

### 3. Definitions

#### **Auxiliary Emission Strategy (“AES”)**

means an emission strategy that becomes active and replaces or modifies the base emission strategy for a specific purpose or purposes and in response to a specific set of ambient and/or operating conditions.

#### **Base Emission Strategy (“BES”)**

means an emission strategy that is active throughout the speed and load operating range of the engine unless an AES is activated.

#### **Defeat Strategy**

means an emission strategy that does not meet the performance requirements for a base and/or auxiliary emission strategy as specified in this gtr.

#### **Element of Design**

Means

- (a) any control system, including: computer software; electronic control systems; and computer logic;
- (b) any control system calibration;
- (c) the results of the interaction of systems; or
- (d) any hardware.

#### **Emission Strategy**

means an element or set of elements of design that is incorporated into the overall design of an engine system or vehicle and used in controlling emissions.

#### **Emission Control System**

means, collectively, the elements of design and emission strategies developed or calibrated for the purpose of controlling emissions.

#### **Engine Family**

means a manufacturer's grouping of engines which, through their design as defined in paragraph 5.2 of gtr No. 4 (the WHDC gtr) have similar emission characteristics; all members of the family must comply with the applicable emission limit values

#### **Engine Starting**

means the point when the engine reaches a speed 150 rpm below the normal, warmed-up idle speed (as determined in the drive position for vehicles equipped with an automatic transmission). For hybrid vehicles or for engines employing alternative engine start hardware or strategies (e.g., integrated starter and generators), the manufacturer may use an alternative definition for engine start (e.g., key-on) provided the alternative definition is based on equivalence to an engine start for a conventional vehicle.

#### **Engine System**

means the engine and its emission control system as it would be configured when tested for its exhaust emissions on a certification test-bed, including:

- (a) the engine's electronic management controller(s);
- (b) the exhaust after-treatment system(s);
- (c) any emission-related component of the engine or the exhaust system which supplies input to, or receives output from, the engine's electronic management controller(s); and,
- (d) the communication interface (hardware and messages) between the engine's electronic management controller(s) and any other powertrain or vehicle control unit if the exchanged information has an influence on the control of emissions.

### 4. General Off-cycle Emissions Requirements

Any engine system and any element of design shall be so designed, constructed, assembled and installed as to enable the engine, in normal use, to comply with the provisions of this gtr including when installed in the vehicle. Normal use is not restricted to the conditions of use as specified in section 6.

#### 4.1 Prohibition of Defeat Strategies

Engine systems and vehicles shall not be equipped with a defeat strategy.

#### 4.2 WNTE Emissions Requirement.

Engine systems and vehicles shall comply with the WNTE emission limit values described in Section 5.2 when measured in accordance with the requirements of this gtr. For lab based testing according to Section 7.4, emissions during any WNTE event shall not exceed the emissions limits specified in Section 5.2. In the event of in-use testing it is understood that emissions during some WNTE events may not be expected to comply to the WNTE emission limits; therefore, Contracting Parties should define and implement statistical methods for determining compliance that are consistent with Sections 7.2 and 7.3.

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### 5. Performance Requirements

#### 5.1 Emission Strategies

##### 5.1.1 Requirements for Base Emission Strategies

- 5.1.1.1 A base emission control strategy (BES) shall be so designed as to enable the engine, in normal use, to comply with the provisions of this gtr. Normal use is not restricted to the conditions of use as specified in section 6.
- 5.1.1.2 A BES shall not discriminate between operation on an applicable type approval or certification test and other operation for the purpose of providing a lesser level of emission control under conditions not substantially included in the applicable type approval or certification tests.
- 5.1.1.3 ~~A BES shall not violate the prohibition of defeat strategies as specified in Section 4.1.~~

##### 5.1.2 Requirements for Auxiliary Emission Strategies

- 5.1.2.1 ~~An AES may be installed on an engine or vehicle provided that the AES does not violate the prohibition of defeat strategies as specified in Section 4.1.~~
- 5.1.2.2 With specific exceptions, an AES shall not reduce the effectiveness of the emission control relative to the BES under conditions that may reasonably be expected to be encountered in normal vehicle operation and use. Normal use is not restricted to the conditions of use as specified in section 6. The specific exceptions are:
  - An AES is allowed if its operation is substantially included in the applicable type approval or certification tests, including the WNTE provisions of section 7.
  - An AES is allowed if it is activated for the purposes of protecting the engine and/or vehicle from damage or accident.
  - An AES is allowed if it is only activated during engine starting or warm up as defined in this gtr.
  - An AES is allowed if 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 affect 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.

## 5.2 WNTE Limits for Gaseous and Particulate Exhaust Emissions

5.2.1 Exhaust emissions from an engine system shall not exceed the applicable WNTE emission limits specified in Section 5.2.2 when the engine system and/or vehicle is operated under the conditions specified in Section 6. The emissions shall be determined in accordance with the test and measurement procedures specified in section 7.

5.2.2 The applicable WNTE emission limits shall be determined using the following formula

$$\text{WNTE Emission Limit} = \text{WHTC Emission Limit} + \text{WNTE Adjustment}$$

where

“WHTC Emission Limit” is the emission limit to which the engine is certified using the WHTC test procedures expressed in g/kWh; and

“WNTE Adjustment” is determined in accordance with section 5.2.3 or by reference to Table 1 of Annex 2 and is based on the engine’s WHTC Emission Limit

5.2.3 The applicable WNTE Adjustments expressed in g/kWh shall be determined using the following equations:

for NOx:	WNTE Adjustment = 0.25 * EL + 0.10	(1)
for HC:	WNTE Adjustment = 0.15 * EL + 0.07	(2)
for CO:	WNTE Adjustment = 0.25 * EL	(3)
for PM:	WNTE Adjustment = 0.25 * EL + 0.0025	(4)

## 6. Applicable Ambient and Operating Conditions

The WNTE emission limits shall apply at

- all atmospheric pressures greater than or equal to 82.5 kPa,
- all temperatures less than or equal to the temperature determined by equation 5 at the specified atmospheric pressure:

$$T = -0.4514 * (101.3 - p_b) + 311 \quad (5)$$

where:

$T$  is the ambient air temperature, K  
 $p_b$  is the atmospheric pressure, kPa

- all engine coolant temperatures within the range of 343 K to 373 K (70°C to 100°C)