Each counter shall be reset to zero only when a non-volatile memory reset occurs (e.g. reprogramming event, etc.) or, if the numbers are stored in keep-alive memory (KAM), when KAM is lost due to an interruption in electrical power to the control module (e.g. battery disconnect, etc.).

3.6.7. The manufacturer shall take measures to ensure that the values of numerator and denominator can not be reset or modified, except in cases provided for explicitly in this section.

3.7. Disablement of Numerators and Denominators and of the General Denominator

3.7.1. Within 10 seconds of a malfunction being detected, which disables a monitor required to meet the monitoring conditions of this Annex (i.e. a pending or confirmed code is stored), the OBD system shall disable further incrementing of the corresponding numerator and denominator for each monitor that is disabled. When the malfunction is no longer detected (i.e., the pending code is erased through self-clearing or through a scan tool command), incrementing of all corresponding numerators and denominators shall resume within 10 seconds.

3.7.2. Within 10 seconds of the start of a power take-off operation (PTO) operation that disables a monitor required to meet the monitoring conditions of this Annex, the OBD system shall disable further incrementing of the corresponding numerator and denominator for each monitor that is disabled. When the PTO operation ends, incrementing of all corresponding numerators and denominators shall resume within 10 seconds.

3.7.3. The OBD system shall disable further incrementing of the numerator and denominator of a specific monitor within 10 seconds, if a malfunction of any component used to determine the criteria within the definition of the specific monitor's denominator (i.e. vehicle speed, ambient temperature, elevation, idle operation, engine cold start, or time of operation) has been detected and the corresponding pending fault code has been stored. Incrementing of the numerator and denominator shall resume within 10 seconds when the malfunction is no longer present (e.g. pending code erased through self-clearing or by a scan tool command).

3.7.4. The OBD system shall disable further incrementing of the general denominator within 10 seconds, if a malfunction has been detected of any component used to determine whether the criteria in section 3.5 are satisfied (i.e. vehicle speed, ambient temperature, elevation, idle operation, or time of operation) and the corresponding pending fault code has been stored. The general denominator may not be disabled from incrementing for any other condition. Incrementing of the general denominator shall resume within 10 seconds when the malfunction is no longer present (e.g., pending code erased through self-clearing or by a scan tool command).

Appendix 2

ESSENTIAL CHARACTERISTICS OF THE VEHICLE FAMILY

1. PARAMETERS DEFINING THE OBD FAMILY

1.1. The OBD family means a manufacturer's grouping of vehicles which, through their design, are expected to have similar exhaust emission and OBD system characteristics. Each engine of this family shall comply with the requirements of this Regulation.

1.2. The OBD family may be defined by basic design parameters which shall be common to vehicles within the family. In some cases there may be interaction of parameters. These effects shall also be taken into consideration to ensure that only vehicles with similar exhaust emission characteristics are included within an OBD family.

2. To this end, those vehicle types whose parameters described below are identical are considered to belong to the same engine/emission control/OBD system combination.

Engine:

— combustion process (i.e. positive-ignition/compression-ignition, two stroke/four stroke/rotary),

— method of engine fuelling (i.e. single or multi-point fuel injection),

— fuel type (i.e. petrol, diesel, flex fuel petrol/ethanol, flex fuel diesel/biodiesel, NG/biomethane, LPG, bi fuel petrol/NG/biomethane, bi fuel petrol/LPG),

Emission control system:

— type of catalytic converter (i. e. oxidation, three-way, heated catalyst, SCR, other),

— type of particulate trap,

— secondary air injection (i.e. with or without),

— exhaust gas recirculation (i.e. with or without),

OBD parts and functioning:

— the methods of OBD functional monitoring, malfunction detection and malfunction indication to the vehicle driver.

(**1**) OJ L 76, 6.4.1971, p. 1.

Changes to legislation:
There are currently no known outstanding effects for the Commission Regulation (EC) No 692/2008, ANNEX XI.