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Guidance on the evaluation of Auxiliary Emission Strategies and the presence of Defeat Devices with regard to the application of Regulation (EC) No 715/2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6)

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Guidance on the evaluation of Auxiliary Emission Strategies and the presence of Defeat Devices with regard to the application of Regulation (EC) No 715/2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6)

DISCLAIMER

This guidance notice reflects the discussions of the expert meetings of the subgroup of TAAEG (Type Approval Authorities Expert Group) on Market Surveillance. The meetings involved the Commission services and experts from the Member States.

It is intended to facilitate the implementation of Regulation (EC) No 715/2007. It is itself not legally binding. Any authoritative reading of the law should only be derived from Regulation (EC) 715/2007 itself and other applicable legal texts or principles, like Commission Regulation (EC) No 692/2008 including all its amending acts. While this note seeks to assist authorities and operators by presenting good practices for an effective implementation of the applicable law, only the Court of Justice of the European Union is competent to authoritatively interpret Union legislation.

Introduction

The concept of a defeat device is an integral part of European car emissions legislation. Both the definition and the prohibition (including some exceptions) of defeat devices are clearly spelled out in Articles 3(10) and 5 (2) respectively of Regulation 715/2007[1]. These provisions are very similar to those foreseen in the emissions legislation for heavy duty vehicles (see Annex I).

Until recently, the Commission had not been requested to provide any additional clarification of the concepts of defeat device, either from the national Type Approval Authorities (TAA) or from the industry or from any other stakeholders. However in order to assist Member States and enabling an effective technical implementation of the existing legislation, the Commission has therefore prepared these guidelines.

The intention of the present document is to set good practices for the assessment of intended engine protection strategies and prevention of illegal defeat devices. For this purpose, it provides guidance on the criteria that should be used by the TAAs in order to evaluate an AES. It also contains examples of AES that need to be evaluated carefully according to the proposed methodology. These examples will be reviewed and updated in the light of the new information.

1 OJ L 171, 29.6.2007, p. 1.

The existing rules on defeat devices have been complemented by Regulation (EU) 2016/646[2] (i.e. RDE2) which amends Regulation (EC) No 692/2008[3]; the RDE 2 Regulation introduced the concept of Auxiliary Emission Strategies (AES[4]) and Base Emission Strategies (BES) for the purposes of type approval of light-duty vehicles. Both concepts were already regulated for the type-approval of heavy-duty vehicles (see Annex I).

As a result, since 10th May 2016, manufacturers need to describe these strategies as part of an extended documentation package, which is delivered to the Type Approval Authorities (TAA) as part of the application for type approval. In the 3rd RDE act/Regulation, the Commission is planning to clarify the requirements for the AES/BES.

The recent emissions scandal triggered market surveillance actions by Type Approval Authorities in the EU. To guide and coordinate these activities, the European Commission, with the support of its Joint Research Centre (JRC), developed a testing protocol to detect a possible presence of defeat device. The protocol sets out criteria to select appropriate testing conditions (or categories of testing conditions) under which the presence of a defeat device may be identified. The testing protocol forms part of this guidance notice.

The notice was discussed with the Member States in the Technical Committee of Motor Vehicles (TCMV), in the Type Approval Authorities Expert Group (TAAEG) and its subgroup on Market Surveillance.

This notice is divided in two parts:

> Part A deals with the process and tools for evaluating Auxiliary Emission Strategies at Type Approval, including the information that the manufacturer needs to provide to the Type Approval Authority and how this information will be used in order to assess whether the AES is acceptable or not, taking into account the prohibition of defeat devices,
>
> and
>
> Part B deals with ways to identify possible cases of defeat devices through targeted emission tests as part of Member States' market surveillance obligations.

1. DEFINITIONS AND GENERIC OBLIGATIONS:

The concept of defeat devices is defined in Article 3 (10) of Regulation (EC) 715/2007:

> *'defeat device' means any element of design which senses temperature, vehicle speed, engine speed (RPM), transmission gear, manifold vacuum or any other parameter for the purpose of activating, modulating, delaying or deactivating the operation of any part of the emission control system, that reduces the effectiveness of the emission*

2 Commission Regulation (EU) 2016/646 amending Regulation (EC) No 692/2008 as regards emissions from light passenger and commercial vehicles (Euro 6) (OJ L 109, 26.4.2016, p. 1).

3 Commission Regulation (EC) No 692/2008 implementing and amending Regulation (EC) No 715/2007 of the European Parliament and of the Council on type-approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information (OJ L 199, 28.7.2008, p. 1).

4 The equivalent of an AES in the US legislation is an "Auxiliary Emissions Control Device" (AECD).
Code of Federal Regulations, Title 40 Part 86 – Control of Emissions from New and In-Use Highway Vehicles and Engines. - http://www.ecfr.gov/cgi-bin/text-idx?node=pt40.19.86&rgn=div5#se40.19.86_11809_601 .

control system under conditions which may reasonably be expected to be encountered in normal vehicle operation and use;;

The prohibition and exceptions are laid down in Article 5(2) of the same Regulation:

The use of defeat devices that reduce the effectiveness of emission control systems shall be prohibited. The prohibition shall not apply where:

(a) the need for the device is justified in terms of protecting the engine against damage or accident and for safe operation of the vehicle;

(b) the device does not function beyond the requirements of engine starting;

or

(c) the conditions are substantially included in the test procedures for verifying evaporative emissions and average tailpipe emissions.

The concepts of AES and BES were introduced earlier in the emissions legislation for Heavy Duty Vehicle and since May 2016 included also in the emissions legislation for Light Duty Vehicles (see Annex I). Article 2, points43 and 42, of Commission Regulation (EU) No 692/2008, as amended by Commission Regulation (EU) No 2016/646, *defines* ***AES***[5] *and* ***BES*** *as follows*:

'43. 'base emission strategy' (hereinafter 'BES') means an emission strategy that is active throughout the speed and load operating range of the vehicle unless an auxiliary emission strategy is activated;

44. 'auxiliary emission strategy' (hereinafter 'AES') means an emission strategy that becomes active and replaces or modifies a BES for a specific purpose and in response to a specific set of ambient or operating conditions and only remains operational as long as those conditions exist.'.

In addition Article 5(11) and (12) of the same Commission Regulation establishes the following:

'11. The manufacturer shall also provide an extended documentation package with the following information:

(a) information on the operation of all AES and BES, including a description of the parameters that are modified by any AES and the boundary conditions under which the AES operate, and indication of the AES or BES which are likely to be active under the conditions of the test procedures set out in this Regulation;

(b) a description of the fuel system control logic, timing strategies and switch points during all modes of operation.

12. The extended documentation package referred to in paragraph 11 shall remain strictly confidential. It may be kept by the approval authority, or, at the discretion of the approval authority, may be retained by the manufacturer. In the case the

[5] The equivalent of an AES in the US legislation is an "Auxiliary Emissions Control Device" (AECD).
Code of Federal Regulations, Title 40 Part 86 – Control of Emissions from New and In-Use Highway Vehicles and Engines. - http://www.ecfr.gov/cgi-bin/text-idx?node=pt40.19.86&rgn=div5#se40.19.86_11809_601 .

manufacturer retains the documentation package, that package shall be identified and dated by the approval authority once reviewed and approved. It shall be made available for inspection by the approval authority at the time of approval or at any time during the validity of the approval.'

1.1. Changes to AES-BES requirements proposed in the third Commission Regulation concerning real-driving emissions (RDE3)

In the third Commission Regulation concerning real-driving emissions from light-duty vehicles (RDE 3) as voted in TCMV on the 20th December 2016, the AES/BES requirements were regulated in further detail, as below:

(a) New wording of Article 5(11):

11. In order for the approval authorities to be able to assess the proper use of AES, taking into account the prohibition of defeat devices contained in Article 5(2) of Regulation (EC) No 715/2007, the manufacturer shall also provide an extended documentation package, as described in Appendix 3a of Annex I to this Regulation.

The extended documentation package referred to in paragraph 11 shall remain strictly confidential. The package shall be identified and dated by the approval authority and kept by that authority for at least ten years after the approval is granted. The extended documentation package shall be transmitted to the Commission upon request.

(b) New wording of Appendix 3a:

Appendix 3a:

Extended Documentation Package

The extended documentation package shall include the following information on all AES:

(a) a declaration of the manufacturer that the vehicle does not contain any defeat device not covered by one of the exceptions in Article 5 (2) of Regulation (EC) 715/2007;

(b) a description of the engine and the emission control strategies and devices employed, whether software or hardware, and any condition(s) under which the strategies and devices will not operate as they do during testing for TA;

(c) a declaration of the software versions used to control these AES/BES, including the appropriate checksums of these software versions and instructions to the authority on how to read the checksums; the declaration shall be updated and sent to the Type Approval Authority that holds this extended documentation package each time there is a new software version that has an impact to the AES/BES;

(d) detailed technical reasoning of any AES; including explanations on why any of the exception clauses from the defeat device prohibition in Article 5(2) of Regulation (EC) No 715/2007 apply, where applicable; including hardware element(s) that need to be protected by the AES, if applicable; and/or proof of sudden and irreparable engine damage that cannot be prevented by regular maintenance and would occur in the absence of the AES along with a risk assessment estimating the risk with the AES and without it; reasoned explanation on why there is a need to use an AES for starting the engine;

(e) a description of the fuel system control logic, timing strategies and switch points during all modes of operation;

(f) a description of the hierarchical relations among the AES (i.e., when more than one AES can be active concurrently, an indication of which AES is primary in responding, the method by which strategies interact, including data flow diagrams and decision logic and how does the hierarchy assure emissions from all AES are controlled to the lowest practical level;

(g) a list of parameters which are measured and/or calculated by the AES, along with the purpose of every parameter measured and/or calculated and how each of those parameters relates to engine damage; including the method of calculation and how well these calculated parameters correlate with the true state of the parameter being controlled and any resulting tolerance or factor of safety incorporated into the analysis;

(h) a list of engine/emission control parameters which are modulated as a function of the measured or calculated parameter(s) and the range of modulation for each engine/emission control parameter; along with the relationship between engine/emission control parameters and measured or calculated parameters;

(i) an evaluation of how the AES will control real-driving emissions to the lowest practical level, including a detailed analysis of the expected increase of total regulated pollutants and CO2 emissions by using the AES, compared to the BES."

2. PART A: EVALUATION OF AUXILIARY EMISSION STRATEGIES

2.1. Prohibition of Defeat Devices and link with AES

The information provided on the according to Article 5(11) OF Commission Regulation 692/2008 (as amended by the draft RDE3 Regulation) will enable type-approval authorities to better assess whether an AES is acceptable, or whether it might constitute a prohibited defeat device pursuant to Article 5 Regulation No 715/2007.

When issuing a type-approval, Type Approval Authority are required to assess, on the basis of the technical information contained in the extended documentation package, whether (i) the emission control strategy constitutes a defeat device pursuant to Article 3 (10) Regulation 715/2007, and, if so, whether (ii) this AES is justified pursuant to Article 5 (2) Regulation 715/2007, or (iii) whether the approval must be refused due to the existence of a prohibited defeat device.

Where a defeat device in the sense of Article 3 Regulation 715/2007 is found, manufacturers tend to claim the exceptions related to engine protection or engine start (points (a) and (b) of Article 5(2) of Regulation 715/2007[1]) in order to justify an emission control strategies which reduces the effectiveness of the emission control system under conditions which may reasonably be expected to be encountered in normal vehicle operation and use and thus leads to high real-world emissions.

In addition, where the use of another AES which was not declared at the time of type-approval is detected later, this may suppose lack of conformity with the approved type and therefore cause a breach of the manufacturer's obligations in the type-approval framework.

2.2. Methodology for the technical evaluation of AES

The extended documentation package, containing the elements for the TAA to judge on the validity of the AES as described above, forms the basis for the detailed technical evaluation of

the emissions control strategy by the Type Approval Authority. It is not excluded that the TAA may need to request additional information from the manufacturer (cfr. Article 6(7) of Directive 2007/46) where necessary.

In addition to the review of the extended documentation package, the assessment of the AES by the TAA should include at least the following verifications:

a) The increase of emissions induced by the AES should be kept at the lowest possible level

- The increase of total emissions when using an AES should be kept at the lowest possible level throughout the normal use of the vehicles
- Whenever a better technology or design that would allow for improved emission control is available on the market it should be used to the largest extent technically possible (i.e. with no unjustified modulation)

b) When used to justify an AES, the risk of sudden and irreparable engine damage should be appropriately demonstrated and documented

- Proof of catastrophic (i.e. sudden and irreparable) engine damage should be provided by the manufacturer, along with a risk assessment which includes an evaluation of the likelihood of the risk occurring and severity of the possible consequences, including results of tests carried out to this effect.
- When a technology or design is available on the market that eliminates or reduces that risk, it should be used to the largest extent technically possible (i.e. with no unjustified modulation).
- Durability and the long-term protection of the engine or components of the emissions control system from wear and malfunctioning (e.g. with a view to decrease maintenance costs and to meet the durability requirements) should not be considered an acceptable reason to grant an exemption from the defeat device prohibition.

c) An adequate technical description should document why it is necessary to use an AES for the safe operation of the vehicle

- Proof of an increased risk to the safe operation of the vehicle should be provided by the manufacturer along with a risk assessment which includes an evaluation of the likelihood of the risk occurring and severity of the possible consequences, including results of tests carried out to this effect.
- When a different technology or design is available on the market that would allow for lowering the safety risk, it should be used to the largest extent technically possible (i.e. with no unjustified modulation)

d) An adequate technical description should document why it is necessary to use an AES during engine start

- Where a different technology or design is available on the market that would allow for improved emission control upon engine start, it should be used to the largest extent technically possible (i.e. with no unjustified modulation)

The Commission will continue to elaborate the above methodology.

2.3. Examples of AES that need to be given particular attention[6]:

AES	Observed behaviour:	Potential manufacturer claim(s):
EGR[7] or after-treatment modulation upon hot engine start[8]	Higher emissions in hot start than in cold start[9]	Engine damage
EGR modulation at ambient temperatures above -4°C[11]	Higher emissions at the lower end of "thermal window" where EGR rate might decrease in order to avoid condensation and/or sooting[10]	Engine damage
EGR modulation at high ambient temperatures[11]	Higher emissions at the higher end of "thermal window" where EGR rate might decrease in order to avoid overheating of the engine[12]	Engine damage
Parameters that are not linked with a phenomenon such as timer, RPM, vehicle speed, engine torque, etc…, used to modulate emission control systems	Using a proxy that is not directly linked with a natural phenomenon (i.e. high vehicle speed used to reduce the efficiency of an EGR or SCR system, or turn-off EGR in order to avoid condensation) to limit the use of an emission control system	Engine damage
Shifting particle size to below 23 nm	Intentionally shifting particle size to a lower size (i.e. below 23 nm), so they cannot be detected by the current measurement systems	Unknown
Dual injection systems for Gasoline vehicle that were not type approved as GDI	Use of a direct injector when the vehicle was not type approved with one, i.e. without respecting particle limits	Unknown

[6] It is expected that this list will be regularly updated with new cases as these appear, and following the technical information provided from national authorities as derived from their own experience.
[7] Exhaust Gas Recirculation
[8] Defined as a test run with warm engine
[9] A significant decrease of emissions should be expected from a hot engine compared to a cold one (EPA, 2016). Particular care should be exercised for periodically regenerating systems to ensure that an increase of the emissions on the hot test is not caused by a regeneration event.
[10] EGR modulation or deactivation during the first few second upon cold engine start in low ambient temperature is acceptable to prevent condensation and soothing. Outside these conditions, further investigation would be needed as to why such procedures are claimed to be necessary.
[11] As long as it is not compensated by other exhaust after-treatment system/s.
[12] Existence of alternative technical measures to address problems of overheating at high ambient temperatures should be considered.

3. PART B: DEFEAT DEVICE RECOGNITION

3.1. Background

Concerning tailpipe emissions, and until Regulation (EU) No 2016/646 (RDE 2) becomes applicable, the compliance with the pollutant emissions limits is controlled with the Type I and Type VI tests set out in Regulation (EC) No 692/2008. After the entry into force of Regulation (EU) No 2016/646 (RDE 2), the emissions levels will also be tested and complied with under the RDE testing conditions. This means that, if the RDE boundary conditions are wide enough, there should be a reduced risk of defeat devices in the future, since vehicles would either comply or not with the RDE not-to-exceed limits.

It is worth noting that checking for defeat devices should also include other types of emissions tests, such as the one for evaporative emissions (Type 4 test).

3.2. How to detect a potential defeat device

For the purpose of assisting the Member States in their market surveillance activities and, in particular, in detecting potential defeat devices, the JRC proposed a ***Testing Protocol for Defeat Devices***. The main objectives of the protocol are:

- To ensure a consistent vehicles selection and "defeat devices testing"

- To set out recommended testing conditions (or categories of testing conditions) which might trigger the conclusion that there is a defeat device and/or an AES

3.2.1. Vehicle selection

Due to the number of vehicles which could potentially be tested within a European test programme, several criteria may be considered to build a sample of vehicles to be checked:

• **Market share:** Preferably sales numbers directly available within an EU Member State should be used. Alternatively sales data in most recent CO_2 monitoring database found in http://www.eea.europa.eu/data-and-maps/data/co2-cars-emission-8 (or its latest yearly version) could be used. It is recommended that the testing starts from the vehicles with the higher sale numbers EU-wide.

• **Technical definition:** Emissions standards, fuel and after-treatment may be considered as a second criterion;

• **Environmental performance:** information on the real world emissions performance of vehicles was not systematically available for pre-RDE vehicles and should, therefore, not constitute the basis for confirming the presence of a defeat device, but provide only an indication. Still, when established in a robust manner (well defined testing protocols, large number of vehicles tested according to the same protocol), it might constitute a good basis to establish the environmental performance of the tested vehicles, and should be used to further investigate those vehicles. Several techniques and data sources of that type might be used. Two of them are briefly presented below:

For screening the environmental performance of in-service fleet, two main techniques are recommended, as the most cost-effective ones:

• Remote fleet monitoring with user-installed on-board sensors (e.g. NOx, engine) also presented as "Simplified Emissions Measurement Systems" (SEMS). This option might represent an intermediate way to correlate high emissions with engine and vehicle operating parameters but the data evaluation strategies remain to be defined.

• Remote Sensing Devices (RSD), which monitor a large number of vehicles at a fixed location or with mobile one (chase test). The RSD data need to be used in conjunction with an access to registration databases to determine the relationship with the vehicle type and its applicable emissions standard. Conclusive information is obtained once a sufficient number of vehicles of the same type are found to be high emitters.

Other techniques might be considered, provided that the vehicle environmental performance is assessed under similar testing conditions (e.g. testing vehicles in a laboratory under driving cycles and/or conditions that differ from the regulatory test).

With the objective of ensuring that information is shared between Member States, and to avoid the duplication of unnecessary testing efforts and therefore make the best use of the available resources, the vehicle information listed in Annex II should be made available to all TAAs by the manufacturers. It should be noted that a single test on a single vehicle may not be representative of the whole emission type and further investigations may be required.

3.2.2. Testing Protocol for Defeat Devices

Currently, vehicles are primarily tested against the emissions limits under the standard emissions test, i.e. the regulatory cycle in the laboratory regulated by the WLTP Regulation..

Thus all testing should, as a minimum, include testing the vehicle in the regulatory methodology. This is an important step in order to make sure that the vehicle is free of malfunctioning, bad maintenance or other similar issues for which the emissions in the regulatory test would be exceeded. This supposes that any vehicle used for testing defeat devices should comply with the limit in the regulatory test as well.

In addition, in order to detect the presence of defeat devices, the vehicles should be tested under variations of the standard testing conditions referred to as *"modified testing conditions"*.

The set of modified conditions is not fixed but instead kept open due to the need to detect specific technology behaviours in response to a complex set of parameters and the need to keep a non-predictable character.

By modifying one or several of the test parameters with respect to the emissions test, one might trigger one or more of the following:

- A defeat device
- An AES
- A modified physical response of the engine and/or emissions control technologies, naturally caused by the change of conditions (e.g. ambient temperature affecting the warm-up of components) but not controlled by software in response to sensed signals/parameters[13].

[13] Note that even in that case, the emissions would still need to respect the limits.

The combination of both (the defeat device or AES and the physical effects) may result in a global change in emissions. The JRC protocol proposed to introduce 4 categories of procedures to cover the possible situations.

• In **category 1,** the testing is conducted in a laboratory under a controlled environment with only limited changes when compared to the legislative cycle and the modified parameters can be controlled. **The modification of the testing conditions should not lead to a significant change in the physical response of the engine system[14]**. Examples of such modifications include testing vehicles with an open door or rolled-down windows.
• In **category 2**, the testing is conducted in a laboratory or on the road with conditions different than the legislative cycle and the value of the modified parameters can be controlled (e.g. driving a legislative cycle on a test track). The modification of the testing conditions **may in some cases lead only to a limited change in the physical response of the engine system.** Examples of such modifications include variations in the test temperature, the execution of hot-start tests, and the repetition of selected phases of the test cycle.
• In **category 3**, the testing is conducted on the road and the values of the modified parameters are - to a large extent - uncontrolled (e.g. the vehicle speed due to the traffic, the temperature, etc...). The modification of the testing conditions **may lead to a significant change in the physical response of the engine system(s)**. The magnitude in the change of the emissions may depend on the severity of the testing conditions. Examples of such modifications include testing at various test routes characterised by a distinct altitude profile, such as the RDE compliant testing. Multiple RDE testing, would also allow to detect possible presence of defeat devices.
• A **category 4** is added in order to allow for "**surprise testing"** to cover testing that does not fall in any of the above categories, but may still be needed in order to detect a possible defeat device, for example in the case of evaporative emissions testing.

The classification of the tests within the different categories is the responsibility of the TAA and should be supported by the AES declarations delivered at type approval. An example of a testing protocol is given in Annex III.

3.3. Evaluation of the test results for the various categories

To facilitate the evaluation of tests under the various categories, it is recommended to develop **testing thresholds** corresponding to acceptable emissions increases per combinations of pollutants, technologies and conditions. Any emission test that falls above those testing thresholds should be classified as a "suspicious" case.

Under category 1, emissions exceeding the recommended thresholds are a strong indication for a possible presence of prohibited defeat devices, since there can be no plausible explanation for an increase in pollutant emissions by simple modifications that do not affect the engine performance. In such a case, it is certain that the vehicle sensed that it is not tested in a regulatory cycle and therefore changed its emission level, i.e. a prohibited defeat device is present.

[14] Engine and the emissions control system(s)

Under categories 2 to 4, emissions exceeding the recommended thresholds might result from the possible presence of a defeat device and/or the physical effects upon the emissions control of an AES. Further investigations and explanations from the manufacturers will be needed.

In the present situation, it is recommended to develop and to fine-tune these thresholds on a case-by-case basis and primarily for NO_x emissions. The following indicative values may be used:

	Reproducing the Type 1 test (NEDC/WLTP)	**Category 1 (as in point 2.2. above)**	**Category 2 (as in point 2.2. above)**	**Category 3 (as in point 2.2. above)**
NOx	1,0	1,1	1,5	2 to 5 (TBD, different for diesel and gasoline)
THC	1,0	TBD	TBD	TBD
CO	1,0	TBD	TBD	TBD
PM/PN	1,0	TBD	TBD	TBD

ANNEX I: Comparison of AES/BES and Defeat Device issues between HDV and LDV (before RDE3)

	Light Duty Vehicles	**Heavy Duty Vehicles**
	Consolidated 715/2007	**Consolidated 595/2009**
Definition	'defeat device' means any element of design which senses temperature, vehicle speed, engine speed (RPM), transmission gear, manifold vacuum or any other parameter for the purpose of activating, modulating, delaying or deactivating the operation of any part of the emission control system, that reduces the effectiveness of the emission control system under conditions which may reasonably be expected to be encountered in normal vehicle operation and use;	'defeat strategy' means an emission control strategy that reduces the effectiveness of the emission controls under ambient or engine operating conditions encountered either during normal vehicle operation or outside the type-approval test procedures;
Requirements	The use of defeat devices that reduce the effectiveness of emission control systems shall be prohibited. The prohibition shall not apply where: (a) the need for the device is justified in terms of protecting the engine against damage or accident and for safe operation of the vehicle; (b) the device does not function beyond the requirements of engine starting; or (c) the conditions are substantially included in the test procedures for verifying evaporative emissions and average tailpipe emissions.	3. The use of defeat strategies that reduce the effectiveness of emission control equipment shall be prohibited.

	Implementing Regulation 692/2008 as amended by (EU) 2016/646	**Implementing Regulation 582/2011**
AES/BES	'base emission strategy' (hereinafter 'BES') means an emission strategy that is active throughout the speed and load operating range of the vehicle unless an auxiliary emission strategy is activated; 'auxiliary emission strategy' (hereinafter 'AES') means an emission strategy that becomes active and replaces or modifies a BES for a specific purpose and in response to a specific set of ambient or operating conditions and only remains operational as long as those conditions exist.'.	'Auxiliary Emission Strategy' (hereinafter 'AES') means an emission strategy that becomes active and replaces or modifies a base emission strategy for a specific purpose and in response to a specific set of ambient and/or operating conditions and only remains operational as long as those conditions exist; 'Base Emission Strategy' (hereinafter 'BES') means an emission strategy that is active throughout the speed and load operating range of the engine unless an AES is activated; ***Along with the performance requirements of UNECE Reg. 49, which is valid under the same Directive (see below) .***
		UNECE Reg. 49
		Requirements for Auxiliary Emission Strategies (AES) An AES shall not reduce the effectiveness of the emission control relative to a BES under conditions that may reasonably be expected to be encountered in normal vehicle operation and use, unless the AES satisfies one the following specific exceptions: (a) its operation is substantially included in the applicable type-approval tests, including the off-cycle test procedures provided for in paragraph 6 of Annex VI to this Regulation and the in-service provisions set out in Article 12 of this Regulation. (interpretation in 582)

		(b) It is activated for the purposes of protecting the engine and/or vehicle from damage or accident; (c) It is only activated during engine starting or warm up as defined in this annex; (d) Its operation is used to trade-off the control of one type of regulated emissions in order to maintain control of another type of regulated emissions under specific ambient or operating conditions not substantially included in the type approval or certification tests. The overall effect of such an AES shall be to compensate for the effects of extreme ambient conditions in a manner that provides acceptable control of all regulated emissions.
Extended Documentation Package	The manufacturer shall also provide an extended documentation package with the following information: (a) information on the operation of all AES and BES, including a description of the parameters that are modified by any AES and the boundary conditions under which the AES operate, and indication of the AES or BES which are likely to be active under the conditions of the test procedures set out in this Regulation; (b) a description of the fuel system control logic, timing strategies and switch points during all modes of operation. The extended documentation package referred to in paragraph 11 shall remain strictly confidential. It may be kept by the approval authority, or, at the discretion	The extended documentation package shall include the following information: (a) information on the operation of all AES and BES, including a description of the parameters that are modified by any AES and the boundary conditions under which the AES operate, and indication of which AES and BES are likely to be active under the conditions of the test procedures set out in Annex VI; (b) a description of the fuel system control logic, timing strategies and switch points during all modes of operation; (c) a full description of the inducement system required by Annex XIII, including the associated monitoring strategies; (d) the description of the anti-tampering measures considered in point (b) of Article 5(4) and in point (a) of Article 7(4). The extended documentation package shall remain strictly confidential. It may be kept by the approval authority, or, at the discretion of the approval authority, may be retained by the

	of the approval authority, may be retained by the manufacturer. In the case the manufacturer retains the documentation package, that package shall be identified and dated by the approval authority once reviewed and approved. It shall be made available for inspection by the approval authority at the time of approval or at any time during the validity of the approval.'.	manufacturer. In the case the manufacturer retains the documentation package, that package shall be identified and dated by the approval authority once reviewed and approved. It shall be made open for inspection by the approval authority at the time of approval or at any time during the validity of the approval.

ANNEX II: TEST VEHICLE INFORMATION

Line	Parameter	Description/unit
1	TEST ID	[code]
2	Test date	[day.month.year]
3	Organisation supervising the test	[name of the organization]
4	Test location	[city, country]
5	Person supervising the test	[name of the principal supervisor]
6	Vehicle driver	[name of the driver]
7	Vehicle type	[vehicle name]
8	Vehicle manufacturer	[name]
9	Vehicle TA number	[TA number]
10	Vehicle ID	[VIN code]
11	Odometer value at test start	[km]
12	Odometer value at test end	[km]
13	Vehicle category	[category]
14	Type approval emissions limit	[Euro X]
15	Engine type	[e.g., spark ignition, compression ignition]
16	Engine rated power	[kW]
17	Peak torque	[Nm]
18	Engine displacement	[ccm]
19	Transmission	[e.g., manual, automatic]
20	Number of forward gears	[#]
21	Fuel	[e.g., gasoline, diesel]
22	Lubricant	[product label]
23	Tire size	[width/height/rim diameter]
24	Front and rear axle tire pressure	[bar; bar]
25	Road load parameters	[F_0, F_1, F_2]
26	Type-approval test cycle	[NEDC, WLTC]
27	Type-approval CO_2 emissions	[g/km]
28	CO_2 emissions in WLTC mode Low	[g/km]
29	CO_2 emissions in WLTC mode Mid	[g/km]
30	CO_2 emissions in WLTC mode High	[g/km]
31	CO_2 emissions in WLTC mode Extra High	[g/km]
32	Vehicle test mass(1)	[kg;%(2)]

ANNEX III: EXAMPLE OF TEST PROTOCOL

Example of test protocol

Test	**Parameter modified / Type 1**	**No engine load increase**	**Low ambient temperatures**	**Hot Start**	**Engine loads > Type 1**
Type 1 (NEDC) - Standard		**X**	**X**	**X**	**X**
Modified testing conditions					
Type 1 with vehicle systems not affecting the engine load	Vehicle systems (doors, windows,...)	**X**			
Type 1 Hot (Back to back following the standard test)	Vehicle conditioning			**X**	
Type 1 Low ambient temperature	Ambient temperature		**X**		
Type 1 on test track	Road load, ambient temperature, ...		**X**	**X**	
RDE	Several				**X**