# B.1. Text of the regulation, general requirements

## 1. Purpose

1.1. This regulation provides a worldwide-harmonized measurement method for the determination of the levels of gaseous pollutant emissions at the tailpipe, the emissions of carbon dioxide and the energy efficiency in terms of fuel consumption of two-wheeled motor vehicles that are representative for real world vehicle operation

## 2. Scope

2.1 Two-wheeled motor vehicles equipped with a propulsion unit in accordance with table B.1-1:

| | Vehicle with PI engines (Petrol) | Vehicle with CI engines (Diesel) |
|---|---|---|
| Type I Test | Yes | Yes |
| Type I Test particulate mass | Yes (only for DI) | Yes |
| Type II Test | Yes | Yes |
| Type VII Test | Yes | Yes |

Table B.1-1

Note: For vehicles with Bi fuels, if the petrol fuel tank (provided for limp home or for starting) capacity is not exceeding two litres, Type I test need not be done in petrol mode.

## 3. Vehicle sub-classification

3.1 Figure B.1-1 provides a graphical overview of the vehicle sub-classification in terms of engine capacity and maximum vehicle speed if subject to the environmental test types indicated by the (sub-)class numbers in the graph areas. The numerical values of the engine capacity and maximum vehicle speed shall not be rounded up or down.

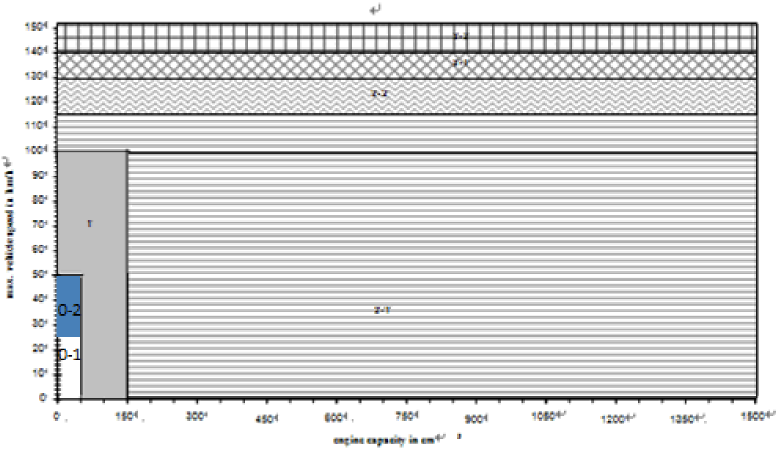



Figure B.1.-1: Vehicle sub-classification for environmental testing, test types I and VII

3.2. **Class 0**

Vehicles that fulfil the following specifications belong to class 0 and shall be sub-classified in:

| | |
|---|---|
| Engine Capacity ≤ 50cm$^3$ and $v_{max}$ ≤ 25km/h | Sub-class 0-1 |

| | |
|---|---|
| Engine Capacity ≤ $50cm^3$ and $25km/h < v_{max} \leq 50km/h$ | Sub-class 0-2 |

Table B.1.-2: sub-classification criteria for class 0 Two wheeled vehicles

3.3 **Class 1**

Vehicles that fulfil the following specifications belong to class 1:

| | |
|---|---|
| $50cm^3$ < Engine Capacity < $150cm^3$ and $v_{max} \leq 50km/h$<br>Or<br>Engine Capacity < $150cm^3$ and $50km/h < v_{max} < 100km/h$ | Class 1 |

Table B.1.-3: Classification criteria for class 1 Two wheeled vehicles

3.4. **Class 2**

Vehicles that fulfil the following specifications belong to class 2 and shall be sub-classified in:

| | |
|---|---|
| Engine Capacity <$150cm^3$ and $100km/h \leq v_{max} < 115km/h$<br>Or<br>Engine Capacity ≥ $150cm^3$ and $v_{max} < 115km/h$ | Sub-class 2-1 |
| $115km/h \leq v_{max} < 130km/h$ | Sub-class 2-2 |

Table B.1.-4: sub-classification criteria for class 2 Two wheeled vehicles

3.5. **Class 3**

Vehicles that fulfil the following specifications belong to class 3 and shall be sub-classified in:

| | |
|---|---|
| $130km/h \leq v_{max} < 140km/h$ | Sub-class 3-1 |
| $v_{max} \geq 140km/h$ | Sub-class 3-2 |

Table B.1.-5: sub-classification criteria for class 3 Two wheeled vehicles

3.6 A Contracting Party may choose Class 0 vehicles to be excluded from the contracting party’s regulation

## 4. Definitions

The following definitions shall apply in this GTR:

4.1 "Equivalent inertia" determined in relation to the reference mass as defined in paragraph 4.41, to this regulation

4.2 "Engine and vehicle characteristics": Subject to the provisions of paragraph 6.2.1, the engine and vehicle characteristics as defined in Annex 4 to this regulation.

4.3 "Unladen mass" (mk) means the nominal mass of a complete vehicle as determined by the following criteria:

Mass of the vehicle with bodywork and all factory fitted equipment, electrical and auxiliary equipment for normal operation of vehicle, including liquids, tools, fire extinguisher, standard spare parts, chocks and spare wheel, if fitted.

The fuel tank shall be filled to at least 90 per cent of rated capacity and the other liquid containing systems to 100 per cent of the capacity specified by the manufacturer

4.4 "Driver mass" means the nominal mass of a driver that shall be 75 kg (subdivided into 68 kg occupant mass at the seat and 7 kg luggage mass in accordance with ISO standard 2416-1992)

4.5 "Gaseous pollutants" means carbon monoxide (CO), oxides of nitrogen (NOx) expressed in terms of nitrogen dioxide (NO2) equivalence, and hydrocarbons (HC), assuming a ratio of:

$C_1H_{1.85}$ for petrol,

$C_1H_{1.86}$ for diesel fuel.

4.6 "CO2 emissions" means carbon dioxide.

4.7 "Fuel consumption" means the amount of fuel consumed, calculated by the carbon balance method.

4.8 "Maximum vehicle speed" (vmax) is the maximum speed of the vehicle as declared by the manufacturer, measured in accordance with Appendix 1 and Appendix 1.1 of Annex-X of European Union Regulation (EU) no. 134/2014(on the maximum design speed, maximum torque and maximum net engine power of two wheeled motor vehicles).

4.9 "Maximum net engine power" is the maximum net engine power of the vehicle as declared by the manufacturer, measured in accordance with Appendix 2, Appendix 2.2, Appendix 2.2.1 and Appendix 2.3 of Annex X of European Union Regulation (EU) no. 134/2014.

4.10 ‘Actuator’ means a converter of an output signal from a control unit into motion, heat or other physical state in order to control the powertrain, engine(s) or drive train;

4.11 ‘Air intake system’ means a system composed of components allowing the fresh-air charge or air-fuel mixture to enter the engine and includes, if fitted, the air filter, intake pipes, resonator(s), the throttle body and the intake manifold of an engine;

4.12 ‘Boost control’ means a device to control the boost level produced in the induction system of a turbocharged or super-charged engine;

4.13 ‘Carburettor’ means a device that blends fuel and air into a mixture that can be combusted in a combustion engine;

4.14 ‘Catalytic converter’ means an emission pollution-control device which converts toxic by-products of combustion in the exhaust of an engine to less toxic substances by means of catalysed chemical reactions;

4.15 ‘Cold-start device’ means a device that temporarily enriches the air/fuel mixture of the engine, or any device or means which can assist to start the engine.

4.16 ‘Common rail’ means a fuel supply system to the engine in which a common high pressure is maintained;

4.17 ‘Compression ignition engine’ or ‘CI engine’ means a combustion engine working according to the principles of the ‘Diesel’ cycle;

4.18 ‘Defeat device’ means any element of design which senses temperature, vehicle speed, engine rotational speed, drive 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 and exhaust after-treatment 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. Such an element of design may not be considered a defeat device if:

(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; or

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

(c) Conditions are substantially included in the Type 1 test procedures.

4.19 'Drive train control unit' means the on-board computer that partly or entirely controls the drive train of the vehicle;

4.20 'Drive train' means the part of the powertrain downstream of the output of the propulsion unit(s) that consists if applicable of the torque converter clutches, the transmission and its control, either a drive shaft or belt drive or chain drive, the differentials, the final drive, and the driven wheel tyre (radius);

4.21 'Electronic throttle control' (ETC) means the control system consisting of sensing of driver input via the accelerator pedal or handle, data processing by the control unit(s), resulting actuation of the throttle and throttle position feedback to the control unit in order to control the air charge to the combustion engine;

4.22 'Engine capacity' means:

(a) for reciprocating piston engines, the nominal engine swept volume;

(b) for rotary-piston (Wankel) engines, double the nominal engine swept volume;

4.23 'Engine control unit' means an on-board computer that partly or entirely controls the engine(s) and all emission related devices / systems of the vehicle;

4.24 'Exhaust emissions' means emissions of gaseous pollutants and particulate matter from the tailpipe;

4.25 'Exhaust gas recirculation (EGR) system' means a part of the exhaust gas flow led back to the combustion chamber of an engine in order to lower the combustion temperature;

4.26 'Intercooler' means a heat exchanger that removes waste heat from the compressed air by a charger before entering into the engine, thereby improving volumetric efficiency by increasing intake air charge density;

4.27 'Distance accumulation' means a representative test vehicle or a fleet of representative test vehicles driving a predefined distance as set out in [point 5 of section B.4.] in accordance with the test requirements of [Annex B.4.1. or B.4.2.];

4.28 'Mono-fuel vehicle' means a vehicle that is designed to run on one type of fuel;

4.29 'Opacity' means an optical measurement of the density of particulate matter in the exhaust flow of an engine, expressed in $m^{-1}$;

4.30 'Parent vehicle' means a vehicle that is representative of a propulsion unit family set out in [Annex B.5.10 ];

4.31 'Particulate filter' means a filtering device fitted in the exhaust system of a vehicle to reduce particulate matter from the exhaust flow;

4.32 'Particulate matter (PM)' means the mass of any particulate material from the vehicle exhaust quantified according to the dilution, sampling and measurement methods as specified in this UN GTR

Particle number emissions" (PN) means the total number of solid particles emitted from the vehicle exhaust quantified according to the dilution, sampling and measurement methods as specified in this UN GTR.

4.33 ‘Pollution-control device’ means those components (hardware or software) of a vehicle that control or reduce emissions;

4.34 ‘Positive ignition engine’ or ‘PI engine’ means a combustion engine working according to the principles of the ‘Otto’ cycle;

4.35 ‘Powertrain’ means the components and systems of a vehicle that generate power and deliver it to the road surface, including the engine(s), the engine management systems or any other control module, the pollution environmental protection control devices including pollutant emissions and noise abatement systems, the transmission and its control, either a drive shaft or belt drive or chain drive, the differentials, the final drive, and the driven wheel tyre (radius);

4.36 ‘Powertrain calibration’ means the application of a specific set of data maps and parameters used by the control unit’s software to tune the vehicle’s powertrain, propulsion or drive train unit(s)’s control;

4.37 ‘Powertrain control unit’ means a combined control unit of combustion engine(s), electric traction motors or drive train unit systems including the transmission or the clutch;

4.38 ‘Powertrain software’ means a set of algorithms concerned with the operation of data processing in powertrain control units, propulsion control units or drive-train control units, containing an ordered sequence of instructions that change the state of the control units;

4.39 ‘Properly maintained and used’ means that when selecting a test vehicle it satisfies the criteria with regard to a good level of maintenance and normal use according to the recommendations of the vehicle manufacturer for acceptance of such a test vehicle;

4.40 ‘Propulsion unit’ means a combustion engine, an electric motor, any hybrid application or a combination of those engine types or any other engine type;

4.41 ‘Reference mass ($m_{ref}$)’ means the unladen mass of the vehicle increased with the mass of the driver (75 kg);

4.42 ‘Scavenging port’ means a connector between crankcase and combustion chamber of a two-stroke engine through which the fresh charge of air, fuel and lubrication oil mixture enters the combustion chamber;

4.43 ‘Sensor’ means a converter that measures a physical quantity or state and converts it into an electric signal that is used as input to a control unit;

4.44 ‘Stop-start system’ means automatic stop and start of the propulsion unit;

4.45 ‘Forced Induction System’ is the process of delivering compressed air / air-fuel mixture to the intake of an internal combustion engine.

4.45.1 ‘Super-charger’ means an intake air/air fuel mixture compressor run by any means other than engine exhaust and used for forced induction of a combustion engine, thereby increasing propulsion unit performance;

4.45.2 ‘Turbocharger’ means an exhaust gas turbine-powered centrifugal compressor boosting the amount of air charge into the combustion engine, thereby increasing the propulsion unit performance;

4.46 ‘Tailpipe emissions’ means the emission of gaseous pollutants and particulate matter at the tailpipe of the vehicle;

4.47 "Useful life" means the relevant period of distance and/or time over which compliance with the relevant gaseous and particulate emission limits has to be assured.

## 5. General Requirements

5.1 The manufacturer shall equip two-wheeled vehicles in the scope of this GTR with systems, components and separate technical units affecting the environmental performance of a vehicle that are designed, constructed and assembled so as to enable the vehicle in normal use and maintained according to the prescriptions of the manufacturer to comply with the detailed technical requirements and testing procedures of this GTR during its useful life, as defined by the Contracting Party, including when installed in the vehicle.

5.2 Any hidden strategy that 'optimises' the powertrain of the vehicle running the relevant test cycles in an advantageous way, reducing tailpipe emissions and running significantly differently under real-world conditions differently than under emission test laboratory conditions, is considered a defeat strategy and is prohibited, unless the manufacturer has documented and declared it to the satisfaction of the responsible authority.

5.2.1 An element of design shall not be considered a defeat device if any of the following conditions is met:

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

5.2.1.2 the device does not function beyond the requirements of engine starting;

5.2.1.3 the operating conditions are included to a substantial extent in the test procedures for verifying if the vehicle complies with this GTR

5.3 The environmental performance type-approval regarding test types I, II and VII shall extend to different vehicle variants, versions and propulsion unit types and families, provided that the vehicle version, propulsion unit or pollution-control system parameters specified in [Annex B.5.10] are identical or remain within the prescribed and declared tolerances in that Annex.

## 6. Nomenclature

6.1 Wherever required, values shall be rounded-off as follows:

When the digit next beyond that last place to be retained, is

(a) less than 5, retain the last digit unchanged. (E.g. 1.243 becomes 1.24)

(b) greater than 5, increase the last digit by one. (E.g. 1.246 becomes 1.25)

(c) equals 5, and there are no digits beyond this, or only zeros, increase the last digit by one, if the last digit is odd (E.g. 1.235 becomes 1.24) and retain the last digit unchanged if it is even (E.g. 1.245 becomes 1.24)

d) equals 5, and there are digits beyond this, increase the last digit by one. (E.g. 1.2451 becomes 1.25)

6.2 Throughout this document the decimal sign is a full stop (period) "." and if used, the thousands separator is a comma ",".

6.3 Temperature shall be measured in °C. Wherever temperature conversion is required in K for calculation purpose, the following equivalence shall be used, °C = 273.15K.

## 7. Performance requirements for the type I test of a two-wheeled vehicle

7.1 The principal requirements of performance are set out in point 7.2 for two-wheeled vehicles. Contracting Parties may also accept compliance with one or more of the alternative performance requirements set out in point 7.3 for two-wheeled vehicles.

7.2 The gaseous pollutant emissions for each class of two-wheeled vehicle set out in point 3. of section B.1., obtained when tested in accordance with the applicable test cycle specified in Annex B.5.14., shall not exceed the pollutant tailpipe emission limit values specified in Table B.1.-6

| Class | Limits (mg/km) | | | | | Reference Fuel |
|---|---|---|---|---|---|---|
| | CO | THC | NMHC | NOx | PM | |
| PI | 1,000 | 100 | 68 | 60 | 4.5 (only for DI) | As per Annex ###(corresponding to E5 |
| CI | 500 | 100 | 68 | 90 | 4.5 | As per Annex ###(corresponding to B5) |

Table B.1.-6: Principal performance requirements.

Note:

The test values multiplied by DF must be below the limits in the above table.
DF for PI engine vehicles for CO is 1.3, THC is 1.3, NMHC is 1.3, NOx is 1.3 and PM is 1.0.
DF for CI engine vehicles for CO is 1.3, THC is 1.1, NMHC is 1.1, NOx is 1.1 and PM is 1.0.

7.3 Alternative performance requirements

The gaseous emissions for each class of vehicle set out in point 3. of section B.1., obtained when tested in accordance with the applicable test cycle specified in Annex B.5.14., shall not exceed the pollutant emission limit values specified in table B.1.-7, as per the Alternate chosen by the Contracting Party.

| Sub-Class | Limits (mg/km) for PI Engines | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CO | | | HC | | | NOx | | | HC+NOx | | |
| | Alt A (3) | Alt B(4) | Alt C(5) | Alt A (3) | Alt B(4) | Alt C(5) | Alt A (3) | Alt B(4) | Alt C(5) | Alt A(1) (3) | Alt B(4) | Alt C(5) |
| 1 | 1,403 | 1,140 | 2,620 | NA | 380 | 750 | 390 | 70 | 170 | 790 | NA | NA |
| 2-1(2) | 1,403 | 1,140 | 2,620 | NA | 380 | 750 | 390 | 70 | 170 | 790 | NA | NA |
| 2-2 | 1,970 | 1,140 | 2,620 | NA | 380 | 750 | 340 | 70 | 170 | 670 | NA | NA |
| 3 | 1,970 | 1,140 | 2,620 | NA | 170 | 330 | 200 | 90 | 220 | 400 | NA | NA |

Notes:

(1) For Alt A, there is an option to comply with evaporative emission norm of 6g/test (instead of 2g/test). HC+NOx norms to be tightened by 200mg/km from the values given in table.

(2) Applicable parts of driving cycle for Alt A are part 1 RS cold and part 1 RS hot, as against Euro 4 part 1 RS cold and part 2 RS hot.

(3) For Alt A: Test values must be below the Alt A limits in the above table.

(4) For Alt B: Test values multiplied by DF must be below the Alt B limits in the above table; DF for CO is 1.3, for NOx is 1.2 and for HC+NOx is 1.2

(5) For Alt C limits, DF are not applicable.

Table B.1.-7: Alternate performance requirements.

# B.2. Text of the regulation, Test Type I, Exhaust Emissions after Cold Start

**1. Introduction**

1.1. This section provides a harmonised method for the determination of the levels of gaseous pollutant emissions and particulate matter collected at the tailpipe, the emissions of carbon dioxide and is referred to in Annex B.4. to determine the energy efficiency in terms of fuel consumption of the vehicle types within the scope of this GTR that are representative for real world vehicle operation.

1.2. The results may form the basis for limiting gaseous pollutants, to report carbon dioxide and the energy efficiency of the vehicle in terms of fuel consumption by the manufacturer within the environmental performance approval procedures in a robust and harmonised way.

**2.** General Requirements

2.1. The components liable to affect the emission of gaseous pollutants, carbon dioxide emissions and affecting the energy efficiency of the vehicle shall be so designed, constructed and assembled as to enable the vehicle in normal use, despite the vibration to which it may be subjected, to comply with the provisions of this GTR.
Note 1: The symbols used in sections B.2., B.3. and B.4. are summarised in Annex B.5.1.

**3.** Test Conditions

3.1. Test room

3.1.1. The test room with the chassis dynamometer and the gas sample collection device shall have a temperature of 25± 5 °C. The room temperature shall be measured in the vicinity of the vehicle cooling blower (fan) before and after the type I test.

3.1.2. The absolute humidity (Ha) of either the air in the test cell or the intake air of the engine shall be measured, recorded and correction factors for NOx shall be applied.

3.1.3. The soak area shall have a temperature of 25 ± 5 °C and be such that the test vehicle which has to be preconditioned can be parked in accordance with para. 4.2.4. of part B2.

3.2. WMTC, test cycle parts
The WMTC test cycle (vehicle speed patterns) for type I, VII and VIII environmental tests consist of up to three parts as set out in Annex B.5.14. Depending on the vehicle classification in terms of engine displacement and maximum design vehicle speed in accordance with point 3. of section B.1., the following WMTC test cycle parts in Table B.2.-1 shall be run:

| Vehicle Sub classification | Applicable Parts of WMTC as specified in Annex B5.15 |
|---|---|
| *Class 0 subdivided in:* | |
| *Sub-class 0-1:* | *part 1, RST25 in cold condition, followed by part 1,RST25 in warm condition* |
| *Sub-class 0-2:* | *part 1, RST45 in cold condition, followed by part 1,RST45 in warm condition* |
| Class 1 | part 1, reduced vehicle speed in cold condition,followed by part 1, reduced vehicle speed in warm condition |
| Class 2 subdivided in: | |
| Sub-class 2-1: | part 1, reduced vehicle speed in cold condition,followed by part 2, reduced vehicle speed in warm condition |
| Sub-class 2-2: | part 1, in cold condition,followed by part 2, in warm condition |
| Class 3 subdivided in: | |
| Sub-class 3-1: | part 1, in cold condition,followed by part 2, in warm condition,followed by part 3, reduced vehicle speed in warm condition |
| Sub-class 3-2: | part 1, in cold condition,followed by part 2, in warm condition,followed by part 3, in warm condition |

3.3. Specification of the reference fuel

The appropriate reference fuels as specified in Annex B.5.2. shall be used for conducting test type I.

| *Reference Fuel Specification* | |
|---|---|
| *Performance requirement* | *Reference fuel specification* |
| *Principal Norm requirements* | *See Annex B5.2* |
| *Alternative A* | *###* |
| *Alternative B* | *###* |
| *Alternative C* | *###* |

Principal norms for Type I test shall be with E0 or E5 reference fuel for gasoline vehicles. For alternate norms, regional reference fuels used for Type I test by contracting parties may be used.

3.4. Type I test procedure

3.4.1. Driver

The test driver shall have a mass of 75 kg ± 5 kg.

3.4.2. Test bench specifications and settings

3.4.2.1. The chassis dynamometer shall have a single roller in the transverse plane with a diameter of at least 400 mm, alternatively, a chassis dynamometer equipped with two rollers on a single axle in the transverse plane (one for each wheel) is permitted when testing two-wheeled vehicles with twinned wheels.

3.4.2.2. The dynamometer shall be equipped with a roller revolution counter for measuring actual distance travelled.

3.4.2.3. Dynamometer flywheels or other means shall be used to simulate the inertia specified in point 4.2.2.

3.4.2.4. The dynamometer rollers shall be clean, dry and free from anything which might cause the tyre(s) to slip.

3.4.2.5. Cooling fan specifications as follows:

3.4.2.5.1. Throughout the test, a variable-rotation speed cooling blower (fan) shall be positioned in front of the vehicle so as to direct the cooling air onto it in a manner that simulates actual operating conditions. The blower rotation speed shall be such that, within the operating range of 10 to 50 km/h, the linear velocity of the air at the blower outlet is within ±5 km/h of the corresponding roller speed (from which the actual vehicle speed is calculated). At the range of over 50 km/h, the linear velocity of the air shall be within ±10 percent. At a desired vehicle speed of less than 10 km/h, air velocity may be zero.

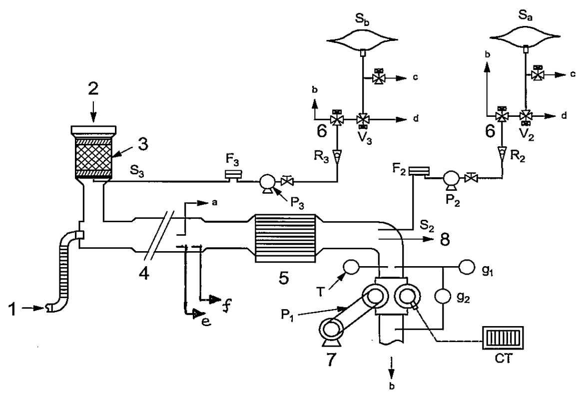
3.4.2.5.2. The air velocity referred to in point 3.4.2.5.1. shall be determined as an averaged value of nine measuring points which are located at the centre of each rectangle dividing the whole of the blower outlet into nine areas (dividing both horizontal and vertical sides of the blower outlet into three equal parts). The value at each of the nine points shall be within 10 percent of the average of the nine values.

3.4.2.5.3. The blower outlet shall have a cross-section area of at least 0.4 m2 and the bottom of the blower outlet shall be between 5 and 20 cm above floor level. The blower outlet shall be perpendicular to the longitudinal axis of the vehicle, between 30 and 45 cm in front of its front wheel. The device used to measure the linear velocity of the air shall be located at between 0 and 20 cm from the air outlet.

3.4.2.6. The detailed requirements regarding the chassis dynamometer are listed in Annex B.5.7.

3.4.3. Exhaust gas measurement system

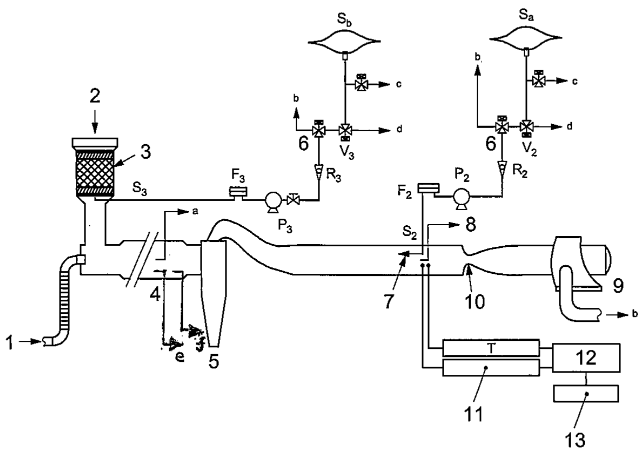
3.4.3.1. The gas-collection device shall be a closed-type device that can collect all exhaust gases at the vehicle exhaust outlets on condition that it satisfies the backpressure condition of ± 1.225 Pa (125 mm H2O). An open system may be used instead if it is confirmed that all the exhaust gases are collected. The gas collection shall be such that there is no condensation which could appreciably modify the nature of exhaust gases at the test temperature. An example of a gas-collection device is illustrated in Figure B.2.-1 a and Figure B.2.-1 b:




Key

| | | | |
|---|---|---|---|
| 1 | exhaust gas | $P_1$ | positive displacement pump |
| 2 | dilution air | $P_2$, $P_3$ | sampling pumps |
| 3 | dilution air filter | $R_2$, $R_3$ | flowmeters |
| 4 | dilution tunnel | $S_a$, $S_b$ | sampling bags |
| 5 | heating exchanger | $S_2$, $S_3$ | sampling probes |
| 6 | diversion valve | T | temperature gauge |
| 7 | motor | $V_2$, $V_3$ | valves |
| 8 | continuous sampling probe | a | To HFID; special sampling line when HFID is used. |
| CT | revolution counter | b | To atmosphere. |
| $F_2$, $F_3$ | filters | c | To exhaust pump. |
| $g_1$, $g_2$ | pressure gauges | d | To analysing system. |
| | | e | To PM;special sampling line when PM is used. |
| | | f | To PN;special sampling line when PN is used. |

**Schematic diagram for the representative closed type CVS system with PDP**



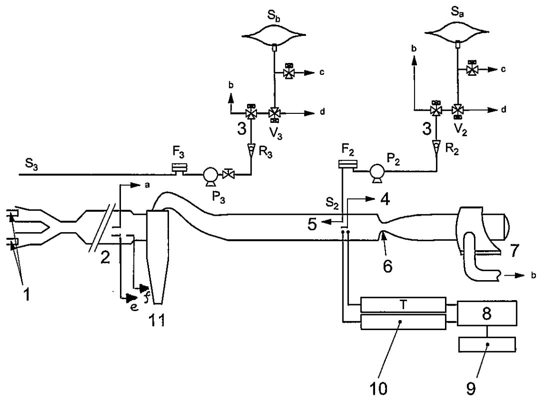

**Key**

1 exhaust gas
2 dilution air
3 dilution air filter
4 dilution tunnel
5 cyclone
6 diversion valve
7 sampling venturi
8 continuous sampling probe
9 blower
10 main critical flow venturi
11 pressure gauge
12 calculator
13 integrator

$F_2$, $F_3$ filters
$P_2$, $P_3$ sampling pumps
$R_2$, $R_3$ flowmeters
$S_a$, $S_b$ sampling bags
$S_2$, $S_3$ sampling probes
T temperature gauge
$V_2$, $V_3$ valves
a To HFID; special sampling line when HFID is used.
b To atmosphere.
c To exhaust pump.
d To analysing system.
e To PM;special sampling line when PM is used.
f To PN;special sampling line when PN is used.

**Schematic diagram for the representative closed type CVS system with CFV**

Figure B.2.-1 a. An example of closed-type systems for sampling gases and measuring their volume




**Key**

1 motorcycle exhaust pipes
2 dilution tunnel
3 diversion valve
4 continuous sampling probe
5 sampling venturi
6 main critical flow venturi
7 blower
8 calculator
9 integrator
10 pressure gauge
11 cyclone

$F_2$, $F_3$ filters
$P_2$, $P_3$ sampling pumps
$R_2$, $R_3$ flowmeters
$S_a$, $S_b$ sampling bags
$S_2$, $S_3$ sampling probes
T temperature gauge
$V_2$, $V_3$ valves
a To HFID; special sampling line when HFID is used.
b To atmosphere.
c To exhaust pump.
d To analysing system.
e To PM;special sampling line when PM is used.
f To PN;special sampling line when PN is used.

**Schematic diagram for the representative open type CVS system with CFV**

Figure B.2.-1 b. An example of open-type system for sampling gases and measuring their volume.

3.4.3.2. A connecting tube shall be placed between the device and the exhaust gas sampling system. This tube and the device shall be made of stainless steel, or of some other material which does not affect the composition of the gases collected and which withstands the temperature of these gases.

3.4.3.3. Positive displacement pump (PDP)

3.4.3.3.1. A positive displacement pump (PDP) full flow exhaust dilution system satisfies the requirements of this Sub-Annex by metering the flow of gas through the pump at constant temperature and pressure. The total volume is measured by counting the revolutions made by the calibrated positive displacement pump. The proportional sample is achieved by sampling with pump, flow meter and flow control valve at a constant flow rate.

3.4.3.3.2. A heat exchanger capable of limiting the temperature variation of the diluted gases in the pump intake to ± 5 °C shall be in operation throughout the test. This exchanger shall be equipped with a preheating system capable of bringing the exchanger to its operating temperature (with the tolerance of ± 5 °C before the test begins.

3.4.3.3.3. A positive displacement pump shall be used to draw in the diluted exhaust mixture. This pump shall be equipped with a motor with several strictly controlled uniform rotation speeds. The pump capacity shall be large enough to ensure the intake of the exhaust gases. A device using a critical-flow venturi (CFV) may also be used.

3.4.3.3.4. A device (T) shall be used for the continuous recording of the temperature of the diluted exhaust mixture entering the pump.

3.4.3.3.5. Two gauges shall be used, the first to ensure the pressure depression of the dilute exhaust mixture entering the pump relative to atmospheric pressure, and the second to measure the dynamic pressure variation of the positive displacement pump.

3.4.3.4. Critical flow venturi (CFV)

3.4.3.4.1. The use of a CFV for the full flow exhaust dilution system is based on the principles of flow mechanics for critical flow. The variable mixture flow rate of dilution and exhaust gas is maintained at sonic velocity that is inversely proportional to the square root of the gas temperature and directly proportional to gas pressure. Flow is continually monitored, computed and integrated throughout the test.

3.4.3.4.2. The use of an additional critical flow sampling venturi ensures the proportionality of the gas samples taken from the dilution tunnel. As both pressure and temperature are equal at the two venturi inlets, the volume of the gas flow diverted for sampling is proportional to the total volume of diluted exhaust gas mixture produced.

3.4.3.4.3. A CFV shall measure the flow volume of the diluted exhaust gas.

3.4.3.5. A probe shall be located near to, but outside, the gas-collecting device, to collect samples of the dilution air stream through a pump, a filter and a flow meter at constant flow rates throughout the test.

3.4.3.6. A sample probe pointed upstream into the dilute exhaust mixture flow, upstream of the positive displacement pump, shall be used to collect samples of the dilute exhaust mixture through a pump, a filter and a flow meter at constant flow rates throughout the test. The minimum sample flow rate in the sampling devices shown in [Figure B.2.-1 and in point 3.4.3.7.] shall be at least 150 litre/hour.

3.4.3.7. Three-way valves shall be used on the sampling system described in points 3.4.3.5. and 3.4.3.8. to direct the samples either to their respective bags or to the outside throughout the test.

3.4.3.8. Gas-tight collection bags

3.4.3.8.1. For dilution air and dilute exhaust mixture the collection bags shall be of sufficient capacity not to impede normal sample flow and shall not change the nature of the pollutants concerned.

3.4.3.8.2. The bags shall have an automatic self-locking device and shall be easily and tightly fastened either to the sampling system or the analysing system at the end of the test.

3.4.3.9. A revolution counter shall be used to count the revolutions of the positive displacement pump throughout the test.

Note 2: Attention shall be paid to the connecting method and the material or configuration of the connecting parts, because each section (e.g. the adapter and the coupler) of the sampling system can become very hot. If the measurement cannot be performed normally due to heat damage to the sampling system, an auxiliary cooling device may be used as long as the exhaust gases are not affected.

Note 3: With open type devices, there is a risk of incomplete gas collection and gas leakage into the test cell. There shall be no leakage throughout the sampling period.

Note 4: If a constant volume sampler (CVS) flow rate is used throughout the test cycle that includes low and high vehicle speeds all in one (i.e. part 1, 2 and 3 cycles), special attention shall be paid to the higher risk of water condensation in the high vehicle speed range.

3.4.3.10. Particulate mass emissions measurement equipment

3.4.3.10.1. Specification

3.4.3.10.1.1. System overview

3.4.3.10.1.1.1. The particulate sampling unit shall consist of a sampling probe (PSP) located in the dilution tunnel, a particle transfer tube (PTT), a filter holder(s) (FH), pump(s), flow rate regulators and measuring units. See Figures A5/11 and A5/12.

3.4.3.10.1.1.2. A particle size pre-classifier (PCF) (e.g. cyclone or impactor) may be used. In such case, it is recommended that it is employed upstream of the filter holder. However, a sampling probe, acting as an appropriate size classification device such as that shown in Figure A5/13, is acceptable.

3.4.3.10.1.2. General Requirements

3.4.3.10.1.2.1. The sampling probe for the test gas flow for particulates shall be so arranged within the dilution tunnel that a representative sample gas flow can be taken from the homogeneous air/exhaust mixture and shall be upstream of a heat exchanger (if any).

3.4.3.10.1.2.2. The particulate sample flow rate shall be proportional to the total mass flow of diluted exhaust gas in the dilution tunnel to within a tolerance of ±5 per cent of the particulate sample flow rate. The verification of the proportionality of the PM sampling should be made during the commissioning of the system and as required by the responsible authority.

3.4.3.10.1.2.3. The sampled dilute exhaust gas shall be maintained at a temperature above 293 K (20 °C) and below 325 K (52 °C) within 20 cm upstream or downstream of the particulate filter face. Heating or insulation of components of the PM sampling system to achieve this is permissible. In the event that the 52 °C limit is exceeded during a test where periodic regeneration event does not occur, the CVS flow rate should be increased or double dilution should be applied (assuming that the CVS flow rate is already sufficient so as not to cause condensation within the CVS, sample bags or analytical system).

3.4.3.10.1.2.4. The particulate sample shall be collected on a single filter per cycle part applicable according to vehicle class. Weighting factor for PM to be same as applied for all gaseous pollutants. All parts of the dilution system and the sampling system from the exhaust pipe up to the filter holder, which are in contact with raw and diluted exhaust gas, shall be designed to minimise deposition or alteration of the particulates. All parts shall be made of electrically conductive materials that do not react with exhaust gas components, and shall be electrically grounded to prevent electrostatic effects.

3.4.3.10.1.2.5. If it is not possible to compensate for variations in the flow rate, provision shall be made for a heat exchanger and a temperature control device as specified in Annex B.5.8. so as to ensure that the flow rate in the system is constant and the sampling rate accordingly proportional.

3.4.3.10.1.2.6. Temperatures required for the PM mass measurement shall be measured with an accuracy of ±1 °C and a response time ($t_{10}$-$t_{90}$ ) of fifteen seconds or less.

3.4.3.10.1.2.7. The PM sample flow from the dilution tunnel shall be measured with an accuracy of ±2.5 per cent of reading or ±1.5 per cent full scale, whichever is the least. The above accuracy of the PM sample flow from the CVS tunnel is also applicable where double dilution is used. Consequently, the measurement and control of the secondary dilution air flow and diluted exhaust flow rates through the PM filter must be of a higher accuracy. All data channels required for the PM mass measurement shall be logged at a frequency of 1 Hz or faster. Typically, these would include:
(a) Diluted exhaust temperature at the PM filter;
(b) PM sampling flow rate;
(c) PM secondary dilution air flow rate (if secondary dilution is used);
(d) PM secondary dilution air temperature (if secondary dilution is used).

3.4.3.10.1.2.8. For double dilution systems, the accuracy of the diluted exhaust transferred from the dilution tunnel, in the equation is not measured directly but determined by differential flow measurement:

Vep=Vset- Vssd

where:

Vep: is the volume of diluted exhaust gas flowing through particulate filter under standard conditions;

Vset: is the volume of the double diluted exhaust gas passing through the particulate collection filters;

Vssd: is the volume of secondary dilution air.

3.4.3.10.1.2.9. The accuracy of the flow meters used for the measurement and control of the double diluted exhaust passing through the particulate collection filters and for the measurement/control of secondary dilution air shall be sufficient so that the differential volume [(symbol)] shall meet the accuracy and proportional sampling requirements specified for single dilution. The requirement that no condensation of the exhaust gas should occur in the CVS dilution tunnel, diluted exhaust flow rate measurement system, CVS bag collection or analysis systems shall also apply in the case of double dilution systems.

3.4.3.10.1.2.10. Each flow meter used in a particulate sampling and double dilution system shall be subjected to a linearity verification as required by the instrument manufacturer.

Figure A5/11
**Particulate Sampling System**

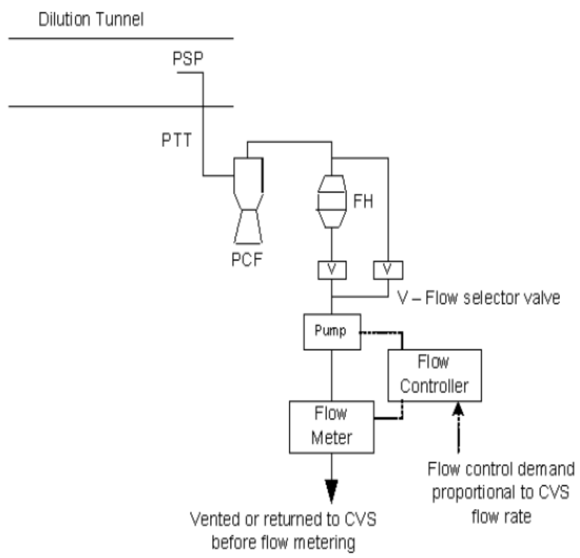
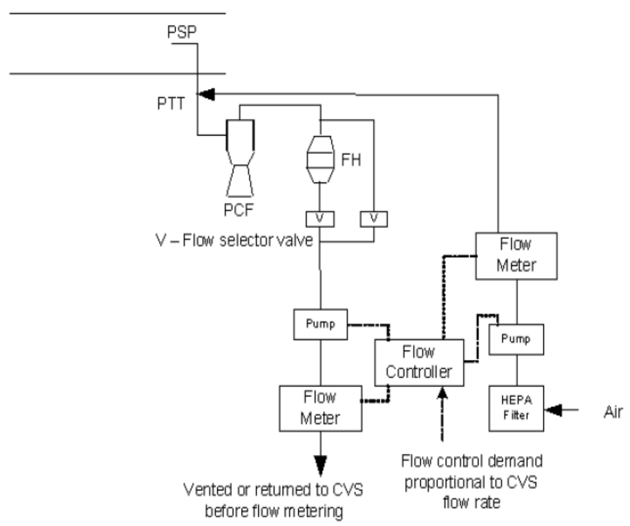



Figure A5/12
**Double Dilution Particulate Sampling System**



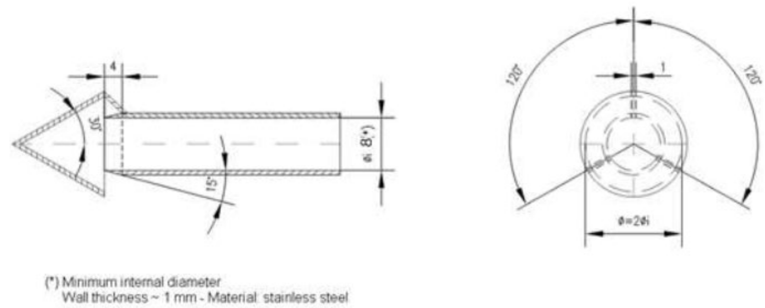
3.4.3.10.1.3. Specific requirements

3.4.3.10.1.3.1. Particulate Matter (PM) sampling probe

3.4.3.10.1.3.1.1. The sample probe shall deliver the particle-size classification performance described in paragraph 4.2.1.3.1.4. below. It is recommended that this performance be achieved by the use of a sharp-edged, open-ended probe facing directly into the direction of flow plus a pre-classifier (cyclone impactor, etc.). An appropriate sampling probe, such as that indicated in Figure A5/13, may alternatively be used provided it achieves the pre-classification performance described in paragraph 4.2.1.3.1.4. below.

Figure A5/13

**Alternative particulate sampling probe configuration**




3.4.3.10.1.3.1.2. The sample probe shall be installed at least 10 tunnel diameters downstream of the exhaust gas inlet to the tunnel and have an internal diameter of at least 8 mm.

If more than one simultaneous sample is drawn from a single sample probe, the flow drawn from that probe shall be split into identical sub-flows to avoid sampling artefacts.

If multiple probes are used, each probe shall be sharp-edged, open-ended and facing directly into the direction of flow. Probes shall be equally spaced around the central longitudinal axis of the dilution tunnel, with the spacing between probes at least 5 cm.

3.4.3.10.1.3.1.3. The distance from the sampling tip to the filter mount shall be at least five probe diameters, but shall not exceed 2,000 mm.

3.4.3.10.1.3.1.4. The pre-classifier (e.g. cyclone, impactor, etc.) shall be located upstream of the filter holder assembly. The pre-classifier 50 percent cut point particle diameter shall be between 2.5 µm and 10 µm at the volumetric flow rate selected for sampling particulate mass emissions. The pre-classifier shall allow at least 99 percent of the mass concentration of 1 µm particles entering the pre-classifier to pass through the exit of the pre-classifier at the volumetric flow rate selected for sampling PM.

3.4.3.10.1.3.1.5. Particle transfer tube (PTT)

3.4.3.10.1.3.1.5.1. Any bends in the PTT shall be smooth and have the largest possible radii.

3.4.3.10.1.3.1.6. Secondary dilution

3.4.3.10.1.3.1.6.1. As an option, the sample extracted from the CVS for the purpose of PM measurement may be diluted at a second stage, subject to the following requirements:

i) Secondary dilution air shall be filtered through a medium capable of reducing particles in the most penetrating particle size of the filter material by ≥ 99.95 per cent, or through a HEPA filter of at least class H13 of EN 1822:2009. The dilution air may optionally be charcoal scrubbed before being passed to the HEPA filter. It is recommended that an additional coarse particle filter is situated before the HEPA filter and after the charcoal scrubber, if used.

ii) The secondary dilution air should be injected into the PTT as close to the outlet of the diluted exhaust from the dilution tunnel as possible.

iii) The residence time from the point of secondary diluted air injection to the filter face shall be at least 0.25 seconds (s), but no longer than five seconds.

iv) If the double diluted PM sample is returned to the CVS, the location of the sample return shall be selected so that it does not interfere with the extraction of other samples from the CVS.

3.4.3.10.1.3.2. Sample pump and flow meter

3.4.3.10.1.3.2.1. The sample gas flow measurement unit shall consist of pumps, gas flow regulators and flow measuring units.

3.4.3.10.1.3.2.2. The temperature of the gas flow in the flow meter may not fluctuate by more than ±3 K except

(a) When the PM sampling flow meter has real time monitoring and flow control operating at 1 Hz or faster;

(b) During regeneration tests on vehicles equipped with periodically regenerating after-treatment devices.

Should the volume of flow change unacceptably as a result of excessive filter loading, the test shall be invalidated. When it is repeated, the rate of flow shall be decreased.

3.4.3.10.1.3.3. Filter and filter holder

3.4.3.10.1.3.3.1. A valve shall be located downstream of the filter in the direction of flow. The valve shall open and close within 1 s of the start and end of test.

3.4.3.10.1.3.3.2. For a given test, the gas filter face velocity shall be set to a single value within the range 20 cm/s to 105 cm/s and should be set at the start of the test so that 105 cm/s will not be exceeded when the dilution system is being operated with sampling flow proportional to CVS flow rate.

3.4.3.10.1.3.3.3. Fluorocarbon coated glass fibre filters or fluorocarbon membrane filters are required.

All filter types shall have a 0.3µm DOP (di-octylphthalate) or PAO (polyalpha-olefin) CS 68649-12-7 or CS 68037-01-4 collection efficiency of at least 99 per cent at a gas filter face velocity of 5.33cm/s measured according to one of the following standards:

(a) U.S.A. Department of Defense Test Method Standard, MIL-STD-282 method 102.8: DOP-Smoke Penetration of Aerosol-Filter Element

(b) U.S.A. Department of Defense Test Method Standard, MIL-STD-282 method 502.1.1: DOP-Smoke Penetration of Gas-Mask Canisters

(c) Institute of Environmental Sciences and Technology, IEST-RPCC021:

Testing HEPA and ULPA Filter Media.

3.4.3.10.1.3.3.4. The filter holder assembly shall be of a design that provides an even flow distribution across the filter stain area. The filter shall be round and have a stain area of at least 1075 mm2.

3.4.3.10.1.3.4. Weighing chamber(or room) and analytical balance specifications

3.4.3.10.1.3.4.1. Weighing chamber(or room) conditions

(a) The temperature of the chamber (or room) in which the particulate filters are conditioned and weighed shall be maintained to within 295 K ± 2 K (22 °C ± 2 °C, 22 °C ± 1 °C if possible) during all filter conditioning and weighing.

(b) Humidity shall be maintained to a dew point of less than 283.5 K (10.5 °C) and a relative humidity of 45 per cent ± 8 per cent.

(c) Limited deviations from weighing temperature and humidity specifications will be allowed provided their total duration does not exceed 30 minutes in any one filter conditioning period.

(d) The levels of ambient contaminants in the chamber (or room) environment that would settle on the particulate filters during their stabilization shall be minimised.

(e) During the weighing operation, no deviations from the specified conditions are permitted.

3.4.3.10.1.3.4.1.1. Linear response of an analytical balance

The analytical balance used to determine the filter weight shall meet the linearity verification criterion of Table A5/1 below. This implies a precision (standard deviation) of at least 2 µg and a resolution of at least 1 µg. 1 digit = 1 µg). At least 4 equally-spaced reference weights shall be tested. The zero value shall be within ±1µg.

Table A5/1
**Analytical balance verification criteria**

| *Measurement system* | *Intercept b* | *Slope m* | *Standard error SEE* | *Coefficient of determination $r^2$* |
|---|---|---|---|---|
| PM Balance | ≤ 1per cent max | 0.99 – 1.01 | ≤ 1per cent max | ≥ 0.998 |

Table A5/1 Analytical balance verification criteria

3.4.3.10.1.3.4.2. Buoyancy Correction

The sample and reference filter weights shall be corrected for their buoyancy in air. The buoyancy correction is a function of sampling filter density, air density and the density of the balance calibration weight, and does not account for the buoyancy of the PM itself.

If the density of the filter material is not known, the following densities shall be used:
(a) PTFE coated glass fiber filter: 2,300 kg/m3;
(b) PTFE membrane filter: 2,144 kg/m3;
(c) PTFE membrane filter with polymethyl pentene support ring: 920 kg/m3.

For stainless steel calibration weights, a density of 8,000 kg/m³ shall be used. If the material of the calibration weight is different, its density must be known. International Recommendation OIML R 111-1 Edition 2004(E) from International Organization of Legal Metrology on calibration weights should be followed.

The following equation shall be used:

$$m_f = m_{uncorr} \times \left( \frac{1 - \frac{\rho_a}{\rho_w}}{1 - \frac{\rho_a}{\rho_f}} \right)$$

where:

$m_f$ is the corrected particulate sample mass, mg;

$m_{uncorr}$ is the uncorrected particulate sample mass, mg;

$\rho_a$ is the density of the air, kg/m$^3$;

$\rho_w$ is the density of balance calibration weight, kg/m$^3$;

$\rho_f$ is the density of the particulate sampling filter, kg/m$^3$.

The density of the air $\rho_a$ shall be calculated as follows:

$$\rho_a = \frac{p_b \times 28.836}{8.3144 \times T_a}$$

$p_b$ is the total atmospheric pressure, kPa;

$T_a$ is the air temperature in the balance environment, Kelvin (K).

The chamber (or room) environment shall be free of any ambient contaminants (such as dust) that would settle on the particulate filters during their stabilisation.
Limited deviations from weighing room temperature and humidity specifications shall be allowed provided their total duration does not exceed 30 minutes in any one filter

conditioning period. The weighing room shall meet the required specifications prior to personal entrance into the weighing room. No deviations from the specified conditions are permitted during the weighing operation.

3.4.3.10.1.3.4.3. The effects of static electricity shall be nullified. This may be achieved by grounding the balance through placement on an antistatic mat and neutralisation of the particulate filters prior to weighing using a Polonium neutraliser or a device of similar effect. Alternatively, nullification of static effects may be achieved through equalisation of the static charge.

3.4.3.10.1.3.4.4. A test filter shall be removed from the chamber no earlier than an hour before the test begins.

3.4.3.10.1.4. Recommended system description

Figure B.2.-2 is a schematic drawing of the recommended particulate sampling system. Since various configurations can produce equivalent results, exact conformity with this figure is not required. Additional components such as instruments, valves, solenoids, pumps and switches may be used to provide additional information and coordinate the functions of component systems. Further components that are not needed to maintain accuracy with other system configurations may be excluded if their exclusion is based on good engineering judgment.

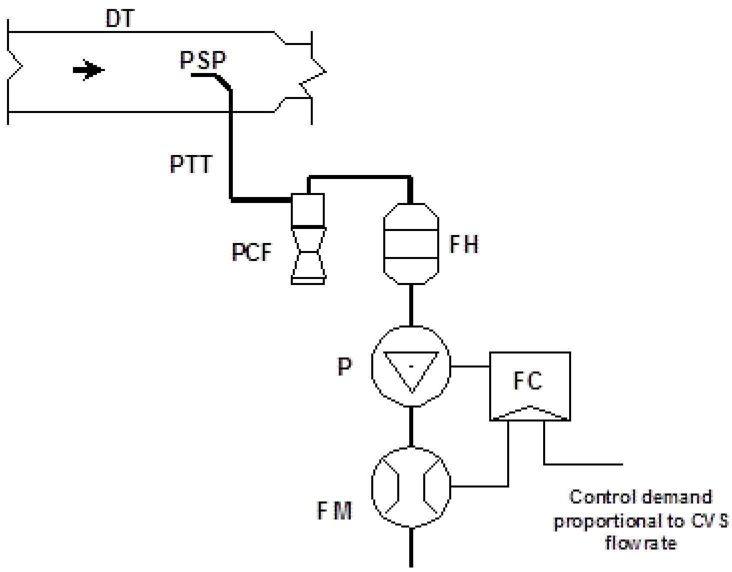



Figure B.2.-2: Particulate sampling system

A sample of the diluted exhaust gas is taken from the full flow dilution tunnel (DT) through the particulate sampling probe (PSP) and the particulate transfer tube (PTT) by means of the pump (P). The sample is passed through the particle size pre-classifier (PCF) and the filter holders (FH) that contain the particulate sampling filters. The flow rate for sampling is set by the flow controller (FC).

3.4.4. Driving schedules

3.4.4.1. Test cycle WMTC

The WMTC test cycles (vehicle speed patterns vs. test time) for the type I test consist of up to three parts, as laid down in Annex B.5.15. The applicable part of WMTC for each sub category shall be as per 3.2 of this section.

3.4.4.2. Vehicle speed tolerances

3.4.4.2.1. The vehicle speed tolerance at any given time on the test cycles prescribed in Annex B.5.14. is defined by upper and lower limits. The upper limit is 3.2 km/h higher than the highest point on the trace within one second of the given time. The lower limit is 3.2 km/h lower than the lowest point on the trace within one second of the given time. Vehicle speed variations greater than the tolerances (such as may occur during gear changes) are acceptable provided they occur for less than two seconds on any occasion. Vehicle speeds lower than those prescribed are acceptable provided the vehicle is operated at maximum available power during such occurrences. Figure B.2.-3 shows the range of acceptable vehicle speed tolerances for typical points.

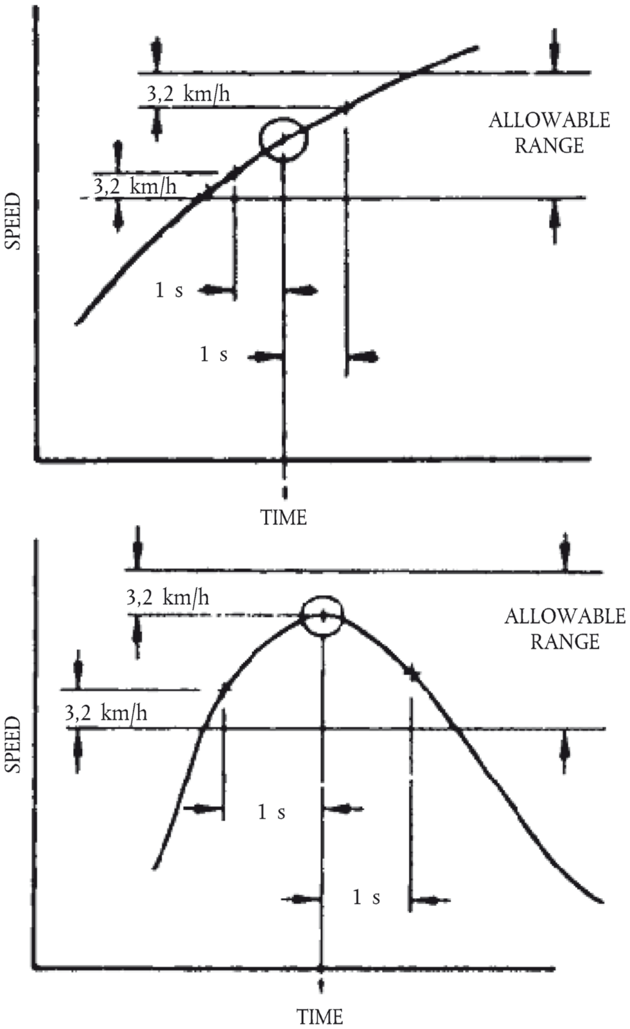



Figure B.2.-3: Drivers trace, allowable range

3.4.4.2.2. If the acceleration capability of the vehicle is not sufficient to carry out the acceleration phases or if the maximum design speed of the vehicle is lower than the prescribed cruising vehicle speed within the prescribed limits of tolerances, the vehicle shall be driven with the throttle fully open until the desired vehicle speed is reached or at the maximum design vehicle speed achievable with fully opened throttle during the time that desired vehicle speed exceeds the maximum design vehicle speed. In both cases, point 3.4.4.2.1. is not applicable. The test cycle shall be carried on normally when desired vehicle speed is again lower than the maximum design speed of the vehicle.

3.4.4.2.3. If the period of deceleration is shorter than that prescribed for the corresponding phase, due to the vehicle characteristics, desired vehicle speed shall be restored by a constant vehicle speed or idling period merging into succeeding constant vehicle speed or idling operation. In such cases, point 3.4.4.2.1. is not applicable.

3.4.4.2.4. Apart from these exceptions, the deviations of the roller speed (from which the actual vehicle speed is calculated) in comparison to the desired vehicle speed of the cycles shall meet the requirements described in point 3.4.4.2.1. If not, the test results shall not be used for further analysis and the test run shall be repeated.

3.4.5. Gearshift prescriptions for the WMTC prescribed for the test cycles set out in Annex B.5.15. and explained in more detail in Annex B.5.15.

3.4.5.1. Test vehicles equipped with an automatic transmission

3.4.5.1.1. Vehicles equipped with transfer cases, multiple sprockets, etc., shall be tested in the configuration recommended by the manufacturer for street or highway use.

3.4.5.1.2. Idle modes shall be run with automatic transmissions in 'Drive' and the wheels braked. After initial engagement, the selector shall not be operated at any time during the test.

3.4.5.1.3. Automatic transmissions shall shift automatically through the normal sequence of gears. The torque converter clutch, if applicable, shall operate as under real-world conditions.

3.4.5.1.4. The deceleration modes shall be run in gear using brakes or throttle as necessary to maintain the desired vehicle speed.

3.4.5.2. Test vehicles equipped with a semi-automatic transmission

3.4.5.2.1. Vehicles equipped with semi-automatic transmissions shall be tested using the gears normally employed for driving, and the gear shift used in accordance with the instructions in the owner's manual.

3.4.5.2.2. Idle modes shall be run with semi-automatic transmissions in 'Drive' and the wheels braked. After initial engagement, the selector shall not be operated at any time during the test.

3.4.5.3. Test vehicles equipped with manual transmission

3.4.5.3.1. Mandatory requirements

3.4.5.3.1.1. Step 1 — Calculation of desired vehicle speeds to shift gear
Upshift desired vehicle speeds ($v1 \rightarrow 2$ and $vi \rightarrow i+1$) in km/h during acceleration phases shall be calculated using the following formulae:

Equation B.2.-3:

$$v_{1 \rightarrow 2} = \left[ (0.5753 \times e^{\left(-1.9 \times \frac{P_n}{mref}\right)} - 0.1) \times (s - n_{idle}) + n_{idle} \right] \times \frac{1}{ndv_1}$$

Equation B.2.-4:

$$v_{i \rightarrow i+1} = \left[ (0.5753 \times e^{(-1.9 \times \frac{P_n}{mref})}) \times (s - n_{idle}) + n_{idle} \right] \times \frac{1}{ndv_i}$$

i = 2 to ng -1
where:
'i' is the gear number (≥ 2)
'ng' is the total number of forward gears
'$P_n$' is the rated power in kW
'$m_{ref}$' is the reference mass in kg
'$n_{idle}$' is the idling engine speed in $min^{-1}$
's' is the rated engine speed in $min^{-1}$
'$ndv_i$' is the ratio between engine speed in min-1 and vehicle speed in km/h in gear 'i'.

Downshift desired vehicle speeds ($v_{i \rightarrow i-1}$) in km/h during cruise or deceleration phases in gears 4 (4th gear) to ng shall be calculated using the following formula:

Equation B.2.-5:

$$v_{i \rightarrow i-1} = \left[ (0.5753 \times e^{(-1.9 \times \frac{P_n}{mref})}) \times (s - n_{idle}) + n_{idle} \right] \times \frac{1}{ndv_{i-2}}$$

i = 4 to ng
where:
i is the gear number (≥ 4)
ng is the total number of forward gears
$P_n$ is the rated power in kW
$m_{ref}$ is the reference mass in kg
$n_{idle}$ is the idling engine speed in $min^{-1}$
s is the rated engine speed in $min^{-1}$
$ndv_{i-2}$ is the ratio between engine speed in min-1 and vehicle speed in km/h in gear i-2

The downshift desired vehicle speed from gear 3 to gear 2 ($v_{3 \rightarrow 2}$) shall be calculated using the following equation:

Equation B.2.-6:

$$v_{2 \rightarrow 3} = \left[ (0.5753 \times e^{(-1.9 \times \frac{P_n}{mref})} - 0.1) \times (s - n_{idle}) + n_{idle} \right] \times \frac{1}{ndv_1}$$

where:
$P_n$ is the rated power in kW
$m_{ref}$ is the reference mass in kg
$n_{idle}$ is the idling engine speed in $min^{-1}$
s is the rated engine speed in $min^{-1}$
$ndv_1$ is the ratio between engine speed in min-1 and vehicle speed in km/h in gear 1.

The downshift desired vehicle speed from gear 2 to gear 1 ($v_{2 \rightarrow 1}$) shall be calculated using the following equation:

Equation B.2.-7:

$$v_{2 \to 1} = \left[0.03 \times (s - n_{idle}) + n_{idle}\right] \times \frac{1}{ndv_2}$$

where:
$ndv_2$ is the ratio between engine speed in min-1 and vehicle speed in km/h in gear 2.

Since the cruise phases are defined by the phase indicator, slight vehicle speed increases could occur and it may be appropriate to apply an upshift. The upshift desired vehicle speeds ($v_{1\to2}$, $v_{2\to3}$ and $v_{i\to i+1}$) in km/h during cruise phases shall be calculated using the following equations:

Equation B.2.-8:

$$v_{1 \to 2} = \left[0.03 \times (s - n_{idle}) + n_{idle}\right] \times \frac{1}{ndv_2}$$

Equation B.2.-9:

$$v_{2 \to 3} = \left[(0.5753 \times e^{(-1.9 \times \frac{P_n}{mref})} - 0.1) \times (s - n_{idle}) + n_{idle}\right] \times \frac{1}{ndv_1}$$

Equation B.2.-10:

$$v_{i \to i+1} = \left[(0.5753 \times e^{(-1.9 \times \frac{P_n}{mref})}) \times (s - n_{idle}) + n_{idle}\right] \times \frac{1}{ndv_{i-1}},\ i = 3 \text{ to } ng$$

3.4.5.3.1.2. Step 2 — Gear choice for each cycle sample

In order to avoid different interpretations of acceleration, deceleration, cruise and stop phases, corresponding indicators are added to the vehicle speed pattern as integral parts of the cycles (see tables in Annex B.5.15.).

The appropriate gear for each sample shall then be calculated according to the vehicle speed ranges resulting from equations to determine the desired vehicle speeds to shift gears of point 3.4.5.3.1.1. and the phase indicators for the cycle parts appropriate for the test vehicle, as follows:

Gear choice for stop phases:

For the last five seconds of a stop phase, the gear lever shall be set to gear 1 and the clutch shall be disengaged. For the previous part of a stop phase, the gear lever shall be set to neutral or the clutch shall be disengaged.

Gear choice for acceleration phases:

gear 1, if $v \leq v_{1\to2}$

gear 2, if $v_{1\to2} < v \leq v_{2\to3}$

gear 3, if $v_{2\to3} < v \leq v_{3\to4}$

gear 4, if $v_{3\to4} < v \leq v_{4\to5}$

gear 5, if $v_{4\to5} < v \leq v_{5\to6}$

gear 6, if $v > v_{5\to6}$

Gear choice for deceleration or cruise phases:

gear 1, if $v < v_{2\to1}$

gear 2, if $v < v_{3\rightarrow 2}$
gear 3, if $v_{3\rightarrow 2} \leq v < v_{4\rightarrow 3}$
gear 4, if $v_{4\rightarrow 3} \leq v < v_{5\rightarrow 4}$
gear 5, if $v_{5\rightarrow 4} \leq v < v_{6\rightarrow 5}$
gear 6, if $v \geq v_{4\rightarrow 5}$

The clutch shall be disengaged, if:
(a) the vehicle speed drops below 10 km/h, or
(b) the engine speed drops below $n_{idle} + 0.03\times(s — n_{idle})$;
(c) there is a risk of engine stalling during cold-start phase.

3.4.5.3.1.3. Step 3 — Corrections according to additional requirements

3.4.5.3.1.3.1. The gear choice shall be modified according to the following requirements:
(a) no gearshift at a transition from an acceleration phase to a deceleration phase. The gear that was used for the last second of the acceleration phase shall be kept for the following deceleration phase unless the vehicle speed drops below a downshift desired vehicle speed;
(b) no upshifts or downshifts by more than one gear, except from gear 2 to neutral during decelerations down to stop;
(c) upshifts or downshifts for up to four seconds are replaced by the gear before, if the gears before and after are identical, e.g. 2 3 3 3 2 shall be replaced by 2 2 2 2 2, and 4 3 3 3 3 4 shall be replaced by 4 4 4 4 4 4.
In the cases of consecutive circumstances, the gear used longer takes over, e.g. 2 2 2 3 3 3 2 2 2 2 3 3 3 will be replaced by 2 2 2 2 2 2 2 2 2 2 3 3 3
If used for the same time, a series of succeeding gears shall take precedence over a series of preceding gears, e.g. 2 2 2 3 3 3 2 2 2 3 3 3 will be replaced by 2 2 2 2 2 2 2 2 2 3 3 3;
(d) no downshift during an acceleration phase.

3.4.5.3.2. Optional provisions
The gear choice may be modified according to the following provisions:
The use of gears lower than those determined by the requirements described in point 3.4.5.2.1. is permitted in any cycle phase. Manufacturers' recommendations for gear use shall be followed if they do not result in gears higher than determined by the requirements of point 3.4.5.2.1.

3.4.5.3.3. Optional provisions
Note 5: The calculation programme to be found on the UN website at the following URL may be used as an aid for the gear selection:
http://live.unece.org/trans/main/wp29/wp29wgs/wp29grpe/wmtc.html

Explanations of the approach and the gearshift strategy and a calculation example are given in Annex B.5.15.

3.4.5.3.4. Idle modes shall be run with manual transmissions with wheels braked.

3.4.6. Dynamometer settings
A full description of the chassis dynamometer and instruments shall be provided in accordance with Annex B.5.13. Measurements shall be taken to the accuracies specified in point 3.4.7. The running resistance force for the chassis dynamometer settings can be derived either from on-road coast-down measurements or from a running resistance table, with reference to Annexes B.5.4. or B.5.5. for a vehicle equipped with one wheel on the powered axle and to Annexes B.5.4. or B.5.6. for a vehicle with two wheels on the powered axles in case of twinned wheel vehicles.

3.4.6.1. Chassis dynamometer setting derived from on-road coast-down measurements

To use this alternative, on-road coast-down measurements shall be carried out as specified in Annex B.5.5. for a vehicle equipped with one wheel on the powered axle and Annex B.5.6. for a vehicle equipped with two wheels on the powered axles in case of twinned wheel vehicles.

(Secretariat note: The Annex numbers above, to check after finalization)

3.4.6.1.1. Requirements for the equipment

The instrumentation for the roller speed (actual vehicle speed), desired vehicle speed and time measurement shall have the accuracies specified in point 3.4.7.

3.4.6.1.2. Inertia mass setting

3.4.6.1.2.1. The equivalent inertia mass mi for the chassis dynamometer shall be the flywheel equivalent inertia mass, mfi, closest to the sum of the mass in running order of the vehicle, the mass of the driver (75 kg). Alternatively, the equivalent inertia mass mi can be derived from Annex B.5.4.

3.4.6.1.2.2. If the reference mass $m_{ref}$ cannot be equalised to the flywheel equivalent inertia mass $m_i$, to make the target running resistance force $F^*$ equal to the running resistance force $F_E$ (which is to be set to the chassis dynamometer), the corrected coast-down time $\Delta T_E$ may be adjusted in accordance with the total mass ratio of the target coast-down time $\Delta T_{road}$ in the following sequence:

Equation B.2.-11:

$$\Delta T_{road} = \frac{1}{3.6}(m_a + m_{r1})\frac{2\Delta v}{F^*}$$

Equation B.2.-12:

$$\Delta T_E = \frac{1}{3.6}(m_i + m_{r1})\frac{2\Delta v}{F_E}$$

Equation B.2.-13:

$$F_E = F^*$$

Equation B.2.-14:

$$\Delta T_E = \Delta T_{road} \times \frac{m_i + m_{r1}}{m_a + m_{r1}}$$

with $0.95 < \frac{m_i + m_{r1}}{m_a + m_{r1}} < 1.05$

where:

$m_{r1}$ may be measured or calculated, in kilograms, as appropriate. As an alternative, $m_{r1}$ may be estimated as 4 percent of m.

For measurement accuracy, see Table B.2.-2

3.4.6.2. Running resistance force derived from a running resistance table or on road coast down

3.4.6.2.1. The chassis dynamometer may be set by the use of the running resistance table instead of the running resistance force obtained by the coast-down method. In this table method, the chassis dynamometer shall be set by the mass in running order regardless of particular vehicle characteristics.

Note 6: Care shall be taken when applying this method to vehicles with extraordinary characteristics.

3.4.6.2.2. The flywheel equivalent inertia mass $m_{fi}$ shall be the equivalent inertia mass mi specified in Annexes B.5.4., B.5.5. or B.5.6. where applicable. The chassis dynamometer shall be set by the rolling resistance of the non-driven wheels (a) and the aero drag coefficient (b) specified in Annex B.5.4., or determined in accordance with the procedures set out in B.5.5. or B.5.6. respectively. (Secretariat note: The Annex numbers above, to check after finalization)

3.4.6.2.3. The running resistance force on the chassis dynamometer FE shall be determined using the following equation:

Equation B.2.-15:

$$F_E = F_T = a + b \cdot v^2$$

3.4.6.2.4. The target running resistance force F* shall be equal to the running resistance force obtained from the running resistance table FT, because the correction for the standard ambient conditions is not necessary.

3.4.7. Measurement accuracies

Measurements shall be taken using equipment that fulfils the accuracy requirements in Table B.2.-2:

| Measurement items | At measured value | Resolution |
|---|---|---|
| a) Running resistance force, F | + 2 percent | - |
| b) Vehicle speed (v1, v2) | ± 1 percent | 0.2 km/h |
| c) Coast-down vehicle speed interval (2Δv = v1 — v2) | ± 1 percent | 0.1 km/h |
| d) Coast-down time (Δt) | ± 0.5 percent | 0.01 s |
| e) Total vehicle mass (mk) | ± 0.5 percent | 1.0 kg |
| f) Wind speed | ± 10 percent | 0.1 m/s |
| g) Wind direction | - | 5 deg. |
| h) Temperature | ± 1 °C | 1 °C |
| i) Barometric pressure | - | 0.2 kPa |
| j) Distance | ± 0.1 percent | 1 m |
| k) Time | ± 0.1 s | 0.1 s |

Table B.2.-2: Required accuracy of measurements

## 4. Test procedures

4.1. Description of the type I test

The test vehicle shall be subjected, according to its category, to test type I requirements as specified in this point 4 and comply with the requirements set out in Annex B.5.3.

4.1.1. Type I test (verifying the average emission of gaseous pollutants, PM for GDI and diesel vehicle, $CO_2$ emissions and fuel consumption in a characteristic driving cycle)

4.1.1.1. The test shall be carried out by the method described in point 4.2. The gases shall be collected and analysed by the prescribed methods.

4.1.1.2. Number of tests

4.1.1.2.1. The number of tests shall be determined as shown in Figure B.2.-4. Ri1 to Ri3 describe the final measurement results for the first (No 1) test to the third (No 3) test and the gaseous pollutant, carbon dioxide emission, fuel consumption as laid down in Annex B.4. ‘Lx’ represents the limit values L1 to L5 as defined in the emission limits in point B.1.9.

4.1.1.2.2. In each test, the masses of the carbon monoxide, hydrocarbons, nitrogen oxides, carbon dioxide and the fuel consumed during the test shall be determined. The mass of particulate matter shall be determined only for vehicles equipped with a CI or a direct injected PI combustion engine.

Note for secretariat: Once the procedure for $CO_2$ and FE is finalized, we need to revisit this flow chart and text for appropriate changes to take care of calculations of $CO_2$, for the number of tests required e.g.---Ri1, Ri2, Ri3. [

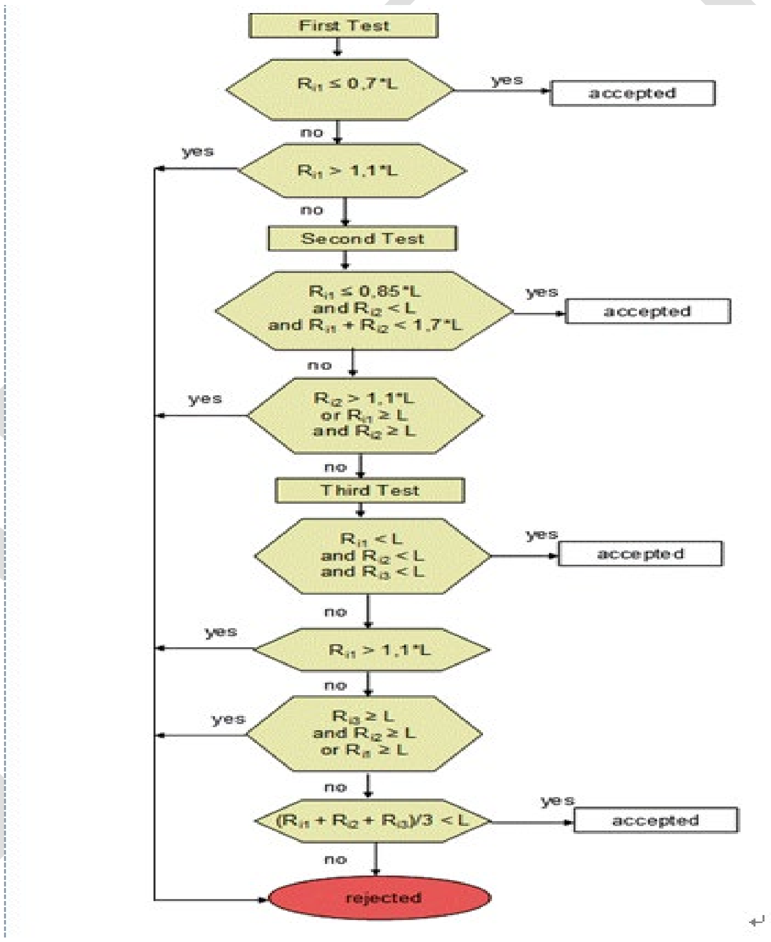



Figure B.2.-4: Flowchart for the number of type I tests

Exhaust emissions may be sampled during preparation tests for type I testing or during verification tests for test types IV, VII or VIII but the results of these tests shall not be used for the purpose of exhaust emission [approval / certification] to satisfy the requirements set out in point 4.1.1.2.2. ]

4.2. Type I test

4.2.1. Introduction

4.2.1.1. The type I test consists of prescribed sequences of dynamometer preparation, fuelling, parking, and operating conditions.

4.2.1.2. The test is designed to determine hydrocarbon, carbon monoxide, oxides of nitrogen, carbon dioxide, particulate matter mass emissions if applicable and fuel consumption while simulating real-world operation. The test consists of engine start-ups and vehicle operation on a chassis dynamometer, through a specified driving cycle. A proportional part of the diluted exhaust emissions is collected continuously for subsequent analysis, using a constant volume (variable dilution) sampler (CVS).

4.2.1.3. Except in cases of component malfunction or failure, all emission-control systems installed on or incorporated in a tested vehicle shall be functioning during all procedures.

4.2.1.4. Background concentrations are measured for all emission constituents for which emissions measurements are taken. For exhaust testing, this requires sampling and analysis of the dilution air.

4.2.1.5. Background particulate mass measurement

The particulate background level of the dilution air may be determined by passing filtered dilution air through the particulate filter. This shall be drawn from the same point as the particulate matter sample, if a particulate mass measurement is applicable according to point 4.1.1.2.2. One measurement may be performed prior to or after the test. Particulate mass measurements may be corrected by subtracting the background contribution from the dilution system. The permissible background contribution shall be ≤ 1 mg/km (or equivalent mass on the filter). If the background contribution exceeds this level, the default figure of 1 mg/km (or equivalent mass on the filter) shall be used. Where subtraction of the background contribution gives a negative result, the particulate mass result shall be considered to be zero.

4.2.2. Dynamometer settings and verification

4.2.2.1. Test vehicle preparation
The test vehicle shall comply with the requirements set out in Annex B.5.3.

4.2.2.1.1. The manufacturer shall provide additional fittings and adapters, as required to accommodate a fuel drain at the lowest point possible in the tanks as installed on the vehicle, and to provide for exhaust sample collection.

4.2.2.1.2. The tyre pressures shall be adjusted to the manufacturer's specifications to the satisfaction of the technical service or so that the speed of the vehicle during the road test and the vehicle speed obtained on the chassis dynamometer are equal.

4.2.2.1.3. The test vehicle shall be warmed up on the chassis dynamometer to the same condition as it was during the road test.

4.2.2.2. Chassis dynamometer preparation, if settings are derived from on-road coast-down measurements:
Before the test, the chassis dynamometer shall be appropriately warmed up to the stabilised frictional force Ff. The load on the chassis dynamometer FE is, in view of its construction, composed of the total friction loss Ff, which is the sum of the chassis dynamometer rotating frictional resistance, the tyre rolling resistance, the frictional resistance of the rotating parts in the powertrain of the vehicle and the braking force of the power absorbing unit (pau) Fpau, as in the following equation:
Equation B.2.-16:

$$F_E = F_f + F_{pau}$$

The target running resistance force F* derived from Annex B.5.4. and; for a vehicle equipped with one wheel on the powered axle Annex B.5.5. or for a vehicle with two or more wheels on the powered axles Annex B.5.6., shall be reproduced on the chassis dynamometer in accordance with the vehicle speed, i.e.:

Equation B.2.-17

$$F_E(v_i) = F^*(v_i)$$

The total friction loss Ff on the chassis dynamometer shall be measured by the method in point 4.2.2.2.1. or 4.2.2.2.2.

4.2.2.2.1. Motoring by chassis dynamometer

This method applies only to chassis dynamometers capable of driving an vehicle. The test vehicle shall be driven steadily by the chassis dynamometer at the reference vehicle speed v0 with the drive train engaged and the clutch disengaged. The total friction loss Ff (v0) at the reference vehicle speed v0 is given by the chassis dynamometer force.

4.2.2.2.2. Coast-down without absorption

The method for measuring the coast-down time is the coast-down method for the measurement of the total friction loss Ff. The vehicle coast-down shall be performed on the chassis dynamometer by the procedure described in Annexes B.5.4. and B.5.5. for a vehicle equipped with one wheel on the powered axle and Annexes B.5.4. and B.5.6. for a vehicle equipped with two or more wheels on the powered axles, with zero chassis dynamometer absorption. The coast-down time $\Delta t_i$ corresponding to the reference vehicle speed v0 shall be measured. The measurement shall be carried out at least three times, and the mean coast-down time $\overline{\Delta t}$ shall be calculated using the following equation:

Equation B.2.-18:

$$\overline{\Delta t} = \frac{1}{n}\sum_{i=1}^{n}\Delta t_i$$

4.2.2.2.3. Total friction loss

The total friction loss $Ff_{(v0)}$ at the reference vehicle speed $v_0$ is calculated using the following equation:

Equation B.2.-19:

$$F_f(v_0) = \frac{1}{3.6}(m_i + m_{r1})\frac{2\Delta v}{\Delta t}$$

4.2.2.2.4. Calculation of power-absorption unit force

The force $F_{pau}(v_0)$ to be absorbed by the chassis dynamometer at the reference vehicle speed v0 is calculated by subtracting Ff(v0) from the target running resistance force F*(v0) as shown in the following equation:

Equation B.2.-20:

$$F_{pau}(v_0) = F^*(v_0) - F_f(v_0)$$

4.2.2.2.5. Chassis dynamometer setting

Depending on its type, the chassis dynamometer shall be set by one of the methods described in points 4.2.2.2.5.1. to 4.2.2.2.5.4. The chosen setting shall be applied to the pollutant and CO2 emission measurements as well as fuel consumption laid down in Annex B.4.

4.2.2.2.5.1. Chassis dynamometer with polygonal function

In the case of a chassis dynamometer with polygonal function, in which the absorption characteristics are determined by load values at several specified vehicle speed points, at least three specified vehicle speeds, including the reference vehicle speed, shall be chosen as the setting points. At each setting point, the chassis dynamometer shall be set to the value Fpau (vj) obtained in point 4.2.2.2.4.

4.2.2.2.5.2. Chassis dynamometer with coefficient control

In the case of a chassis dynamometer with coefficient control, in which the absorption characteristics are determined by given coefficients of a polynomial function, the value of Fpau (vj) at each specified vehicle speed shall be calculated by the procedure in point 4.2.2.2.

Assuming the load characteristics to be:

Equation B.2.-21:

$$F_{pau}(v) = a \bullet v^2 + b \bullet v + c$$

where:

the coefficients a, b and c shall be determined by the polynomial regression method.

The chassis dynamometer shall be set to the coefficients a, b and c obtained by the polynomial regression method.

4.2.2.2.5.3. Chassis dynamometer with F* polygonal digital setter

In the case of a chassis dynamometer with a polygonal digital setter, where a central processor unit is incorporated in the system, F*is input directly, and $\Delta t_i$, $F_f$ and $F_{pau}$ are automatically measured and calculated to set the chassis dynamometer to the target running resistance force:

Equation B.2.-22:

$$F^* = f_0 + f_2 \cdot v^2$$

In this case, several points in succession are directly input digitally from the data set of F*j and $v_j$, the coast-down is performed and the coast-down time $\Delta t_j$ is measured. After the coast-down test has been repeated several times, $F_{pau}$ is automatically calculated and set at vehicle speed intervals of 0.1 km/h, in the following sequence:

Equation B2.-23:

$$F^* + F_f = \frac{1}{3.6}(m_i + m_{r1})\frac{2\Delta v}{\Delta t_i}$$

Equation B.2.-24:

$$F_f = \frac{1}{3.6}(m_i + m_{r1})\frac{2\Delta v}{\Delta t_i} - F^*$$

Equation B.2.-25:

$$F_{pau} = F^* - F_f$$

4.2.2.2.5.4. Chassis dynamometer with $f^*_0$, $f^*_2$ coefficient digital setter

In the case of a chassis dynamometer with a coefficient digital setter, where a central processor unit is incorporated in the system, the target running resistance force $F^* = f_0 + f_2 \cdot v^2$ is automatically set on the chassis dynamometer.

In this case, the coefficients $f^*_0$ and $f^*_2$ are directly input digitally; the coast-down is performed and the coast-down time $\Delta t_j$ is measured. $F_{pau}$ is automatically calculated and set at vehicle speed intervals of 0.06 km/h, in the following sequence:

Equation B.2.-26:

$$F^* + F_f = \frac{1}{3.6}(m_i + m_{r1})\frac{2\Delta v}{\Delta t_i}$$

Equation B.2.-27:

$$F_f = \frac{1}{3.6}(m_i + m_{r1})\frac{2\Delta v}{\Delta t_i} - F^*$$

Equation B.2.-28:

$$F_{pau} = F^* - F_f$$

4.2.2.2.6. Dynamometer settings verification

4.2.2.2.6.1. Verification test

Immediately after the initial setting, the coast-down time $\Delta t_E$ on the chassis dynamometer corresponding to the reference vehicle speed ($v_0$) shall be measured by the procedure set out in Annexes B.5.4. and B.5.5. for a vehicle equipped with one wheel on the powered axle and in Annexes B.5.4. and B.5.6. for a vehicle with two or more wheels on the powered axles. The measurement shall be carried out at least three times, and the mean coast-down time $\Delta t_E$ shall be calculated from the results. The set running resistance force at the reference vehicle speed, $F_E$ ($v_0$) on the chassis dynamometer is calculated by the following equation:

Equation B.2.-29:

$$F_E(v_0) = \frac{1}{3.6}(m_i + m_{r1})\frac{2\Delta v}{\Delta t_E}$$

4.2.2.2.6.2. Calculation of setting error

The setting error ε is calculated by the following equation:

Equation B.2.-30:

$$\varepsilon = \frac{\left| F_E(v_0) - F^*(v_0) \right|}{F^*(v_0)} \times 100$$

The chassis dynamometer shall be readjusted if the setting error does not satisfy the following criteria:

$\varepsilon \leq 2$ percent for $v_0 \geq 50$ km/h

$\varepsilon \leq 3$ percent for 30 km/h $\leq v_0 < 50$ km/h

$\varepsilon \leq 10$ percent for $v_0 < 30$ km/h

The procedure in points 4.2.2.2.6.1. to 4.2.2.2.6.2. shall be repeated until the setting error satisfies the criteria. The chassis dynamometer setting and the observed errors shall be recorded. Template record forms are provided in the template in accordance with Annex B.5.13.

4.2.2.3. Chassis dynamometer preparation, if settings are derived from a running resistance table

4.2.2.3.1. The specified vehicle speed for the chassis dynamometer

The running resistance on the chassis dynamometer shall be verified at the specified vehicle speed v. At least four specified vehicle speeds shall be verified. The range of specified vehicle speed points (the interval between the maximum and minimum points) shall extend either side of the reference vehicle speed or the reference vehicle speed range, if there is more than one reference vehicle speed, by at least Δv, as defined in Annex B.5.4. and B.5.5. for a vehicle equipped with one wheel on the powered axle and in Annex B.5.4. and B.5.6. for a vehicle with two or more wheels on the powered axles. The specified vehicle speed points, including the reference vehicle speed points, shall be at regular intervals of no more than 20 km/h apart.

4.2.2.3.2. Verification of chassis dynamometer

4.2.2.3.2.1. Immediately after the initial setting, the coast-down time on the chassis dynamometer corresponding to the specified vehicle speed shall be measured. The vehicle shall not be set up on the chassis dynamometer during the coast-down time measurement. The coast-down time measurement shall start when the chassis dynamometer vehicle speed exceeds the maximum vehicle speed of the test cycle.

4.2.2.3.2.2. The measurement shall be carried out at least three times, and the mean coast-down time $\Delta t_E$ shall be calculated from the results.

4.2.2.3.2.3. The set running resistance force $FE(v_j)$ at the specified vehicle speed on the chassis dynamometer is calculated using the following equation:

Equation B.2.-31:

$$F_E\left(v_j\right) = \frac{1}{3.6} \bullet m_i \bullet \frac{2\Delta v}{\Delta t_E}$$

4.2.2.3.2.4. The setting error ε at the specified vehicle speed is calculated using the following equation:

Equation B.2.-32:

$$\varepsilon = \frac{\left| F_E\left(v_j\right) - F_T \right|}{F_T} \times 100$$

4.2.2.3.2.5. The chassis dynamometer shall be readjusted if the setting error does not satisfy the following criteria:

$\varepsilon \leq 2$ percent for $v \geq 50$ km/h

$\varepsilon \leq 3$ percent for 30 km/h $\leq v < 50$ km/h

$\varepsilon \leq 10$ percent for $v < 30$ km/h

4.2.2.3.2.6. The procedure described in points 4.2.2.3.2.1. to 4.2.2.3.2.5. shall be repeated until the setting error satisfies the criteria. The chassis dynamometer setting and the observed errors shall be recorded.

4.2.2.4. The chassis dynamometer system shall comply with the calibration and verification methods laid down in Annex B.5.6.

4.2.3. Calibration of analysers

4.2.3.1. Analyzer calibration procedures

Each analyser shall be calibrated as specified by the instrument manufacturer or at least as often as described in Table A5/3.

Table A5/3

**Instrument calibration intervals**

| *Instrument checks* | *Interval* | *Criteria* |
|---|---|---|
| Gas analyser linearization (calibration) | Every 6 months | ±2 per cent of reading |
| Mid span | Every 6 months | ±2 per cent |
| CO NDIR: $CO_2/H_2O$ interference | Monthly | -1 to 3 ppm |
| $NO_x$ converter check | Monthly | > 95 per cent |
| $CH_4$ cutter check | Yearly | 98per cent of Ethane |
| FID $CH_4$ response | Yearly | See ~~5.4.3.~~ 5.1.1.4.4 |
| FID air/fuel flow | At major maintenance | According to instrument mfr. |
| NO/$NO_2$ NDUV: $H_2O$, HC interference | At major maintenance | According to instrument mfr. |
| Laser infrared spectrometers ~~(modulated high resolution~~ narrow band infrared analysers): interference check | Yearly or at major ~~maintenance~~ | According to instrument mfr. |
| ~~GC methods~~ | ~~See paragraph 7.2.~~ | ~~See paragraph 7.2.~~ |
| FTIR: linearity verification | Within 370 days before testing and after major maintenance | See paragraph 7.1. |
| Microgram balance linearity | Yearly or at major maintenance | See paragraph ~~4.2.2.2.~~ 3.4.3.10.1.3.4.1.1 |
| ~~PNC (particle number counter)~~ | ~~See paragraph 5.7.1.1.~~ | ~~See paragraph 5.7.1.3.~~ |
| ~~VPR (volatile particle remover)~~ | ~~See paragraph 5.7.2.1.~~ | ~~See paragraph 5.7.2.~~ |

Non-dispersive infrared absorption analysers shall be checked at the same intervals using nitrogen/ CO and nitrogen/ CO2 mixtures in nominal concentrations equal to 10, 40, 60, 85 and 90 percent of full scale.

4.2.3.2. Each normally used operating range shall be linearized by the following procedure:

4.2.3.2.1. The analyser linearization curve shall be established by at least five calibration points spaced as uniformly as possible. The nominal concentration of the calibration gas of the highest concentration shall be not less than 80 per cent of the full scale.

4.2.3.2.2. The calibration gas concentration required may be obtained by means of a gas divider, diluting with purified $N_2$ or with purified synthetic air.

4.2.3.2.3. The linearization curve shall be calculated by the least squares method. If the resulting polynomial degree is greater than 3, the number of calibration points shall be at least equal to this polynomial degree plus 2.

4.2.3.2.4. The linearization curve shall not differ by more than ±2 per cent from the nominal value of each calibration gas.

4.2.3.2.5. From the trace of the linearization curve and the linearization points, it is possible to verify that the calibration has been carried out correctly. The different characteristic parameters of the analyser shall be indicated, particularly:

(a) Scale;
(b) Sensitivity;
(c) Zero point;

(d) Date of the linearization.

4.2.3.2.6. If it can be shown to the satisfaction of the responsible authority that alternative technologies (e.g. computer, electronically controlled range switch, etc.) can give equivalent accuracy, these alternatives may be used.

4.2.3.3. Analyser zero and calibration verification procedure

4.2.3.3.1. Each normally used operating range shall be checked prior to each analysis in accordance with the following subparagraphs.

4.2.3.3.1.1. The calibration shall be checked by use of a zero gas and by use of a calibration gas according to paragraph 5.1.1.2. (a),(b),(c).

4.2.3.3.1.2. After testing, zero gas and the same calibration gas shall be used for rechecking according to paragraph 5.1.1.2. (e).

4.2.3.4. FID hydrocarbon response check procedure

4.2.3.4.1. Detector response optimisation

The FID shall be adjusted as specified by the instrument manufacturer. Propane in air should be used on the most common operating range.

4.2.3.4.2. Calibration of the HC analyser

The analyser shall be calibrated using propane in air and purified synthetic air. A calibration curve as described in paragraph 5.2.2. shall be established.

4.2.3.4.3. Response factors of different hydrocarbons and recommended limits

The response factor ($R_f$), for a particular hydrocarbon compound is the ratio of the FID C1 reading to the gas cylinder concentration, expressed as ppm C1. The concentration of the test gas shall be at a level to give a response of approximately 80 per cent of full-scale deflection, for the operating range. The concentration shall be known to an accuracy of ±2 per cent in reference to a gravimetric standard expressed in volume. In addition, the gas cylinder shall be pre-conditioned for 24 hours at a temperature between 293 K and 303 K (20 and 30 °C).

Response factors shall be determined when introducing an analyser into service and thereafter at major service intervals. The test gases to be used and the recommended response factors are:

Methane and purified air: $1.00 < Rf < 1.15$ or $1.00 < Rf < 1.05$ for NG/biomethane-fuelled vehicles
Propylene and purified air: $0.90 < Rf < 1.00$
Toluene and purified air: $0.90 < Rf < 1.00$
These are relative to a response factor (Rf) of 1.00 for propane and purified air.

4.2.3.4.4. NOx converter efficiency test procedure

4.2.3.4.4.1. Using the test set up as shown in Figure A5/15 and the procedure described below, the efficiency of converters for the conversion of $NO_2$ into NO shall be tested by means of an ozonator as follows:

4.2.3.4.4.1.1. The analyser shall be calibrated in the most common operating range following the manufacturer's specifications using zero and calibration gas (the NO content of which shall amount to approximately 80 per cent of the operating range and the $NO_2$

concentration of the gas mixture shall be less than 5 per cent of the NO concentration). The NOx analyser shall be in the NO mode so that the calibration gas does not pass through the converter. The indicated concentration shall be recorded.

4.2.3.4.4.1.2. Via a T-fitting, oxygen or synthetic air shall be added continuously to the calibration gas flow until the concentration indicated is approximately 10 per cent less than the indicated calibration concentration given in paragraph 4.2.3.4.4.1.1 above. The indicated concentration (c) shall be recorded. The ozonator shall be kept deactivated throughout this process.

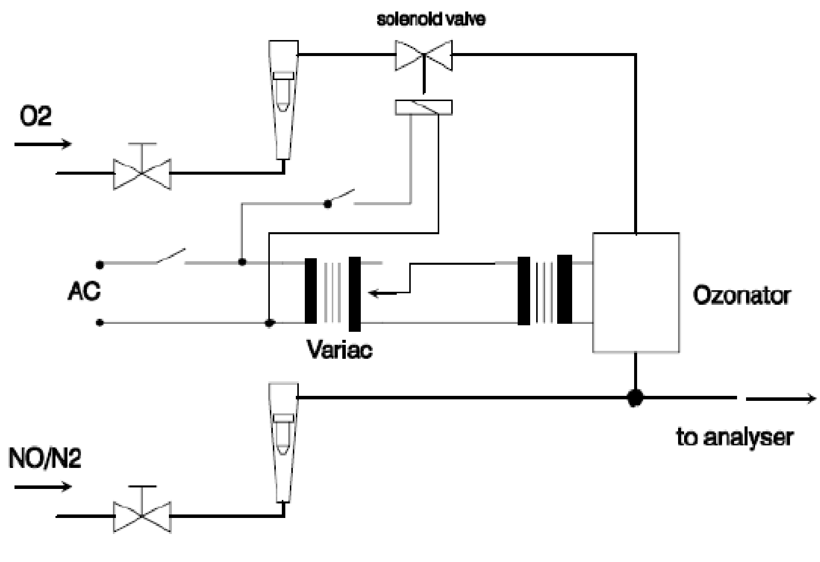
4.2.3.4.4.1.3. The ozonator shall now be activated to generate enough ozone to bring the NO concentration down to 20 per cent (minimum 10 per cent) of the calibration concentration given in paragraph 4.2.3.4.4.1.1 above. The indicated concentration (d) shall be recorded.\

4.2.3.4.4.1.4. The NOx analyser shall then be switched to the NOx mode, whereby the gas mixture (consisting of NO, $NO_2$, $O_2$ and $N_2$) now passes through the converter. The indicated concentration (a) shall be recorded.

4.2.3.4.4.1.5. The ozonator shall now be deactivated. The mixture of gases described in paragraph 4.2.3.4.4.1.2 above shall pass through the converter into the detector. The indicated concentration (b) shall be recorded.

Figure A5/15

**$NO_x$ converter efficiency test configuration**




4.2.3.4.4.1.6. With the ozonator deactivated, the flow of oxygen or synthetic air shall be shut off. The $NO_2$ reading of the analyser shall then be no more than 5 per cent above the figure given in paragraph 4.2.3.4.4.1.1 above.

4.2.3.4.4.1.7. The efficiency of the NOx converter shall be calculated using the concentrations a, b, c and d determined in paragraphs 4.2.3.4.4.1.2 through 4.2.3.4.4.1.5 above as follows:

$$\text{Efficiency (per cent)} = \left(1 + \frac{a - b}{c - d}\right) \times 100$$

The efficiency of the converter shall not be less than 95 per cent. The efficiency of the converter shall be tested in the frequency defined in Table A5/3.

4.2.3.5. Calibration of the microgram balance

The calibration of the microgram balance used for particulate filter weighing shall be traceable to a national or international standard. The balance shall comply with the linearity requirements given in paragraph 3.4.3.10.1.3.4.1.1. The linearity verification shall be performed at least every 12 months or whenever a system repair or change is made that could influence the calibration.

Calibration and validation of the particle sampling system

Examples of calibration/validation methods are available at: http://www.unece.org/trans/main/wp29/wp29wgs/wp29grpe/pmpFCP.html.

4.2.3.5.1. Flow meter calibration

The technical service shall check that a calibration certificate has been issued for the flow meter demonstrating compliance with a traceable standard within a 12-month period prior to the test, or since any repair or change which could influence calibration.

4.2.3.5.2. Microbalance calibration

The technical service shall check that a calibration certificate has been issued for the microbalance demonstrating compliance with a traceable standard within a 12-month period prior to the test.

4.2.3.5.3. Reference filter weighing

To determine the specific reference filter weights, at least two unused reference filters shall be weighed within eight hours of, but preferably at the same time as, the sample filter weighing. Reference filters shall be of the same size and material as the sample filter.

If the specific weight of any reference filter changes by more than ± 5 µg between sample filter weighings, the sample filter and reference filters shall be reconditioned in the weighing room and then reweighed.

This shall be based on a comparison of the specific weight of the reference filter and the rolling average of that filter's specific weights.

The rolling average shall be calculated from the specific weights collected in the period since the reference filters were placed in the weighing room. The averaging period shall be between one day and 30 days.

Multiple reconditioning and re-weighings of the sample and reference filters are permitted up to 80 hours after the measurement of gases from the emissions test.

If, within this period, more than half the reference filters meet the ± 5 µg criterion, the sample filter weighing can be considered valid.

If, at the end of this period, two reference filters are used and one filter fails to meet the ± 5 µg criterion, the sample filter weighing may be considered valid provided that the sum of the absolute differences between specific and rolling averages from the two reference filters is no more than 10 µg.

If fewer than half of the reference filters meet the ± 5 µg criterion, the sample filter shall be discarded and the emissions test repeated. All reference filters shall be discarded and replaced within 48 hours.

In all other cases, reference filters shall be replaced at least every 30 days and in such a manner that no sample filter is weighed without comparison with a reference filter that has been in the weighing room for at least one day.

If the weighing room stability criteria outlined in point 3.4.3.12.1.3.4. are not met but the reference filter weighings meet the criteria listed in point 4.2.3.5.3., the vehicle manufacturer has the option of accepting the sample filter weights or voiding the tests, fixing the weighing room control system and re-running the test.

4.2.3.6. Reference gases

4.2.3.6.1. Pure gases

The following pure gases shall be available, if necessary, for calibration and operation:

Purified nitrogen: (purity: ≤ 1 ppm C1, ≤ 1 ppm CO, ≤ 400 ppm $CO_2$, ≤ 0.1 ppm NO);

Purified synthetic air: (purity: ≤ 1 ppm C1, ≤ 1 ppm CO, ≤ 400 ppm $CO_2$, ≤ 0.1 ppm NO); oxygen content between 18 and 21 percent by volume;

Purified oxygen: (purity > 99.5 percent vol. $O_2$);

Purified hydrogen (and mixture containing helium): (purity ≤ 1 ppm C1, ≤ 400 ppm $CO_2$);

Carbon monoxide: (minimum purity 99.5 percent);

Propane: (minimum purity 99.5 percent).

4.2.3.6.2. Calibration gases

The true concentration of a calibration gas shall be within ±1 per cent of the stated value or as given below. Mixtures of gases having the following compositions shall be available with a bulk gas specification according to paragraphs 4.2.3.6.1:

(a) $C_3H_8$ in synthetic air (see point 4.2.3.6.1 above);
(b) CO in nitrogen;
(c) $CO_2$ in nitrogen;
(d) $CH_4$ in synthetic air
(e) NO in Nitrogen (the amount of $NO_2$ contained in this calibration gas shall not exceed 5 percent of the NO content).
(f) $NO_2$ in nitrogen (tolerance ±2 per cent);

4.2.3.7. Calibration and verification of the dilution system

The dilution system shall be calibrated and verified and shall comply with the requirements of Annex B.5.7.

4.2.4. Test vehicle preconditioning

4.2.4.1. The test vehicle shall be moved to the test area and the following operations performed:

- The fuel tanks shall be drained through the drains of the fuel tanks provided and charged with the test fuel requirement as specified in Annex B.5.2. to half the capacity of the tanks.
- The test vehicle shall be placed, either by being driven or pushed, on a dynamometer and operated through the applicable test cycle as specified for the vehicle (sub-)category in Annex B.5.14. The vehicle need not be cold, and may be used to set dynamometer power.

4.2.4.2. Practice runs over the prescribed driving schedule may be performed at test points, provided an emission sample is not taken, for the purpose of finding the minimum throttle action to maintain the proper vehicle speed-time relationship, or to permit sampling system adjustments.

4.2.4.3. Within five minutes of completion of preconditioning, the test vehicle shall be removed from the dynamometer and may be driven or pushed to the soak area to be parked. The vehicle shall be stored for between six and 36 hours prior to the cold start type I test or until the engine oil temperature TO or the coolant temperature TC or the sparkplug seat/gasket temperature TP (only for air-cooled engine) equals the air temperature of the soak area within 2 °C.

4.2.4.4. For the purpose of measuring particulates, between six and 36 hours before testing, the applicable test cycle set out in Annex B.5.14. shall be conducted. The technical details of the applicable test cycle are laid down in Annex B.5.14. and the applicable test cycle shall also be used for vehicle pre-conditioning. Three consecutive cycles shall be driven. The dynamometer setting shall be indicated as in point 3.4.6.

4.2.4.5. At the request of the manufacturer, vehicles fitted with indirect injection positive-ignition engines may be preconditioned with one Part One, one Part Two and two Part Three driving cycles, if applicable, from the WMTC.

In a test facility where a test on a low particulate emitting vehicle could be contaminated by residue from a previous test on a high particulate emitting vehicle, it is recommended that, in order to pre-condition the sampling equipment, the low particulate emitting vehicle undergo a 20 minute 120 km/h steady state drive cycle or at 70% of the maximum design vehicle speed for vehicles not capable of attaining 120 km/h followed by three consecutive Part Two or Part Three WMTC cycles, if feasible.

After this preconditioning, and before testing, vehicles shall be kept in a room in which the temperature remains relatively constant at 25 ± 5°C. This conditioning shall be carried out for at least six hours and continue until the engine oil temperature and coolant, if any, are within ± 2.0 °C of the temperature of the room.

If the manufacturer so requests, the test shall be carried out not later than 30 hours after the vehicle has been run at its normal temperature.

4.2.5. Emissions tests

4.2.5.1. Engine starting and restarting

4.2.5.1.1. The engine shall be started according to the manufacturer's recommended starting procedures. The test cycle run shall begin when the engine starts.

4.2.5.1.2. Test vehicles equipped with automatic chokes shall be operated according to the instructions in the manufacturer's operating instructions or owner's manual covering choke-setting and 'kick-down' from cold fast idle. In the case of the WMTC set out in Annex B.5.14., the transmission shall be put in gear 15 seconds after the engine is started. If necessary, braking may be employed to keep the drive wheels from turning.

4.2.5.1.3. Test vehicles equipped with manual chokes shall be operated according to the manufacturer's operating instructions or owner's manual. Where times are provided in the instructions, the point for operation may be specified, within 15 seconds of the recommended time.

4.2.5.1.4. The operator may use the choke, throttle, etc. where necessary to keep the engine running.

4.2.5.1.5. If the manufacturer's operating instructions or owner's manual do not specify a warm engine starting procedure, the engine (automatic and manual choke engines) shall be started by opening the throttle about half way and cranking the engine until it starts.

4.2.5.1.6. If, during the cold start, the test vehicle does not start after ten seconds of cranking or ten cycles of the manual starting mechanism, cranking shall cease and the reason for failure to start determined. The revolution counter on the constant volume sampler shall be turned off and the sample solenoid valves placed in the 'standby' position during this diagnostic period. In addition, either the CVS blower shall be turned off or the exhaust tube disconnected from the tailpipe during the diagnostic period.

4.2.5.1.7. In case of an operational error, that causes a delay in the starting of sampling collection at the initiation of engine start up procedure, the test vehicle shall be rescheduled for testing from a cold start. If failure to start is caused by vehicle malfunction, corrective action (following the unscheduled maintenance provisions) lasting less than 30 minutes may be taken and the test continued (During the corrective action sampling system shall be deactivated). The sampling system shall be reactivated at the same time cranking is started. The driving schedule timing sequence shall begin when the engine starts. If failure to start is caused by vehicle malfunction and the vehicle cannot be started, the test shall be voided, the vehicle removed from the dynamometer, corrective action taken (following the unscheduled maintenance provisions) and the vehicle rescheduled for test from a cold start. The reason for the malfunction (if determined) and the corrective action taken shall be reported.

4.2.5.1.8. If the test vehicle does not start during the warm start after ten seconds of cranking or ten cycles of the manual starting mechanism, cranking shall cease, the test shall be voided, the vehicle removed from the dynamometer, corrective action taken and the vehicle rescheduled for test. The reason for the malfunction (if determined) and the corrective action taken shall be reported.

4.2.5.1.9. If the engine ‘false starts’, the operator shall repeat the recommended starting procedure (such as resetting the choke, etc.)

4.2.5.2. Stalling

4.2.5.2.1. If the engine stalls during an idle period, it shall be restarted immediately and the test continued. If it cannot be started soon enough to allow the vehicle to follow the next acceleration as prescribed, the driving schedule indicator shall be stopped. When the vehicle restarts, the driving schedule indicator shall be reactivated.

4.2.5.2.2. If the engine stalls during some operating mode other than idle, the driving schedule indicator shall be stopped, the test vehicle restarted and accelerated to the vehicle speed required at that point in the driving schedule, and the test continued. During acceleration to this point, gearshifts shall be performed in accordance with point 3.4.5.

4.2.5.2.3. If the test vehicle will not restart within one minute, the test shall be voided, the vehicle removed from the dynamometer, corrective action taken and the vehicle rescheduled for test. The reason for the malfunction (if determined) and the corrective action taken shall be reported.

4.2.6. Drive instructions

4.2.6.1. In case of multi-mode vehicles, the vehicle shall be tested in the worst case based on the different tailpipe emissions. It may be in one mode or more than one mode. The decision for the worst case will be based on the documentation provided by the vehicle manufacturers and mutually agreed by the approval authority.

4.2.6.2. The test vehicle shall be driven with minimum throttle movement to maintain the desired vehicle speed. No simultaneous use of brake and throttle shall be permitted.

4.2.6.3. If the test vehicle cannot accelerate at the specified rate, it shall be operated with the throttle fully opened until the roller speed (actual vehicle speed) reaches the value prescribed for that time in the driving schedule.

4.2.7. Dynamometer test runs

4.2.7.1. The complete dynamometer test consists of consecutive parts as described in Annex B.5.14.

4.2.7.2. The following steps shall be taken for each test:

(a) place drive wheel of vehicle on dynamometer without starting engine;

(b) activate vehicle cooling fan;
(c) for all test vehicles, with the sample selector valves in the ‘standby’ position, connect evacuated sample collection bags to the dilute exhaust and dilution air sample collection systems;
(d) start the CVS (if not already on), the sample pumps and the temperature recorder. (The heat exchanger of the constant volume sampler, if used, and sample lines shall be preheated to their respective operating temperatures before the test begins);
(e) adjust the sample flow rates to the desired flow rate and set the gas flow measuring devices to zero;

- For gaseous bag (except hydrocarbon) samples, the minimum flow rate is 0.08 litre/second;
- For hydrocarbon samples, the minimum flame ionisation detection (FID) (or heated flame ionisation detection (HFID) in the case of methanol-fuelled vehicles) flow rate is 0.031 litre/second;

(f) attach the flexible exhaust tube to the vehicle tailpipes;
(g) start the gas flow measuring device, position the sample selector valves to direct the sample flow into the ‘transient’ exhaust sample bag, the ‘transient’ dilution air sample bag, turn the key on and start cranking the engine;
(h) put the transmission in gear;
(i) begin the initial vehicle acceleration of the driving schedule;
(j) operate the vehicle according to the driving cycles specified in Annex B.5.14.;
(k) at the end of part 1 or part 1 in cold condition, simultaneously switch the sample flows from the first bags and samples to the second bags and samples, switch off gas flow measuring device No 1 and start gas flow measuring device No 2;
(l) in case of vehicles capable of running Part 3 of the WMTC, at the end of Part 2 simultaneously switch the sample flows from the second bags and samples to the third bags and samples, switch off gas flow measuring device No 2 and, start gas flow measuring device No 3;
(m) before starting a new part, record the measured roll or shaft revolutions and reset the counter or switch to a second counter. As soon as possible, transfer the exhaust and dilution air samples to the analytical system and process the samples according to point 5., obtaining a stabilised reading of the exhaust bag sample on all analysers within 20 minutes of the end of the sample collection phase of the test;
(n) turn the engine off two seconds after the end of the last part of the test;
(o) immediately after the end of the sample period, turn off the cooling fan;
(p) turn off the constant volume sampler (CVS) or critical-flow venturi (CFV) or disconnect the exhaust tube from the tailpipes of the vehicle;
(q) disconnect the exhaust tube from the vehicle tailpipes and remove the vehicle from the dynamometer;
(r) for comparison and analysis reasons, second-by-second emissions (diluted gas) data shall be monitored as well as the bag results.

## 5. Analysis of results

### 5.1. Type I tests

#### 5.1.1. Exhaust emission and fuel consumption analysis

##### 5.1.1.1. Analysis of the samples contained in the bags

The analysis shall begin as soon as possible, and in any event not later than 20 minutes after the end of the tests, in order to determine:

- the concentrations of hydrocarbons, carbon monoxide, nitrogen oxides, particulate matter if applicable and carbon dioxide in the sample of dilution air contained in bag(s) B;
- the concentrations of hydrocarbons, carbon monoxide, nitrogen oxides, carbon dioxide and particulate matter if applicable in the sample of diluted exhaust gases contained in bag(s) A.

##### 5.1.1.2. Calibration of analysers and concentration results

The analysis of the results has to be carried out in the following steps:

(a) prior to each sample analysis, the analyser range to be used for each pollutant shall be set to zero with the appropriate zero gas;
(b) the analysers are set to the calibration curves by means of span gases of nominal concentrations of 70 to 100 percent of the range;
(c) the analysers' zeroes are rechecked. If the reading differs by more than 2 percent of range from that set in (b), the procedure is repeated;
(d) the samples are analysed;
(e) after the analysis, zero and span points are rechecked using the same gases. If the readings are within 2 percent of those in point (c), the analysis is considered acceptable;
(f) at all points in this section the flow-rates and pressures of the various gases shall be the same as those used during calibration of the analysers;
(g) the figure adopted for the concentration of each pollutant measured in the gases is that read off after stabilisation on the measuring device.

5.1.1.3. Measuring the distance covered

The distance (S) actually covered for a test part shall be calculated by multiplying the number of revolutions read from the cumulative counter (see point 3.4.2.2.) by the circumference of the roller. This distance shall be expressed in km to three decimal places.

5.1.1.4. Determination of the quantity of gas emitted

The reported test results shall be computed for each test and each cycle part by use of the following formulae. The results of all emission tests shall be rounded.

5.1.1.4.1. Total volume of diluted gas (PDP)

The total volume of diluted gas, expressed in $m^3$/cycle part, adjusted to the reference conditions of 0 °C and 101.3 kPa, is calculated by Equation B.2.-33:

$$V = \frac{V_0 \times N \times (P_a - P_i) \times 273.15}{101.3 \times (T_P + 273.15)}$$

where:
$V_0$ is the volume of gas displaced by pump P during one revolution, expressed in $m^3$/revolution. This volume is a function of the differences between the intake and output sections of the pump;
N is the number of revolutions made by pump P during each part of the test;
$P_a$ is the ambient pressure in kPa;
$P_i$ is the average under-pressure during the test part in the intake section of pump P, expressed in kPa;
$T_P$ is the temperature (expressed in °C) of the diluted gases during the test part, measured in the intake section of pump P.

5.1.1.4.2. Total volume of diluted gas ( CFV)

The calibration procedure described in points B5 2.3.3. to 2.3.7..
Total volume of diluted gas is based on the flow equation for a critical-flow venturi:

$$Q_s = \frac{K_v P}{\sqrt{T}}$$

where:
Qs = flow in $m^3$/min
Kv = calibration coefficient;
P = absolute pressure (kPa);
T = absolute temperature (K).
Gas flow is a function of inlet pressure and temperature.

$$K_v = \frac{Q_s \sqrt{T_v}}{P_v}$$

where:
Qs = flow-rate in m$^3$/min at 0 °C and 101.3 kPa;
Tv = temperature at the venturi inlet (K);
Pv = absolute pressure at the venturi inlet (kPa).

$$V = Kv \int_0^{te} \frac{Pv(t)}{\sqrt{Tv(t)}} dt$$

te = measuring time (s)

5.1.1.4.3. Hydrocarbons (HC)

The mass of unburned hydrocarbons emitted by the exhaust of the vehicle during the test shall be calculated using the following formula:

Equation B.2.-34:

$$HC_m = \frac{1}{S} \cdot V \cdot d_{HC} \cdot \frac{HC_C}{10^6}$$

where:
$HC_m$ is the mass of hydrocarbons emitted during the test part, in mg/km;
S is the distance defined in point 5.1.1.3.;
V is the total volume, defined in point 5.1.1.4.1.;
$d_{HC}$ is the density of the hydrocarbons at reference temperature and pressure (0.0 °C and 101.3 kPa);

$d_{HC}$
=619x10$^3$mg/m$^3$ for petrol (E0) $C_1H_{1.85}$;
=631x10$^3$mg/m$^3$ for petrol (E5) $C_1H_{1.89}O_{0.016}$;
=646x10$^3$mg/m$^3$ for petrol (E10) $C_1H_{1.93}O_{0.033}$);
=619x103mg/m3 for diesel (B0) $C_1H_{1.86}$)
=622x103mg/m3 for diesel (B5/B7) $C_1H_{1.86}O_{0.005}$

$HC_C$ is the concentration of diluted gases, expressed in parts per million (ppm) of carbon equivalent (e.g. the concentration in propane multiplied by three), corrected to take account of the dilution air by the following equation:

Equation B.2.-35:

$$HC_c = HC_e - HC_d * \left(1 - \frac{1}{DiF}\right)$$

where:
$HC_e$ is the concentration of hydrocarbons expressed in parts per million (ppm) of carbon equivalent, in the sample of diluted gases collected in bag(s) A;
$HC_d$ is the concentration of hydrocarbons expressed in parts per million (ppm) of carbon equivalent, in the sample of dilution air collected in bag(s) B;
DiF is the coefficient defined in point 5.1.1.4.7.

5.1.1.4.4. Non-methane hydrocarbon (NMHC)

5.1.1.4.4.1. For methane measurement using a GC-FID, the non-methane hydrocarbon (NMHC) concentration shall be calculated using the following equations:

Equation B.2.-37:

$$NMHC_C = HC_C - \left(Rf_{CH_4} \cdot CH_{4C}\right)$$

where:

$HC_C$ is the concentration of hydrocarbons (HC) in the diluted exhaust gas, expressed in ppm carbon equivalent and corrected by the amount of HC contained in the dilution air, defined in point 5.1.1.4.3.
$Rf_{CH4}$ is the FID response factor to methane as defined in point 4.2.3.4.3.
$CH_{4C}$ is the concentration of methane ($CH_4$) in the diluted exhaust gas, expressed in ppm carbon equivalent, corrected to take account of the dilution air by the following equation:
Equation B.2.-38:

$$CH_{4C} = CH_{4e} - CH_{4d} \cdot \left(1 - \frac{1}{DiF}\right)$$

where:
$CH_{4e}$ is the concentration of methane expressed in parts per million (ppm), in the sample of diluted gases collected in bag(s) A;
$CH_{4d}$ is the concentration of methane expressed in parts per million (ppm), in the sample of dilution air collected in bag(s) B;
DiF is the coefficient defined in point 5.1.1.4.9.

5.1.1.4.4.2. The mass of non-methane hydrocarbon (NMHC) emitted by the exhaust of the vehicle during the test shall be calculated using the following equation:
Equation B.2.-36:

$$NMHC_m = \frac{1}{S} \cdot V \cdot d_{NMHC} \cdot \frac{NMHC_C}{10^6}$$

where:
$NMHC_m$ is the mass of non-methane hydrocarbon (NMHC) emitted during the test part, in mg/km;
S is the distance defined in point 5.1.1.3.;
V is the total volume, defined in point 5.1.1.4.1. and 5.1.1.4.2.;
$d_{NMHC}$ is the density for NMHC which shall be equal to that of hydrocarbons at reference temperature and pressure (0.0 °C and 101.3 kPa) and is fuel-dependent;
$NMHC_C$ is the corrected concentration of the diluted exhaust gas, expressed in ppm carbon equivalent.

5.1.1.4.4.3. For methane measurement using an NMC-FID, the calculation of NMHC depends on the calibration gas/method used for the zero/calibration adjustment. The FID used for the HC measurement (without NMC) shall be calibrated with propane/air in the normal manner. For the calibration of the FID in series with an NMC, the following methods are permitted:
(a) The calibration gas consisting of propane /air bypasses the NMC;
(b) The calibration gas consisting of methane/air passes through the NMC.
It is highly recommended to calibrate the methane FID with methane/air through the NMC.
In case (a), the concentration of $CH_4$ and NMHC shall be calculated using the following equations:
Equation B.2.39:

$$CH_{4C} = \frac{HC_{(W/NMC)C} - HC_{(W/ONMC)C} \times (1 - E_E)}{R_f \times (E_E - E_M)}$$

Equation B.2.40:

$$NMHC_C = \frac{HC_{(W/ONMC)C} \times (1 - E_M) - HC_{(W/NMC)C}}{E_E - E_M}$$

In case (b), the concentration of $CH_4$ and NMHC shall be calculated using the following equations:
Equation B.2.41:

$$CH_{4C} = \frac{HC_{(W/NMC)C} \times R_f \times (1 - E_M) - HC_{(W/ONMC)C} \times (1 - E_E)}{R_f \times (E_E - E_M)}$$

Equation B.2.42:

$$NMHC_C = \frac{HC_{(W/ONMC)C} \times (1 - E_M) - HC_{(W/NMC)C} \times R_f \times (1 - E_M)}{E_E - E_M}$$

where:

Rf is the methane response factor as defined in point 4.2.3.4.3.;

$E_M$ is the methane efficiency as determined per paragraph 5.1.1.4.4.3.2. below;
$E_E$ is the ethane efficiency as determined per paragraph 5.1.1.4.4.3.3. below.
If Rf < 1.05, it may be omitted in the equations B.2. 39, 41 and 42.
$HC_{(w/NMC)C}$ is the HC concentration with sample gas flowing through the NMC, ppm C,corrected to take account of the dilution air by the following equation B.2.43:
$HC_{(w/oNMC)C}$ is the HC concentration with sample gas bypassing the NMC, ppm C,corrected to take account of the dilution air by the following equation B.2.-44:

Equation B.2.-43:

$$HC_{(W/NMC)C} = HC_{(W/NMC)e} - HC_{(W/NMC)d} \cdot \left(1 - \frac{1}{DiF}\right)$$

where:
$HC_{(W/NMC)e}$ is the concentration of HC expressed in parts per million (ppm), in the sample of diluted gases flowing through the NMC, collected in bag(s) A;
$HCH_{(W/NMC)d}$ is the concentration of HC expressed in parts per million (ppm), in the sample of dilution air flowing through the NMC, collected in bag(s) B;
DiF is the coefficient defined in point 5.1.1.4.9.

Equation B.2.-44:

$$HC_{(W/oNMC)C} = HC_{(W/oNMC)e} - HC_{(W/oNMC)d} \cdot \left(1 - \frac{1}{DiF}\right)$$

where:
$HC_{(W/oNMC)e}$ is the concentration of HC expressed in parts per million (ppm), in the sample of diluted gases bypassing the NMC, collected in bag(s) A;
$HCH_{(W/oNMC)d}$ is the concentration of HC expressed in parts per million (ppm), in the sample of dilution air bypassing the NMC, collected in bag(s) B;
DiF is the coefficient defined in point 5.1.1.4.9.

5.1.1.4.4.3.1. Conversion efficiencies of the non-methane cutter (NMC)

The NMC is used for the removal of the non-methane hydrocarbons from the sample gas by oxidizing all hydrocarbons except methane. Ideally, the conversion for methane is 0 per cent, and for the other hydrocarbons represented by ethane is 100 per cent. For the accurate measurement of NMHC, the two efficiencies shall be determined and used for the calculation of the NMHC emission.

5.1.1.4.4.3.2. Methane conversion efficiency

The methane/air calibration gas shall be flowed to the FID through the NMC and bypassing the NMC and the two

concentrations recorded. The efficiency shall be determined using the following equations:
Equation B.2.45

$$E_M = 1 - \frac{HC_{CH_4(W/NMC)C}}{HC_{CH_4(W/ONMC)C}}$$

where:
$HC_{CH4(w/NMC)C}$ is the HC concentration with $CH_4$ flowing through the NMC, ppm C;
$HC_{CH4(w/oNMC)C}$ is the HC concentration with $CH_4$ bypassing the NMC, ppm C.

5.1.1.4.4.3.3. Ethane conversion efficiency

The ethane/air calibration gas shall be flowed to the FID through the NMC and bypassing the NMC and the two concentrations recorded. The efficiency shall be determined using the following equations:
Equation B.2.46

$$E_E = 1 - \frac{HC_{C_2H_6(W/NMC)C}}{HC_{C_2H_6(W/ONMC)C}}$$

where:
$HC_{C2H6(w/NMC)C}$ is the HC concentration with $C_2H_6$ flowing through the NMC, ppm C;
$HC_{C2H6(w/oNMC)C}$ is the HC concentration with $C_2H_6$ bypassing the NMC in ppm C.
If the ethane conversion efficiency of the NMC is 0.98 or above, $E_E$ shall be set to 1 for any subsequent calculation.

5.1.1.4.4.3.4. If the methane FID is calibrated through the cutter, then $E_M$ shall be 0.

Equation B.2.41 from above becomes:

Equation B.2.47

$$CH_{4C} = HC_{(W/NMC)C}$$

Equation B.2.42 from above becomes:
Equation B.2.48

$$NMHC_C = HC_{(W/ONMC)C} - HC_{(W/NMC)C} \times R_f$$

5.1.1.4.5. Carbon monoxide (CO)

The mass of carbon monoxide emitted by the exhaust of the vehicle during the test shall be calculated using the following formula:
Equation B.2.-37:

$$CO_m = \frac{1}{S} \cdot V \cdot d_{CO} \cdot \frac{CO_C}{10^6}$$

where:
$CO_m$ is the mass of carbon monoxide emitted during the test part, in mg/km;
S is the distance defined in point 5.1.1.3.;
V is the total volume defined in point 5.1.1.4.1.;
$d_{CO}$ is the density of the carbon monoxide, $d_{CO}$ = $1.25 \cdot 10^6$ mg/m$^3$ at reference temperature and pressure (0 °C and 101.3 kPa);

$CO_c$ is the concentration of diluted gases, expressed in parts per million (ppm) of carbon monoxide, corrected to take account of the dilution air by the following equation:
Equation B.2.-38:

$$CO_c = CO_e - CO_d \cdot \left(1 - \frac{1}{DiF}\right)$$

where:
$CO_e$ is the concentration of carbon monoxide expressed in parts per million (ppm), in the sample of diluted gases collected in bag(s) A;
$CO_d$ is the concentration of carbon monoxide expressed in parts per million (ppm), in the sample of dilution air collected in bag(s) B;
DiF is the coefficient defined in point 5.1.1.4.9.

5.1.1.4.6. Nitrogen oxides (NOx)

The mass of nitrogen oxides emitted by the exhaust of the vehicle during the test shall be calculated using the following formula:
Equation B.2.-39:

$$NO_{Xm} = \frac{1}{S} \cdot V \cdot d_{NO_2} \cdot \frac{NO_{XC} \cdot K_h}{10^6}$$

where:
$NO_{xm}$ is the mass of nitrogen oxides emitted during the test part, in mg/km;
S is the distance defined in point 5.1.1.3.;
V is the total volume defined in point 5.1.1.4.1.;
$d_{NO_2}$ is the density of the nitrogen oxides in the exhaust gases, assuming that they will be in the form of nitric oxide, $d_{NO_2}$= $2.05 \cdot 10^6$ mg/m$^3$ at reference temperature and pressure (0 °C and 101.3 kPa);

$NO_{xc}$ is the concentration of diluted gases, expressed in parts per million (ppm), corrected to take account of the dilution air by the following equation:
Equation B.2.-40:

$$NO_{xc} = NO_{xe} - NO_{xd} \cdot \left(1 - \frac{1}{DiF}\right)$$

where:
$NO_{xe}$ is the concentration of nitrogen oxides expressed in parts per million (ppm) of nitrogen oxides, in the sample of diluted gases collected in bag(s) A;
$NO_{xd}$ is the concentration of nitrogen oxides expressed in parts per million (ppm) of nitrogen oxides, in the sample of dilution air collected in bag(s) B;
DiF is the coefficient defined in point 5.1.1.4.7.;
$K_h$ is the humidity correction factor, calculated using the following formula:
Equation B.2.-41:

$$K_h = \frac{1}{1 - 0.0329 \cdot (H - 10.7)}$$

where:
H is the absolute humidity in g of water per kg of dry air:
Equation B.2.-42:

$$H = \frac{6.2111 \cdot U \cdot p_d}{p_a - p_d \cdot \frac{U}{100}}$$

where:
U is the relative humidity as a percentage;
$p_d$ is the saturated pressure of water at the test temperature in kPa;
$p_a$is the atmospheric pressure in kPa.

5.1.1.4.7. Particulate matter mass

Particulate emission Mp (mg/km) is calculated by means of the following equation:
Equation 2-43:

$$M_p = \frac{(V_{mix} + V_{ep}) \cdot P_e}{V_{ep} \cdot S}$$

where exhaust gases are vented outside the tunnel;
Equation B.2.-43:

$$M_p = \frac{V_{mix} \cdot P_e}{V_{ep} \cdot S}$$

where exhaust gases are returned to the tunnel;
where:
$V_{mix}$ = volume V of diluted exhaust gases under standard conditions;
$V_{ep}$ = volume of exhaust gas flowing through particulate filter under standard conditions;
$P_e$ = particulate mass collected by filter(s);
S = is the distance defined in point 5.1.1.3.;
$M_p$ = particulate emission in mg/km.
Where correction for the particulate background level from the dilution system has been used, this shall be determined in accordance with point 4.2.1.5. In this case, the particulate mass (mg/km) shall be calculated as follows:
Equation B.2.-44:

$$M_p = \left[\frac{P_e}{V_{ep}} - \left(\frac{P_a}{V_{ap}} \cdot \left(1 - \frac{1}{DiF}\right)\right)\right] \cdot \frac{(V_{mix} + V_{ep})}{S}$$

where exhaust gases are vented outside the tunnel;
Equation B.2.-45:

$$M_p = \left[\frac{P_e}{V_{ep}} - \left(\frac{P_a}{V_{ap}} \cdot \left(1 - \frac{1}{DiF}\right)\right)\right] \cdot \frac{V_{mix}}{S}$$

where exhaust gases are returned to the tunnel;
where:
$V_{ap}$ = volume of tunnel air flowing through the background particulate filter under standard conditions;
$P_a$ = particulate mass collected by background filter;
DiF = dilution factor as determined in point 5.1.1.4.9.

Where application of a background correction results in a negative particulate mass (in mg/km), the result shall be considered to be zero mg/km particulate mass.

5.1.1.4.8. Carbon dioxide ($CO_2$)

The mass of carbon dioxide emitted by the exhaust of the vehicle during the test shall be calculated using the following formula:
Equation B.2.-46:

$$CO_{2m} = \frac{1}{S} \cdot V \cdot d_{CO_2} \cdot \frac{CO_{2c}}{10^2}$$

where:
$CO_{2m}$ is the mass of carbon dioxide emitted during the test part, in g/km;
S is the distance defined in point 5.1.1.3.;
V is the total volume defined in point 5.1.1.4.1.;

$d_{CO2}$ is the density of the carbon monoxide, $d_{CO2} = 1.964 \cdot 10^3$ g/m$^3$ at reference temperature and pressure (0 °C) and 101.3 kPa);

$CO_{2c}$ is the concentration of diluted gases, expressed as a percentage of carbon dioxide equivalent, corrected to take account of the dilution air by the following equation:

Equation B.2.-47:

$$CO_{2c} = CO_{2e} - CO_{2d} \times (1 - \frac{1}{DiF})$$

where:

$CO_{2e}$ is the concentration of carbon dioxide expressed as a percentage of the sample of diluted gases collected in bag(s) A;

$CO_{2d}$ is the concentration of carbon dioxide expressed as a percentage of the sample of dilution air collected in bag(s) B;

DiF is the coefficient defined in point 5.1.1.4.9.

5.1.1.4.9. Dilution factor (DiF)

The dilution factor is calculated as follows:

For each reference fuel, except hydrogen:

Equation B.2.-48:

$$DiF = \frac{X}{C_{CO2} + (C_{HC} + C_{CO}) \cdot 10^{-4}}$$

For a fuel of composition $C_xH_yO_z$, the general formula is:

Equation B.2.-49:

$$X = 100 \cdot \frac{x}{x + \frac{y}{2} + 3.76 \cdot \left( x + \frac{y}{4} - \frac{z}{2} \right)}$$

For the reference fuels contained in annex B.5.2., the values of 'X' are as follows:

| Fuel | X |
|---|---|
| Petrol(E0~E10) | 13.4 |
| Diesel(B5) / (B7) | 13.5 |

Table B.2.-3: Factor 'X' in formulae to calculate DiF

In these equations:

$C_{CO2}$ = concentration of $CO_2$ in the diluted exhaust gas contained in the sampling bag, expressed in percent by volume,

$C_{HC}$ = concentration of HC in the diluted exhaust gas contained in the sampling bag, expressed in ppm carbon equivalent,

$C_{CO}$ = concentration of CO in the diluted exhaust gas contained in the sampling bag, expressed in ppm,

5.1.1.5. Weighting of type I test results

5.1.1.5.1. With repeated measurements (see point 4.1.1.2.), the pollutant (mg/km), and $CO_2$ (g/km) emission results obtained by the calculation method described in point 5.1.1. and fuel consumption determined according to Section B.4. are averaged for each cycle part.

5.1.1.6. Weighting of WMTC results

The (average) result of Part 1 or Part 1 reduced vehicle speed is called $R_1$, the (average) result of Part 2 or Part 2 reduced vehicle speed is called $R_2$ and the (average) result of Part 3 or part 3 reduced vehicle speed is called $R_3$. Using these emission (mg/km) and fuel consumption (litres/100 km) results, the final result $R_F$, depending on the vehicle category as defined in point 5.1.1.6.1., shall be calculated using the following equations:

Equation B.2.-52:

$R_F$ = R1.w1 + R1.w2

Equation B.2.-53:

$$R_F = R_1 \cdot w_1 + R_2 \cdot w_2$$

where:
$w_1$ = weighting factor cold phase
$w_2$ = weighting factor warm phase
Equation B.2.-54:

$$R_F = R_1 \cdot w_1 + R_2 \cdot w_2 + R_3 \cdot w_3$$

where:
$w_n$ = weighting factor phase n (n=1, 2 or 3)

5.1.1.6.1. For each gaseous pollutant, PM and carbon dioxide emission the weightings shown in Tables B.2.-4 shall be used.

| Vehicle Class | Equation | Weighting Factor |
|---|---|---|
| 0 | B.2 - 52 | $w_1$ = 0.50<br>$w_2$ = 0.50 |
| 1 | B.2 - 52 | $w_1$ = 0.30<br>$w_2$ = 0.70 |
| 2 | B.2 - 53 | $w_1$ = 0.30<br>$w_2$ = 0.70 |
| 3 | B.2 - 54 | $w_1$ = 0.25<br>$w_2$ = 0.50<br>$w_3$ = 0.25 |

Table B.2.-4: Type I test cycles (also applicable for test Types VII and VIII), applicable weighting equations and weighting factors.

## 6. Records required

6.1. The following information shall be recorded with respect to each test:
(a) test number;
(b) vehicle, system or component identification;
(c) date and time of day for each part of the test schedule;
(d) instrument operator;
(e) driver or operator;
(f) test vehicle: make, vehicle identification number, model year, drivetrain / transmission type, odometer reading at initiation of preconditioning, engine displacement, engine family, emission-control system, recommended engine speed at idle, nominal fuel tank capacity, inertial loading, reference mass recorded at 0 kilometre, and drive-wheel tyre pressure;

(g) dynamometer serial number: as an alternative to recording the dynamometer serial number, a reference to a vehicle test cell number may be used, with the advance approval of the Administration, provided the test cell records show the relevant instrument information;

(h) all relevant instrument information, such as tuning, gain, serial number, detector number, range. As an alternative, a reference to a vehicle test cell number may be used, with the advance approval of the Administration, provided test cell calibration records show the relevant instrument information;

(i) recorder charts: identify zero point, span check, exhaust gas, and dilution air sample traces;

(j) test cell barometric pressure, ambient temperature and humidity;

Note 7: A central laboratory barometer may be used; provided that individual test cell barometric pressures are shown to be within ± 0.1 percent of the barometric pressure at the central barometer location.

(k) pressure of the mixture of exhaust and dilution air entering the CVS metering device, the pressure increase across the device, and the temperature at the inlet. The temperature shall be recorded continuously or digitally to determine temperature variations;

(l) the number of revolutions of the positive displacement pump accumulated during each test phase while exhaust samples are being collected. The number of standard cubic meters metered by a critical-flow venturi (CFV) during each test phase would be the equivalent record for a CFV-CVS;

(m) the humidity of the dilution air.

Note 8: If conditioning columns are not used, this measurement can be deleted. If the conditioning columns are used and the dilution air is taken from the test cell, the ambient humidity can be used for this measurement;

(n) the driving distance for each part of the test, calculated from the measured roll or shaft revolutions;

(o) the actual roller vehicle speed pattern for the test;

(p) the gear use schedule for the test;

(q) the emissions results of the type I test for each part of the test and the total weighted test results;

(r) the second-by-second emission values of the type I tests, if deemed necessary;

(s) the emissions results of the type II test (see Annex B.3.).

# B.3. Text of the regulation, Test Type II, Tailpipe Emissions at (increased) Idle and at Free Acceleration

**1. Introduction**

This section describes the procedure for type II testing designed to ensure the on- road pollution under control requisite measurement of emissions during for in-use vehicle roadworthiness testing. The purpose of the requirements laid down in this section is to demonstrate that the [approved] / [certified] vehicle complies with the minimum requirements with regard to in-use vehicle roadworthiness testing.

**2. Scope**

2.1. During the environmental performance [approval] / [certification] process, it shall be demonstrated to the technical service and responsible authority that the vehicles shall comply with the test type II requirements prescribed in regional regulation of contracting parties applicable at the time of certification.

2.2. Vehicles equipped with a propulsion unit type of which a positive ignition combustion engine forms part shall be subject only to a type II emission test as set out in points 3., 4., 5. and 6.

2.3. Vehicles equipped with a propulsion unit type of which a compression ignition combustion engine forms part shall be subject only to a type II free acceleration emission test as set out in points 3., 7. and 8. In this case point 3.8. is not applicable.

**3. General conditions of type II emission testing**

3.1. In general practice, Type II test shall be carried out immediately after Type I test, if not, a visual inspection of any emission-control equipment shall be conducted prior to start of the type II emission test in order to check that the vehicle is complete, in a satisfactory condition and that there are no leaks in the fuel, air supply or exhaust systems. The test vehicle shall be properly maintained and used.

3.2. The fuel used to conduct the type II test shall be the reference fuel applicable for Type I test.

3.3. During the test, the environmental temperature shall be between 20 °C and 30 °C.

3.4. In the case of vehicles with manually-operated or semi-automatic-shift transmission, the test type II test shall be carried out with the gear lever in the 'neutral' position and the clutch engaged.

3.5. In the case of vehicles with automatic-shift transmission, the idle type II test shall be carried out with the gear selector in either the 'neutral' or the 'park' position. Where an automatic clutch is also fitted, the driven axle shall be lifted up to a point at which the wheels can rotate freely.

3.6. The type II emission test shall be conducted immediately after the type I emission test. In any other event, if type-II test is required to be conducted independently of Type-I test, the vehicle shall be warmed up until one of the following conditions is satisfied:

a) conditions at the end of type 1 test or, if not feasible,
b) conditions according to ISO 17479 or, if not feasible,
c) lubricant temperature of at least 70°C, or
d) minimum of 600 seconds of continuous driving under normal traffic conditions.

3.7. The exhaust outlets shall be provided with an air-tight extension, so that the sample probe used to collect exhaust gases may be inserted at least 60 cm into the exhaust outlet without increasing the back pressure of more than 125 mm H2O and without disturbing operation of the vehicle. This extension shall be so shaped as to avoid any appreciable dilution of exhaust gases in the air at the location of the sample probe. Where a vehicle is equipped with an exhaust system with multiple outlets, either these shall be joined to a common pipe or the measured pollutants carbon monoxide content shall be collected from each of them and an arithmetical average taken.

3.8. The emission test equipment and analysers to perform the type II testing shall be regularly calibrated and maintained. A flame ionisation detection or nondispersive infrared (NDIR) analyser may be used for measuring hydrocarbons.

3.9. For vehicles equipped with a stop-start system, the manufacturer shall provide a type II test 'service mode' that makes it possible to inspect the vehicle for this roadworthiness test on a running fuel-consuming engine, in order to determine its performance in relation to the data collected. Where this inspection requires a special procedure, this shall be detailed in the service manual (or equivalent media). That special procedure shall not require the use of special equipment other than that provided with the vehicle.

**4. Test type II – description of test procedure to measure tailpipe emissions at (increased) idle and free acceleration**

4.1. The possible positions of the adjustment components shall be limited by any of the following:

4.1.1. The larger of the following two values:

(a) the lowest idling engine speed which the engine can reach;

(b) the engine speed recommended by the manufacturer, minus 100 revolutions per minute;

4.1.2 The smallest of the following three values:

(a) the highest rotation speed which the crankshaft of the engine can attain by activation of the idling engine speed components;

(b) the rotation speed recommended by the manufacturer, plus 250 revolutions per minute;

(c) the cut-in rotation speed of automatic clutches.

4.2 Settings incompatible with the correct running of the engine shall not be adopted as measurement settings. In particular, if the engine is equipped with several carburettors, all the carburettors shall have the same setting.

4.3 The following parameters shall be measured and recorded at normal idling engine speed and at high idle engine speed, at the choice of CP:

(a) the carbon monoxide (CO) content by volume of the exhaust gases emitted (in vol%);

(b) the carbon dioxide ($CO_2$) content by volume of the exhaust gases emitted (in vol%);

(c) hydrocarbons (HC) in ppm;

(d) the oxygen ($O_2$) content by volume of the exhaust gases emitted (in vol%) or lambda, as chosen by the manufacturer;

(e) the engine speed during the test, including any tolerances;

(f) the engine oil temperature at the time of the test. Alternatively, for liquid cooled engines, the coolant temperature shall be acceptable. Alternatively for vehicles with air cooling the sparkplug seat/gasket temperature (TP) shall be acceptable.

4.3.1 With respect to the parameters under point 4.3. (d), the following shall apply:

4.3.1.1 the measurement shall only be conducted at high idle engine speed

4.3.1.2 vehicles in the scope of this measurement are only those equipped with a closed loop fuel system;

4.3.1.3 exemptions for vehicle with:

4.3.1.3.1 engines equipped with a mechanically-controlled (spring, vacuum) secondary air system;

4.3.1.3.2 two-stroke engines operated on a mix of fuel and lubrication oil.

**5. CO concentration calculation in the type II idle test**

5.1 The CO ($C_{CO}$) and $CO_2$ ($C_{CO2}$) concentration shall be determined from the measuring instrument readings or recordings, by use of appropriate calibration curves.

5.2 The corrected concentration for carbon monoxide is:

Equation B.3.-1, for 4-Stroke vehicles:

$$C_{COcorr} = 15 \times \frac{C_{CO}}{C_{CO} + C_{CO_2}}$$

Equation B.3.-2, for 2-Stroke vehicles:

$$C_{COcorr} = 10 \times \frac{C_{CO}}{C_{CO} + C_{CO_2}}$$

$c_{CO}$ is the measured concentration of carbon monoxide, in vol. %;
$c_{CO2}$ is the measured concentration of carbon dioxide, in vol. %;
$c_{COcorr}$ is the corrected concentration for carbon monoxide, in vol. %;
$c_{HC}$ is the measured concentration of hydrocarbon, in vol. ppm;
$c_{HCcorr}$ is the corrected concentration for hydrocarbon, in vol. ppm, expressed by methane CH4 equivalent;
a is 1,8 when concentration of hydrocarbon is measured by NDIR (Non-Dispersion Infra Red), and *a* is 1 when the concentration of hydrocarbon is measured by FID (Flame Ionization Detector);
b is *m* when the concentration of hydrocarbon is expressed by ppm Cm (for example *b* is 6 for n-hexane C6H14 equivalent *or b* is 1 for methane C1H4 equivalent).

5.3 The $C_{CO}$ concentration (see point 5.1.) shall be measured in accordance with the formula in point 5.2. and does not need to be corrected if the total of the concentrations measured ($C_{CO}$ + $C_{CO2}$) is at least:

(a) for petrol (E5): 15%;

## 6. Fail criteria test type II for vehicles equipped with a PI combustion engine

6.1 The test shall only be regarded as failed if the reported values exceed the limit values prescribed in the regulation of the contracting parties

## 7. Test type II – free acceleration test procedure

7.1. The exhaust gas opacity shall be measured during free acceleration (no load from idle up to cut-off engine speed) with gear lever in neutral and clutch engaged.

7.2. Vehicle preconditioning:

Vehicles may be tested without preconditioning although for safety reasons checks should be made that the engine is warm and in a satisfactory mechanical condition. The following precondition requirements shall apply:

7.2.1. The engine shall be fully warm, for instance the engine oil temperature measured by a probe in the oil level dipstick tube to be at least 70°C, or normal operating temperature if lower, or the engine block temperature measured by the level of infrared radiation to be at least an equivalent temperature. If, owing to vehicle configuration, this measurement is impractical, the establishment of the engine's normal operating temperature may be made by other means for example by the operation of the engine cooling fan;

7.2.2. The exhaust system shall be purged by at least three free acceleration cycles or by an equivalent method;

7.2.3. For vehicles equipped with continuously variable transmission (CVT) and automatic clutch, the driven wheels may be lifted from the ground;

7.2.4. For engines with safety limits in the engine control (e.g. max. 1500 rpm without running wheels or without gear), this maximum engine speed shall be reached.

7.3. Test procedure
The following test procedure shall be conducted:

7.3.1. The combustion engine and any turbocharger or super-charger fitted shall be running at idle before the start of each free acceleration test cycle;

7.3.2. To initiate each free acceleration cycle, the throttle shall be fully applied gradually but not violently to reach full throttle operating condition within 5 seconds quickly and continuously (in less than one second) but not violently, so as to obtain maximum delivery from the Fuel injection pump;

7.3.3. During each free acceleration cycle, the engine shall reach cut-off engine speed or, for vehicles with automatic transmissions, the engine speed specified by the manufacturer or if this data is not available then two thirds of the cut-off engine speed, before the throttle is released. This could be checked, for instance, by monitoring engine speed or by allowing a sufficient time to elapse between initial throttle depression and release, which should be at least Five seconds elapsing between initial throttle depression and release.

7.3.4. The average concentration level of the particulate matter opacity (in m-1) measured in the exhaust flow (opacity) for the 3 consecutive free acceleration test shall be measured during five free acceleration tests taken for decision making. The time duration between the two consecutive free accelerations tests shall be between 5-20 s.

**8. Fail criteria test type II for vehicles equipped with a CI combustion engine**

8.1. The test shall only be regarded as failed if the arithmetic means of at least the last three free acceleration cycles are in excess of the limit value as prescribed in the regulation of the contracting parties. This may be calculated by ignoring any measurement that departs significantly from the measured mean, or the result of any other statistical calculation that takes account of the scattering of the measurements.

# B.4. Text of the regulation, test type VII, energy efficiency

**1. Introduction**

1.1. This section sets out requirements with regard to energy efficiency of vehicles, in particular with respect to the measurements of CO2 emissions and fuel consumption.

1.2. The requirements laid down in this section apply to the following tests of vehicles equipped with associated powertrain configurations:
a) the measurement of the emission of carbon dioxide (CO2) and fuel consumption;

1.3. A standardised method for measuring vehicles' energy efficiency (fuel consumption and carbon dioxide emissions) is necessary to ensure that customers and users are supplied with objective and precise information.

**2. Specification and tests**

2.1. General
The components liable to affect CO2 emissions and fuel consumption shall be so designed, constructed and assembled as to enable the vehicle, in normal use, despite the vibrations to which it may be subjected, to comply with the provisions of this section. The test vehicles shall be properly maintained and used.

2.2. Description of tests for vehicles powered by a combustion engine only

2.2.1. The emissions of CO2 and fuel consumption shall be measured according to the test procedure described in Annex B.4.1. The test procedure, test fuel, conditioning of vehicle, other requirements, etc, are to be followed for Type VII test same as for Type I test described in Section B2.

2.2.2. For $CO_2$ emissions, the test results shall be expressed in grams per kilometre (g/km) rounded to the nearest one decimal place.

2.2.3. Fuel consumption values shall be expressed in terms of both litres per 100 km and also kilometer per litre and their values shall be rounded off to two decimals and one decimal respectively. The values shall be calculated according to point 1.4.3. of Annex B.4.1. by the carbon balance method, using the measured emissions of $CO_2$ and the other carbon-related emissions (CO and HC).

2.2.4. The appropriate reference fuels as set out in Annex B.5.2. shall be used for testing.
For the purpose of the calculation referred in point 2.2.3., the fuel consumption shall be expressed in appropriate units and the following fuel characteristics shall be used:
(a) density: measured on the test fuel according to ISO 3675:1998 or an equivalent method. For petrol and diesel fuel, the density measured at 15 °C and 101.3 kPa shall be used
(b) hydrogen-carbon ratio: fixed values will be used, as follows:
$C_{1:1.85}\ O_{0.0}$ for E0 petrol;
$C_{1:1.89}\ O_{0.016}$ for E5 petrol;
$C_{1:1.93}\ O_{0.033}$ for E10 petrol;
$C_{1:1.80}\ O_{0.0}$ for B0 diesel;
$C_{1:1.86}\ O_{0.005}$ for B5/B7 diesel

2.3. Interpretation of test results

2.3.1. The $CO_2$ value or the value of fuel consumption adopted as the approval/certification value shall be that declared by the manufacturer if this is not exceeded by more than 4 percent by the value measured by the technical service. The measured value may be lower without any limitations.

2.3.2. If the measured value of $CO_2$ emissions or fuel consumption exceeds the manufacturer's declared $CO_2$ emissions or fuel consumption by more than 4 percent, another test shall be run on the same vehicle.
Where the average of the two test results does not exceed the manufacturer's declared value by more than 4 percent, the value declared by the manufacturer shall be taken as the approval/certification value.

2.3.3. If, in the event of another test being run, the average still exceeds the declared value by more than 4 percent, a final test shall be run on the same vehicle. The average of the three test results shall be taken as the approval/certification value.

**3.** For Contracting Parties applying type-approval requirements with respect to modification and extension of approval of the approved type

3.1. For all approved types, the approval authority that approved the type shall be notified of any modification of it. The approval authority may then either:

3.1.1. consider that the modifications made are unlikely to have an appreciable adverse effect on the $CO_2$ emissions and fuel consumption values and that the original environmental performance approval will be valid for the modified vehicle type with regard to the environmental performance, or

3.1.2. require a further test report from the technical service responsible for conducting the tests in accordance with point 4.

3.2. For Contracting Parties applying type-approval confirmation or extension of approval specifying the alterations, shall be communicated by the following procedure:

3.2.1. If particulars recorded in the information package have changed, without requiring inspections or tests to be repeated, the amendment shall be designated a 'revision'.

In such cases, the approval authority shall issue the revised pages of the information package as necessary, marking each revised page to show clearly the nature of the change and,

3.2.2. The amendment shall be designated an 'extension' when particulars recorded in the information package have changed and any of the following occurs:

(a) further inspections or tests are required;

(b) any information on the approval certificate with the exception of its attachments, has changed;

(c) new requirements become applicable to the approved vehicle type or to the approved system, component or separate technical unit.

In the event of an extension, the approval authority shall issue an updated approval certificate denoted by an extension number, incremented in accordance with the number of successive extensions already granted. That approval certificate shall clearly show the reason for the extension and the date of re-issue.

3.3. The approval authority that grants the extension of the approval shall assign a serial number for such an extension according to the procedure below:

3.3.1. Whenever amended pages or a consolidated, updated version are issued, the index to the information package attached to the approval certificate shall be amended accordingly to show the date of the most recent extension or revision, or the date of the most recent consolidation of the updated version.

3.3.2. No amendment to the approval of a vehicle shall be required if the new requirements referred to in point (c) of paragraph 3.2.2. are, from a technical point of view, irrelevant to that type of vehicle or concern categories of vehicle other than the category to which it belongs.

**4. For Contracting Parties applying type-approval requirements with respect to conditions of extension of vehicle environmental performance approval**

4.1. Vehicles powered by an internal combustion engine only

An approval may be extended to vehicles produced by the same manufacturer that are of the same type or of a type that differs with regard to the following characteristics:

4.1.1. reference mass;

4.1.2. maximum authorised mass.;

4.1.3. type of bodywork;

4.1.4. overall gear ratios;

4.1.5. engine equipment and accessories;

4.1.6. engine speed versus vehicle speed in highest gear with an accuracy of +/- 5 %;

provided the CO2 emissions or fuel consumption as measured in Annex B.4.1 by the technical service do not exceed the approval value by more than 4 percent.

# B.4.1. Annex: method of measuring carbon dioxide emissions and fuel consumption of vehicles powered by a combustion engine only

## 1. Specification of the test

1.1. The carbon dioxide ($CO_2$) emissions and fuel consumption of vehicles powered by a combustion engine only shall be determined according to the procedure for the type I test in section B.2. in force at the time of the approval/certification of the vehicle.

1.2. In addition to the $CO_2$ emission and fuel consumption results for the entire type I test, $CO_2$ emissions and fuel consumption shall also be determined separately for parts 1, 2 and 3, if applicable, by using the applicable type I test procedure.

1.3. In addition to the conditions in section B.2. in force at the time of the approval/certification of the vehicle, the following conditions shall apply:

1.3.1. Only the equipment necessary for the operation of the vehicle during the test shall be in use. If there is a manually controlled device for the engine intake air temperature, it shall be in the position prescribed by the manufacturer for the ambient temperature at which the test is performed. In general, the auxiliary devices required for the normal operation of the vehicle shall be in use.

1.3.2. If the radiator fan is temperature-controlled, it shall be in normal operating condition. The passenger compartment heating system, if present, shall be switched off, as shall any air-conditioning system, but the compressor for such systems shall be functioning normally.

1.3.3. If a super-charger is fitted, it shall be in normal operating condition for the test conditions.

1.3.4. All lubricants shall be those recommended by the manufacturer of the vehicle and shall be specified in the test report.

1.3.5. The widest tyre shall be chosen, except where there are more than three tyre sizes, in which case the second widest shall be chosen. The pressures shall be indicated in the test report.

1.4. Calculation of $CO_2$ and fuel consumption values

1.4.1. The mass emission of $CO_2$, expressed in g/km, shall be calculated from the measurements taken in accordance with the provisions of point 5 of section B.2.

1.4.1.1. For this calculation, the density of $CO_2$ shall be assumed to be $Q_{CO2} = 1.964 \cdot 10^3$ g/m$^3$.

1.4.2. The fuel consumption values shall be calculated from the hydrocarbon, carbon monoxide and carbon dioxide emission measurements taken in accordance with the provisions of point 4 of section B.2. in force at the time of the approval/certification of the vehicle.

1.4.3. Fuel consumption (FC), expressed in litres per 100 km (in the case of petrol,:

1.4.3.1. for vehicles with a positive ignition engine fuelled with petrol (E5):

Equation B.4.1-1:

$FC = (0.118/D) \cdot ((0.848 \cdot HC) + (0.429 \cdot CO) + (0.273 \cdot CO2));$

1.4.3.2. for vehicles with a compression ignition engine fuelled with diesel (B5):

Equation B.4.1-9:

$FC = (0.116/D) \cdot ((0.861 \cdot HC) + (0.429 \cdot CO) + (0.273 \cdot CO2));$

1.4.4. In these formulae:

FC = the fuel consumption in litres per 100 km in the case of petrol, diesel or biodiesel, in m3 per 100 km

HC = the measured emission of hydrocarbons in g/km

CO = the measured emission of carbon monoxide in g/km

CO2 = the measured emission of carbon dioxide in g/km

D = the density of the test fuel.

## B.5. TEXT OF THE REGULATION, COMMON ANNEXES

**Annexes to test type I, II and VII**

## B.5.1. Annex: symbols

| Symbol | Definition | Unit |
|---|---|---|
| a | Coefficient of polygonal function | - |
| $a_T$ | Rolling resistance force of front wheel | N |
| A | NG / biomethane quantity within the $H_2NG$ mixture | percent vol. |
| b | Coefficient of polygonal function | - |
| $b_T$ | Coefficient of aerodynamic function | $N/(km/h)^2$ |
| c | Coefficient of polygonal function | - |
| $C_{CO}$ | Concentration of carbon monoxide | ppm |
| $C_{CO2}$ | Concentration of CO2 in the diluted exhaust gas contained in the sampling bag | percent vol. |
| $C_{COcorr}$ | Corrected concentration of carbon monoxide | percent vol. |
| $CO_{2c}$ | Carbon dioxide concentration of diluted gas, corrected to take account of diluent air | percent |
| $CO_{2d}$ | Carbon dioxide concentration in the sample of diluent air collected in bag B | percent |
| $CO_{2e}$ | Carbon dioxide concentration in the sample of diluent air collected in bag A | percent |
| $CO_{2m}$ | Mass of carbon dioxide emitted during the test part | mg/km |
| $CO_c$ | Carbon monoxide concentration of diluted gas, corrected to take account of diluent air | ppm |
| $CO_d$ | Carbon monoxide concentration in the sample of diluent air, collected in bag B | ppm |
| $CO_e$ | Carbon monoxide concentration in the sample of diluent air, collected in bag A | ppm |
| $CO_m$ | Mass of carbon monoxide emitted during the test part | mg/km |
| $C_{H2}$ | Concentration of hydrogen in the diluted exhaust gas contained in sampling bag | ppm |
| $C_{H2O}$ | Concentration of H2O in the diluted exhaust gas contained in the sampling bag | percent vol. |
| $C_{H2O-DA}$ | Concentration of H2O in the air used for dilution | percent vol. |
| $C_{HC}$ | Concentration of HC in the diluted exhaust gas contained in the sampling bag | ppm (carbon equivalent) |
| $d_0$ | Standard ambient relative air density | - |
| $d_{CO}$ | Density of carbon monoxide | $mg/cm^3$ |
| $d_{CO_2}$ | Density of carbon dioxide | $g/dm^3$ |
| $d_{HC}$ | Density of hydrocarbon | $mg/cm^3$ |
| $D_{av}$ | Average distance between two battery recharges | km |
| $D_e$ | Electric range of the vehicle | km |
| DiF | Dilution factor | - |
| $D_{OVC}$ | Distance from externally chargeable vehicle | km |
| S / d | Distance driven in a cycle part | km |
| $d_{NOx}$ | Density of nitrogen oxide | $mg/m^3$ |
| $d_T$ | Relative air density under test condition | - |
| $\Delta t$ | Coast-down time | s |
| $\Delta t_{ai}$ | Coast-down time measured in the first road test | s |
| $\Delta t_{bi}$ | Coast-down time measured in the second road test | s |
| $\Delta T_E$ | Coast-down time corrected for the inertia mass | s |
| $\Delta t_E$ | Mean coast-down time on the chassis dynamometer at the reference vehicle speed | s |
| $\Delta T_i$ | Average coast-down time at specified vehicle speed | s |
| $\Delta t_i$ | Coast-down time at corresponding s vehicle peed | s |
| $\Delta T_j$ | Average coast-down time at specified vehicle speed | s |
| $\Delta T_{road}$ | Target coast-down time | s |
| $\overline{\Delta t}_t$ | Mean coast-down time on the chassis dynamometer without absorption | s |
| $\Delta v$ | Coast-down vehicle speed interval ($2\Delta v = v1 - v2$) | km/h |
| $\varepsilon$ | Chassis dynamometer setting error | percent |
| F | Running resistance force | N |
| $F^*$ | Target running resistance force | N |

| | | |
|---|---|---|
| $F^*_{(v0)}$ | Target running resistance force at reference vehicle speed on chassis dynamometer | N |
| $F^*_{(vi)}$ | Target running resistance force at specified vehicle speed on chassis dynamometer | N |
| $f^*_0$ | Corrected rolling resistance in the standard ambient condition | N |
| $f^*_2$ | Corrected coefficient of aerodynamic drag in the standard ambient condition | $N/(km/h)^2$ |
| $F^*_j$ | Target running resistance force at specified vehicle speed | N |
| $f_0$ | Rolling resistance | N |
| $f_2$ | Coefficient of aerodynamic drag | $N/(km/h)^2$ |
| $F_E$ | Set running resistance force on the chassis dynamometer | N |
| $F_{E(v0)}$ | Set running resistance force at the reference s vehicle peed on the chassis dynamometer | N |
| $F_{E(v2)}$ | Set running resistance force at the specified vehicle speed on the chassis dynamometer | N |
| $F_f$ | Total friction loss | N |
| $F_{f(v0)}$ | Total friction loss at the reference vehicle speed | N |
| $F_j$ | Running resistance force | N |
| $F_{j(v0)}$ | Running resistance force at the reference vehicle speed | N |
| $F_{pau}$ | Braking force of the power absorbing unit | N |
| $F_{pau(v0)}$ | Braking force of the power absorbing unit at the reference vehicle speed | N |
| $F_{pau(vj)}$ | Braking force of the power absorbing unit at the specified vehicle speed | N |
| $F_T$ | Running resistance force obtained from the running resistance table | N |
| H | Absolute humidity | g of water / kg of dry air |
| $HC_c$ | Concentration of diluted gases expressed in the carbon equivalent, corrected to take account of diluent air | ppm |
| $HC_d$ | Concentration of hydrocarbons expressed in the carbon equivalent, in the sample of diluent air collected in bag B | ppm |
| $HC_e$ | Concentration of hydrocarbons expressed in the carbon equivalent, in the sample of diluent air collected in bag A | ppm |
| $HC_m$ | Mass of hydrocarbon emitted during the test part | mg/km |
| i | gear number | - |
| $K_0$ | Temperature correction factor for rolling resistance | - |
| $K_h$ | Humidity correction factor | - |
| L | Approval limit values of gaseous pollutant emission | mg/km |
| m | Test vehicle mass | kg |
| $m_a$ | Actual mass of the test vehicle | kg |
| $m_{corr}$ | PM mass corrected for buoyancy | mg |
| $m_{fi}$ | Flywheel equivalent inertia mass | kg |
| $m_i$ | Equivalent inertia mass | kg |
| $m_{mix}$ | molar mass of air in balance environment (28.836 $gmol^{-1}$) | $gmol^{-1}$ |
| $m_r$ | Equivalent inertia mass of all the wheels | kg |
| $m_{ri}$ | Equivalent inertia mass of all the rear wheel and vehicle parts rotating with wheel | kg |
| $m_k$ or $m_{ref}$ | Reference mass of the vehicle | kg |
| $m_{rf}$ | Rotating mass of the front wheel | kg |
| $m_{rid}$ | Rider mass | kg |
| $m_{uncorr}$ | PM mass uncorrected for buoyancy | mg |
| $M_i$ | Mass emission of the pollutant i in mg/km | mg |
| $M_{2i}$ | Average mass emission of the pollutant i with an electrical energy/power storage device in minimum state of charge (maximum discharge of capacity) | mg/km |
| $M_{1i}$ | Average mass emission of the pollutant i with a fully charged electrical energy/power storage device | mg/km |
| Mp | Particulate mass emission | mg/km |
| n | Engine speed | $min^{-1}$ |

| | | |
|---|---|---|
| n | Number of data regarding the emission or the test | - |
| N | Number of revolution made by pump P | - |
| $nd_{vi}$ | Ratio between engine speed in $min^{-1}$ and vehicle speed in km/h in gear 'i' | - |
| ng | Number of forward gears | - |
| $n_{idle}$ | Idling engine speed | $min^{-1}$ |
| $n\_max\_acc_{(1)}$ | Upshift engine speed from gear 1 to gear 2 during acceleration phases | $min^{-1}$ |
| $n\_max\_acc_{(i)}$ | Up shift engine speed from gear i to gear i+1 during acceleration phases, i>1 | $min^{-1}$ |
| $n\_min\_acc_{(i)}$ | Minimum engine speed for cruising or deceleration in gear 1 | $min^{-1}$ |
| $NO_{xc}$ | Nitrogen oxide concentration of diluted gases, corrected to take account of diluent air | ppm |
| $NO_{xd}$ | Nitrogen oxide concentration in the sample of diluent air collected in bag B | ppm |
| $NO_{xe}$ | Nitrogen oxide concentration in the sample of diluent air collected in bag A | ppm |
| $NO_{xm}$ | Mass of nitrogen oxides emitted during the test part | mg/km |
| $p_0$ | Standard ambient pressure | kPa |
| $p_a$ | Ambient/atmospheric pressure | kPa |
| $p_{abs}$ | absolute pressure in balance environment | |
| $p_d$ | Saturated pressure of water at the test temperature | kPa |
| $p_i$ | Average under-pressure during the test part in the section of pump P | kPa |
| $p_T$ | Mean ambient pressure during the test | kPa |
| Pn | Rated power | kW |
| Q | Electric energy balance | Ah |
| $\rho_0$ | Standard relative ambient air volumetric mass | $mg/cm^3$ |
| $\rho_{air}$ | density of air in balance environment | $mg/cm^3$ |
| $\rho_{weight}$ | density of calibration weight used to span balance | $mg/cm^3$ |
| $\rho_{media}$ | density of PM sample medium (filter) with filter medium Teflon coated glass fibre (e.g. TX40): $\rho_{media}$ = 2.300 kg/m3 | $mg/cm^3$ |
| r(i) | Gear ratio in gear i | - |
| R | molar gas constant (8.314 $Jmol^{-1}K^{-1}$) | $Jmol^{-1}K^{-1}$ |
| $R_f$ | Response factor to calibrate HC analyser | - |
| $R_F$ | Final test result of pollutant emissions, carbon dioxide emission or fuel consumption | mg/km, g/km, 1/100km |
| $R_1$ | Test results of pollutant emissions, carbon dioxide emission or fuel consumption for cycle part 1 with cold start | mg/km, g/km, 1/100km |
| $R_2$ | Test results of pollutant emissions, carbon dioxide emission or fuel consumption for cycle part 2 with warm condition | mg/km, g/km, 1/100km |
| $R_3$ | Test results of pollutant emissions, carbon dioxide emission or fuel consumption for cycle part 1 with warm condition | mg/km, g/km, 1/100km |
| $Ri_1$ | First type I test results of pollutant emissions | mg/km |
| $Ri_2$ | Second type I test results of pollutant emissions | mg/km |
| $Ri_3$ | Third type I test results of pollutant emissions | mg/km |
| s | Rated engine speed | $min^{-1}$ |
| S | Accumulated distance in test cycle ( point 5.1.1.3 of Annex B.2) | km |
| $T_{amb}$ | absolute ambient temperature of balance environment | °C |
| $T_C$ | Temperature of the coolant | °C |
| $T_O$ | Temperature of the engine oil | °C |
| $T_P$ | Temperature of the spark-plug seat/gasket | °C |
| $T_0$ | Standard ambient temperature | °C |
| $T_p$ | Temperature of the diluted gases during the test part, measured in the intake section of pump P | °C |
| $T_T$ | Mean ambient temperature during the test | °C |
| U | Relative humidity | percent |
| v | Specified vehicle speed | km/h |

| | | |
|---|---|---|
| V | Total volume of diluted gas | m3 |
| $v_{max}$ | Maximum design vehicle speed of test vehicle | km/h |
| $v_0$ | Reference vehicle speed | km/h |
| $V_0$ | Volume of gas displaced by pump P during one revolution | $m^3$/rev. |
| $v_1$ | Vehicle speed at which the measurement of the coast-down time begins | km/h |
| $v_2$ | Vehicle speed at which the measurement of the coast-down time ends | km/h |
| vi | Specified vehicle speed selected for the coast-down time measurement | km/h |
| $w_1$ | Weighting factor of cycle part 1 with cold start | - |
| $w_{1warm}$ | Weighting factor of cycle part 1 with warm condition | - |
| $w_2$ | Weighting factor of cycle part 2 with warm condition | - |
| $w_3$ | Weighting factor of cycle part 3 with warm condition | - |

Table B.5.1-1: symbols used

**B.5.2. Annex: reference fuels**

1. Specifications of reference fuels for testing vehicles in environmental tests, in particular for tailpipe and evaporative emissions testing

1.1. The following tables list the technical data on liquid reference fuels that Contracting Parties may require to be used for environmental performance testing of two-wheeled vehicles. These reference fuels were used to define the emission limits set out in point 9. of section B.1.

| B.5.2.1. Type: Petrol E0 (nominal 90 RON) | | | | |
|---|---|---|---|---|
| Fuel Property or Substance Name | Unit | Standard | | Test method |
| | | Minimum | Maximum | |
| Research octane number, RON | | 90 | 92 | JIS K2280 |
| Motor octane number, MON | | 80 | 82 | JIS K2280 |
| Density | $g/cm^3$ | 0.72 | 0.77 | JIS K2249 |
| Vapour pressure | kPa | 56 | 60 | JIS K2258 |
| Distillation: | | | | |
| — 10 % distillation temperature | K (°C) | 318 (45) | 328 (55) | JIS K2254 |
| — 50 % distillation temperature | K (°C) | 363 (90) | 373 (100) | JIS K2254 |
| — 90 % distillation temperature | K (°C) | 413 (140) | 443 (170) | JIS K2254 |
| — final boiling point | K (°C) | | 488 (215) | JIS K2254 |
| — olefins | % v/v | 15 | 25 | JIS K2536-1<br>JIS K2536-2 |
| — aromatics | % v/v | 20 | 45 | JIS K2536-1<br>JIS K2536-2<br>JIS K2536-3 |
| — benzene | % v/v | | 1.0 | JIS K2536-2<br>JIS K2536-3<br>JIS K2536-4 |
| Oxygen content | | not to be detected | | JIS K2536-2<br>JIS K2536-4<br>JIS K2536-6 |
| Existent gum | mg/100ml | | 5 | JIS K2261 |
| Sulphur content | Wt ppm | | 10 | JIS K2541-1<br>JIS K2541-2<br>JIS K2541-6<br>JIS K2541-7 |
| Lead content | | not to be detected | | JIS K2255 |
| Ethanol | | not to be detected | | JIS K2536-2<br>JIS K2536-4<br>JIS K2536-6 |
| Methanol | | not to be detected | | JIS K2536-2<br>JIS K2536-4<br>JIS K2536-5<br>JIS K2536-6 |
| MTBE | | not to be detected | | JIS K2536-2<br>JIS K2536-4<br>JIS K2536-5<br>JIS K2536-6 |
| Kerosene | | not to be detected | | JIS K2536-2<br>JIS K2536-4 |

| B.5.2.2. Type: Petrol E0 (nominal 95 RON) | | | | | |
|---|---|---|---|---|---|
| Parameter | Unit | Limits (1) | | Test method | Publication |
| | | Minimum | Maximum | | |
| Research octane number, RON | | 95.0 | | EN 25164 | 1993 |
| Motor octane number, MON | | 85.0 | | EN 25163 | 1993 |
| Density at 15 °C | kg/m$^3$ | 748 | 762 | ISO 3675 | 1995 |
| Reid vapour pressure | kPa | 56.0 | 60.0 | EN 12 | 1993 |
| Distillation: | | | | | |
| - initial boiling point | °C | 24 | 40 | EN-ISO 3205 | 1988 |
| - evaporated at 100 °C | per cent v/v | 49.0 | 57.0 | EN-ISO 3205 | 1988 |
| - evaporated at 150 °C | per cent v/v | 81.0 | 87.0 | EN-ISO 3205 | 1988 |
| - final boiling point | °C | 190 | 215 | EN-ISO 3205 | 1988 |
| Residue | per cent | | 2 | EN-ISO 3205 | 1988 |
| Hydrocarbon analysis: | | | | | |
| - olefins | per cent v/v | | 10 | ASTM D 1319 | 1995 |
| - aromatics(3) | per cent v/v | 28.0 | 40.0 | ASTM D 1319 | 1995 |
| - benzene | per cent v/v | | 1.0 | pr. EN 12177 | 1998 (2) |
| - saturates | per cent v/v | | balance | ASTM D 1319 | 1995 |
| Carbon/hydrogen ratio | | report | report | | |
| Oxidation stability (4) | min. | 480 | | EN-ISO 7536 | 1996 |
| Oxygen content (5) | per cent m/m | | 2.3 | EN 1601 | 1997 (2) |
| Existent gum | mg/ml | | 0.04 | EN-ISO 6246 | 1997 (2) |
| Sulphur content (6) | mg/kg | | 100 | pr.EN-ISO/DIS 14596 | 1998 (2) |
| Copper corrosion at 50 °C | | | 1 | EN-ISO 2160 | 1995 |
| Lead content | g/l | | 0.005 | EN 237 | 1996 |
| Phosphorus content | g/l | | 0.0013 | ASTM D 3231 | 1994 |

(1) The values quoted in the specification are "true values". In establishment of their limit values the terms of ISO 4259 "Petroleum products - Determination and application of precision data in relation to methods of test,' have been applied and in fixing a minimum value, a minimum difference of 2R above zero has been taken into account; in fixing a maximum and minimum value, the minimum difference is 4R (R = reproducibility).

Notwithstanding this measure, which is necessary for statistical reasons, the manufacturer of fuels should nevertheless aim at a zero value where the stipulated maximum value is 2R and at the mean value in the case of quotations of maximum and minimum limits. Should it be necessary to clarify the question as to whether a fuel meets the requirements of the specifications, the terms of ISO 4259 should be applied.

(2) The month of publication will be completed in due course.

(3) The reference fuel used shall have a maximum aromatics content of 35 per cent v/v.

(4) The fuel may contain oxidation inhibitors and metal deactivators normally used to stabilise refinery gasoline streams, but detergent/dispersive additives and solvent oils shall not be added.

(5) The actual oxygen content of the fuel for the tests shall be reported. In addition the maximum oxygen content of the reference fuel shall be 2.3 per cent.

(6) The actual sulphur content of the fuel used for the tests shall be reported. In addition the reference fuel shall have a maximum sulphur content of 50 ppm.

| B.5.2.3. Type: Petrol E0 (nominal 100 RON) | | | | |
|---|---|---|---|---|
| Fuel Property or Substance Name | Unit | Standard | | Test method |
| | | Minimum | Maximum | |
| Research octane number, RON | | 99 | 101 | JIS K2280 |
| Motor octane number, MON | | 86 | 88 | JIS K2280 |
| Density | g/cm³ | 0.72 | 0.77 | JIS K2249 |
| Vapour pressure | kPa | 56 | 60 | JIS K2258 |
| Distillation: | | | | |
| — 10 % distillation temperature | K (°C) | 318 (45) | 328 (55) | JIS K2254 |
| — 50 % distillation temperature | K (°C) | 363 (90) | 373 (100) | JIS K2254 |
| — 90 % distillation temperature | K (°C) | 413 (140) | 443 (170) | JIS K2254 |
| — final boiling point | K (°C) | | 488 (215) | JIS K2254 |
| — olefins | % v/v | 15 | 25 | JIS K2536-1<br>JIS K2536-2 |
| — aromatics | % v/v | 20 | 45 | JIS K2536-1<br>JIS K2536-2<br>JIS K2536-3 |
| — benzene | % v/v | | 1.0 | JIS K2536-2<br>JIS K2536-3<br>JIS K2536-4 |
| Oxygen content | | not to be detected | | JIS K2536-2<br>JIS K2536-4<br>JIS K2536-6 |
| Existent gum | mg/100ml | | 5 | JIS K2261 |
| Sulphur content | Wt ppm | | 10 | JIS K2541-1<br>JIS K2541-2<br>JIS K2541-6<br>JIS K2541-7 |
| Lead content | | not to be detected | | JIS K2255 |
| Ethanol | | not to be detected | | JIS K2536-2<br>JIS K2536-4<br>JIS K2536-6 |
| Methanol | | not to be detected | | JIS K2536-2<br>JIS K2536-4<br>JIS K2536-5<br>JIS K2536-6 |
| MTBE | | not to be detected | | JIS K2536-2<br>JIS K2536-4<br>JIS K2536-5<br>JIS K2536-6 |
| Kerosene | | not to be detected | | JIS K2536-2<br>JIS K2536-4 |

**B.5.2.4. Type: Petrol E5 (nominal 95 Octane)**

| *Parameter* | *Unit* | *Limits*[1] | | *Test method* |
|---|---|---|---|---|
| | | *Minimum* | *Maximum* | |
| Research octane number, RON | | 95.0 | - | EN 25164 / prEN ISO 5164 |
| Motor octane number, MON | | 85.0 | - | EN 25163 / prEN ISO 5163 |
| Density at 15 °C | kg/$m^3$ | 743 | 756 | EN ISO 3675 / EN ISO 12185 |
| Vapour pressure | kPa | 56.0 | 60.0 | EN ISO 13016-1 (DVPE) |
| Water content | % v/v | | 0.015 | ASTM E 1064 |
| Distillation: | | | | |
| – Evaporated at 70 °C | % v/v | 24.0 | 44.0 | EN ISO 3405 |
| – Evaporated at 100 °C | % v/v | 48.0 | 60.0 | EN ISO 3405 |
| – Evaporated at 150 °C | % v/v | 82.0 | 90.0 | EN ISO 3405 |
| – Final boiling point | °C | 190 | 210 | EN ISO 3405 |
| Residue | % v/v | — | 2.0 | EN ISO 3405 |
| Hydrocarbon analysis: | | | | |
| – Olefins | % v/v | 3.0 | 13.0 | ASTM D 1319 |
| – Aromatics | % v/v | 29.0 | 35.0 | ASTM D 1319 |
| – Benzene | % v/v | - | 1.0 | EN 12177 |
| – Saturates | % v/v | Report | | ASTM 1319 |
| Carbon/hydrogen ratio | | Report | | |
| Carbon/oxygen ratio | | Report | | |
| Induction period[2] | minutes | 480 | - | EN ISO 7536 |
| Oxygen content[4] | % m/m | Report | | EN 1601 |
| Existent gum | mg/ml | - | 0.04 | EN ISO 6246 |
| Sulphur content[3] | mg/kg | - | 10 | EN ISO 20846 / EN ISO 20884 |
| Copper corrosion | | - | Class 1 | EN ISO 2160 |
| Lead content | mg/l | - | 5 | EN 237 |
| Phosphorus content | mg/l | - | 1.3 | ASTM D 3231 |
| Ethanol[5] | % v/v | 4.7 | 5.3 | EN 1601 / EN 13132 |

[1] The values quoted in the specifications are ‘true values’. For establishing the limit values, the terms of ISO 4259:2006 (Petroleum products — Determination and application of precision data in relation to methods of test) have been applied and for fixing a minimum value, a minimum difference of 2R above zero has been taken into account; for fixing a maximum and minimum value, the minimum difference is 4R (R = reproducibility).

Notwithstanding this measure, which is necessary for technical reasons, the fuel manufacturer shall nevertheless aim at a zero value where the stipulated maximum value is 2R and at the mean value when quoting maximum and minimum limits. Should it be necessary to clarify whether a fuel meets the requirements of the specifications, the terms of ISO 4259:2006 shall be applied.

[2] The fuel may contain oxidation inhibitors and metal deactivators normally used to stabilise refinery petrol streams, but detergent/dispersive additives and solvent oils shall not be added.

[3] The actual sulphur content of the fuel used for the type I test shall be reported.

[4] Ethanol meeting the specification of prEN 15376 is the only oxygenate that shall be intentionally added to the reference fuel.

[5] There shall be no intentional addition to this reference fuel of compounds containing phosphorus, iron, manganese or lead.

| B.5.2.5. Type: Diesel fuel (B0) | | | | | |
|---|---|---|---|---|---|
| Parameter | Unit | Limits (1) | | Test method | Publication |
| | | Minimum | Maximum | | |
| Cetane number (2) | | 52.0 | 54.0 | EN-ISO 5165 | 1998 (3) |
| Density at 15°C | kg/m³ | 833 | 837 | EN-ISO 3675 | 1995 |
| Distillation: | | | | | |
| - 50 per cent point | °C | 245 | - | EN-ISO 3405 | 1988 |
| - 95 per cent | °C | 345 | 350 | EN-ISO 3405 | 1988 |
| - final boiling point | °C | - | 370 | EN-ISO 3405 | 1988 |
| Flash point | °C | 55 | - | EN 22719 | 1993 |
| CFPP | °C | - | -5 | EN 116 | 1981 |
| Viscosity at 40 °C | mm²/s | 2.5 | 3.5 | EN-ISO 3104 | 1996 |
| Polycyclic aromatic hydrocarbons | per cent m/m | 3 | 6.0 | IP 391 | 1995 |
| Sulphur content (4) | mg/kg | - | 300 | pr. EN-ISO/DIS 14596 | 1998(3) |
| Copper corrosion | | - | 1 | EN-ISO 2160 | 1995 |
| Conradson carbon residue (10 per cent DR) | per cent m/m | - | 0.2 | EN-ISO 10370 | 1995 |
| Ash content | per cent m/m | - | 0.01 | EN-ISO 6245 | 1995 |
| Water content | per cent m/m | - | 0.05 | EN-ISO 12937 | 1998 (3) |
| Neutralisation (strong acid) number | mg KOH/g | - | 0.02 | ASTM D 974-95 | 1998 (3) |
| Oxidation stability (5) | mg/ml | - | 0.025 | EN-ISO 12205 | 1996 |

(1) The values quoted in the specification are "true values". In establishment of their limit values the terms of ISO 4259 "Petroleum products - Determination and application of precision data in relation to methods of test" have been applied and in fixing a minimum value, a minimum difference of 2R above zero has been taken into account; in fixing a maximum and minimum value, the minimum difference is 4R (R = reproducibility).
Notwithstanding this measure, which is necessary for statistical reasons, the manufacturer of fuels should nevertheless aim at a zero value where the stipulated maximum value is 2R and at the mean value in the case of quotations of maximum and minimum limits. Should it be necessary to clarify the question as to whether a fuel meets the requirements of the specifications, the terms of ISO 4259 should be applied.

(2) The range for the Cetane number is not in accordance with the requirement of a minimum range of 4R. However, in the case of a dispute between fuel supplier and fuel user, the terms in ISO 4259 may be used to resolve such disputes provided replicate measurements, of sufficient number to archive the necessary precision, are made in preference to single determinations.

(3) The month of publication will be completed in due course.

(4) The actual sulphur content of the fuel used for the Type I test shall be reported. In addition the reference fuel shall have a maximum sulphur content of 50 ppm.

(5) Even though oxidation stability is controlled, it is likely that shelf life will be limited. Advice should be sought from the supplier as to storage conditions and life.

| B.5.2.6. Type: Diesel fuel (B5) | | | | |
|---|---|---|---|---|
| *Parameter* | *Unit* | *Limits*[1] | | *Test method* |
| | | *Minimum* | *Maximum* | |
| Cetane number[2] | | 52.0 | 54.0 | EN ISO 5165 |
| Density at 15 °C | $kg/m^3$ | 833 | 837 | EN ISO 3675 |
| Distillation: | | | | |
| - 50 % point | °C | 245 | - | EN ISO 3405 |
| - 95 % point | °C | 345 | 350 | EN ISO 3405 |
| - Final boiling point | °C | - | 370 | EN ISO 3405 |
| Flash point | °C | 55 | - | EN 22719 |
| CFPP | °C | - | - 5 | EN 116 |
| Viscosity at 40 °C | $mm^2/s$ | 2.3 | 3.3 | EN ISO 3104 |
| Polycyclic aromatic hydrocarbons | % m/m | 2.0 | 6.0 | EN 12916 |
| Sulphur content[3] | mg/kg | - | 10 | EN ISO 20846 / EN ISO 20884 |
| Copper corrosion | | - | Class 1 | EN ISO 2160 |
| Conradson carbon residue (10 % DR) | % m/m | - | 0.2 | EN ISO 10370 |
| Ash content | % m/m | - | 0.01 | EN ISO 6245 |
| Water content | % m/m | - | 0.02 | EN ISO 12937 |
| Neutralisation (strong acid) number | mg KOH/g | - | 0.02 | ASTM D 974 |
| Oxidation stability[4] | mg/ml | - | 0.025 | EN ISO 12205 |
| Lubricity (HFRR wear scan diameter at 60 °C) | µm | - | 400 | EN ISO 12156 |
| Oxidation stability at 110 °C[4.6] | h | 20.0 | | EN 14112 |
| FAME[5] | % v/v | 4.5 | 5.5 | EN 14078 |

1 The values quoted in the specifications are ‘true values’. For establishing the limit values, the terms of ISO 4259:2006 (Petroleum products — Determination and application of precision data in relation to methods of test) have been applied and for fixing a minimum value, a minimum difference of 2R above zero has been taken into account; for fixing a maximum and minimum value, the minimum difference is 4R (R = reproducibility).
Notwithstanding this measure, which is necessary for technical reasons, the fuel manufacturer shall nevertheless aim at a zero value where the stipulated maximum value is 2R and at the mean value when quoting maximum and minimum limits. Should it be necessary to clarify whether a fuel meets the requirements of the specifications, the terms of ISO 4259:2006 shall be applied.

2 The range for Cetane number is not in accordance with the requirements of a minimum range of 4R. However, the terms of ISO 4259:2006 may be used to resolve disputes between fuel supplier and fuel user, provided replicate measurements, of sufficient number to archive the necessary precision, are taken in preference to single determinations.

3 The actual sulphur content of the fuel used for the type I test shall be reported.

4 Even though oxidation stability is controlled, it is likely that shelf life will be limited. Advice shall be sought from the supplier as to storage conditions and shelf life.

5 FAME content to meet the specification of EN 14214.

6 Oxidation stability can be demonstrated by EN ISO 12205:1995 or EN 14112:1996. This requirement shall be reviewed based on CEN/TC19 evaluations of oxidative stability performance and test limits.

[EPPR-IWG to add proposal for B7 fuel – proposed draft as below :

**Technical specifications of the reference Diesel Fuel (B7)**

| Parameter | Unit | Limits [1] | | Test method |
|---|---|---|---|---|
| | | Minimum | Maximum | |
| Cetane Index | | 46.0 | | EN ISO 4264 |
| Cetane number [2] | | 52.0 | 56.0 | EN ISO 5165 |
| Density at 15 °C | kg/m$^3$ | 833.0 | 837.0 | EN ISO 12185 |
| Distillation: | | | | |
| - 50% point | °C | 245.0 | — | EN ISO 3405 |
| - 95% point | °C | 345.0 | 360.0 | EN ISO 3405 |
| - final boiling point | °C | — | 370.0 | EN ISO 3405 |
| Flash point | °C | 55 | — | EN ISO 2719 |
| Cloud point | °C | - | -10 | EN 23015 |
| Viscosity at 40 °C | mm$^2$/s | 2.30 | 3.30 | EN ISO 3104 |
| Polycyclic aromatic hydrocarbons | % m/m | 2.0 | 4.0 | EN 12916 |
| Sulphur content | mg/kg | — | 10.0 | EN ISO 20846<br>EN ISO 20884 |
| Copper corrosion 3hrs, 50 °C | | — | Class 1 | EN ISO 2160 |
| Conradson carbon residue (10 % DR) | % m/m | — | 0.20 | EN ISO 10370 |
| Ash content | % m/m | — | 0.010 | EN ISO 6245 |
| Total contamination | mg/kg | - | 24 | EN 12662 |
| Water content | mg/kg | — | 200 | EN ISO 12937 |
| Acid number | mg KOH/g | — | 0.10 | EN ISO 6618 |
| Lubricity (HFRR wear scan diameter at 60 °C) | µm | — | 400 | EN ISO 12156 |
| Oxidation stability @ 110 °C [3] | h | 20.0 | | EN 15751 |
| FAME [4] | % v/v | 6.0 | 7.0 | EN 14078 |

1 The values quoted in the specifications are 'true values'. In establishment of their limit values the terms of ISO 4259 Petroleum products – Determination and application of precision data in relation to methods of test have been applied and in fixing a minimum value, a minimum difference of 2R above zero has been taken into account; in fixing a maximum and minimum value, the minimum difference is 4R (R = reproducibility). Notwithstanding this measure, which is necessary for technical reasons, the manufacturer of fuels shall nevertheless aim at a zero value where the stipulated maximum value is 2R and at the mean value in the case of quotations of maximum and minimum limits. Should it be necessary to clarify whether a fuel meets the requirements of the specifications, the terms of ISO 4259 shall be applied.

2 The range for cetane number is not in accordance with the requirements of a minimum range of 4R. However, in the case of a dispute between fuel supplier and fuel user, the terms of ISO 4259 may be used to resolve such disputes provided replicate measurements, of sufficient number to archive the necessary precision, are made in preference to single determinations.

3 Even though oxidation stability is controlled, it is likely that shelf life will be limited. Advice shall be sought from the supplier as to storage conditions and life.

4 FAME content to meet the specification of EN 14214.

]

## B.5.3. Annex: test vehicle requirements Test types I, II and VII

1. General

1.1. All components of the test vehicle shall conform to those of the production series or, if the test vehicle is different from the production series, a full description shall be given in the test report. In selecting the test vehicle, the vehicle manufacturer and the technical service shall agree to the satisfaction of the [approval authority] / [certification authority] which tested parent vehicle is representative of the related vehicle propulsion unit family as laid down in Annex B.5.10.

1.2. Unless specified differently elsewhere within the GTR, the vehicle shall be used, adjusted, specified, maintained, fuelled and lubricated as it would be in the production series and as recommended to the user. Parts and consumables shall be used which are or will be commercially available and are permitted for use on the intended roads and for the atmospheric and road conditions experienced while under test.

1.3. The lighting and signalling and auxiliary devices, except those required for the testing and usual daytime operation of the vehicle, shall be switched off.

1.4. If the batteries are operated above the ambient temperature, the operator shall follow the procedure recommended by the vehicle manufacturer in order to keep the battery temperature in the normal operating range. The vehicle manufacturer shall be in a position to attest that the thermal management system of the battery is neither disabled nor reduced.

2. Run-in

The vehicle shall be presented in good mechanical condition, properly maintained and used. It shall have been run in and driven at least 1,000 km before the test. The engine, pollutant emission abatement equipment, drive train, and vehicle shall be properly run in, in accordance with the vehicle manufacturer's requirements.

3. Adjustments

The test vehicle shall be adjusted in accordance with the vehicle manufacturer's requirements, e.g. as regards the viscosity of the oils, or, if it differs from the production series, a full description shall be given in the test report. In case of a four by four drive, the axle to which the lowest torque is delivered may be deactivated in order to allow testing on a standard chassis dynamometer.

4. Test mass and load distribution

The test mass, including the masses of the rider and the instruments, shall be measured before the beginning of the tests. The load shall be distributed across the wheels in conformity with the vehicle manufacturer's instructions.

5. Tyres

The tyres shall be of a type specified as original equipment by the vehicle manufacturer. The tyre pressures shall be adjusted to the specifications of the vehicle manufacturer or to those where the speed of the vehicle during the road test and the vehicle speed obtained on the chassis dynamometer are equalised. The tyre pressure shall be indicated in the test report.

**B.5.4. <u>Annex: classification of equivalent inertia mass and running resistance, applicable for two-wheeled vehicles (table method)</u>**

1. The chassis dynamometer can be set using the running resistance table instead of the running resistance force obtained by the coast-down methods set out in sections B.5.5. or B.5.6. In this table method, the chassis dynamometer shall be set by the reference mass regardless of particular light motor vehicle characteristics.

2. The flywheel equivalent inertia mass $m_{ref}$ shall be the equivalent inertia mass $m_i$ specified in point 3.4.6.1.2 of section B.2. The chassis dynamometer shall be set by the rolling resistance of front wheel 'a' and the aerodynamic drag coefficient 'b' specified in the following table.

| **Reference mass $m_{ref}$ (kg)** | **Equivalent inertia mass $m_i$ (kg)** | **Rolling resistance of front wheel a (N)** | **Aero drag coefficient b (N/(km/h)$^2$)** |
|---|---|---|---|
| $0 < m_{ref} \leq 25$ | 20 | 1.8 | 0.0203 |
| $25 < m_{ref} \leq 35$ | 30 | 2.6 | 0.0205 |
| $35 < m_{ref} \leq 45$ | 40 | 3.5 | 0.0206 |
| $45 < m_{ref} \leq 55$ | 50 | 4.4 | 0.0208 |
| $55 < m_{ref} \leq 65$ | 60 | 5.3 | 0.0209 |
| $65 < m_{ref} \leq 75$ | 70 | 6.8 | 0.0211 |
| $75 < m_{ref} \leq 85$ | 80 | 7.0 | 0.0212 |
| $85 < m_{ref} \leq 95$ | 90 | 7.9 | 0.0214 |
| $95 < m_{ref} \leq 105$ | 100 | 8.8 | 0.0215 |
| $105 < m_{ref} \leq 115$ | 110 | 9.7 | 0.0217 |
| $115 < m_{ref} \leq 125$ | 120 | 10.6 | 0.0218 |
| $125 < m_{ref} \leq 135$ | 130 | 11.4 | 0.0220 |
| $135 < m_{ref} \leq 145$ | 140 | 12.3 | 0.0221 |
| $145 < m_{ref} \leq 155$ | 150 | 13.2 | 0.0223 |
| $155 < m_{ref} \leq 165$ | 160 | 14.1 | 0.0224 |
| $165 < m_{ref} \leq 175$ | 170 | 15.0 | 0.0226 |
| $175 < m_{ref} \leq 185$ | 180 | 15.8 | 0.0227 |

| | | | |
|---|---|---|---|
| $185 < m_{ref} \leq 195$ | 190 | 16.7 | 0.0229 |
| $195 < m_{ref} \leq 205$ | 200 | 17.6 | 0.0230 |
| $205 < m_{ref} \leq 215$ | 210 | 18.5 | 0.0232 |
| $215 < m_{ref} \leq 225$ | 220 | 19.4 | 0.0233 |
| $225 < m_{ref} \leq 235$ | 230 | 20.2 | 0.0235 |
| $235 < m_{ref} \leq 245$ | 240 | 21.1 | 0.0236 |
| $245 < m_{ref} \leq 255$ | 250 | 22.0 | 0.0238 |
| $255 < m_{ref} \leq 265$ | 260 | 22.9 | 0.0239 |
| $265 < m_{ref} \leq 275$ | 270 | 23.8 | 0.0241 |
| $275 < m_{ref} \leq 285$ | 280 | 24.6 | 0.0242 |
| $285 < m_{ref} \leq 295$ | 290 | 25.5 | 0.0244 |
| $295 < m_{ref} \leq 305$ | 300 | 26.4 | 0.0245 |
| $305 < m_{ref} \leq 315$ | 310 | 27.3 | 0.0247 |
| $315 < m_{ref} \leq 325$ | 320 | 28.2 | 0.0248 |
| $325 < m_{ref} \leq 335$ | 330 | 29.0 | 0.0250 |
| $335 < m_{ref} \leq 345$ | 340 | 29.9 | 0.0251 |
| $345 < m_{ref} \leq 355$ | 350 | 30.8 | 0.0253 |
| $355 < m_{ref} \leq 365$ | 360 | 31.7 | 0.0254 |
| $365 < m_{ref} \leq 375$ | 370 | 32.6 | 0.0256 |
| $375 < m_{ref} \leq 385$ | 380 | 33.4 | 0.0257 |
| $385 < m_{ref} \leq 395$ | 390 | 34.3 | 0.0259 |
| $395 < m_{ref} \leq 405$ | 400 | 35.2 | 0.0260 |
| $405 < m_{ref} \leq 415$ | 410 | 36.1 | 0.0262 |
| $415 < m_{ref} \leq 425$ | 420 | 37.0 | 0.0263 |
| $425 < m_{ref} \leq 435$ | 430 | 37.8 | 0.0265 |
| $435 < m_{ref} \leq 445$ | 440 | 38.7 | 0.0266 |

| | | | |
|---|---|---|---|
| $445 < m_{ref} \leq 455$ | 450 | 39.6 | 0.0268 |
| $455 < m_{ref} \leq 465$ | 460 | 40.5 | 0.0269 |
| $465 < m_{ref} \leq 475$ | 470 | 41.4 | 0.0271 |
| $475 < m_{ref} \leq 485$ | 480 | 42.2 | 0.0272 |
| $485 < m_{ref} \leq 495$ | 490 | 43.1 | 0.0274 |
| $495 < m_{ref} \leq 505$ | 500 | 44.0 | 0.0275 |
| At every 10 kg | At every 10 kg | $a = 0.088 \times m_i$ */ | $b = 0.000015 \times m_i + 0.02$ **/ |

*/The value shall be rounded to one decimal place.

**/The value shall be rounded to four decimal places.

Table B.5.4.-1: Classification of equivalent inertia mass and running resistance used for two- and three wheeled vehicles.

## B.5.5. Annex: road tests of two-wheeled vehicles equipped with one wheel on the driven axle for the determination of test bench settings

### 1. Requirements for the rider

1.1. The rider shall wear a well-fitting (one-piece) suit or similar clothing and a protective helmet, eye protection, boots and gloves.

1.2. The rider, dressed and equipped as described in point 1.1., shall have a mass of 75 kg ± 5 kg and be 1.75 m ± 0.05 m tall.

1.3. The rider shall be seated on the seat provided, with his feet on the footrests and his arms extended normally. This position shall allow the rider to have proper control of the vehicle at all times during the tests.

### 2. Requirement for the road and ambient conditions

2.1. The test road shall be flat, level, straight and smoothly paved. The road surface shall be dry and free of obstacles or wind barriers that might impede the measurement of the running resistance. The slope of the surface shall not exceed 0.5% between any two points at least 2 m apart.

2.2. During data collecting periods, the wind shall be steady. The wind speed and the direction of the wind shall be measured continuously or with adequate frequency at a location where the wind force during coast-down is representative.

2.3. The ambient conditions shall be within the following limits:

- maximum wind speed: 3 m/s
- maximum wind speed for gusts: 5 m/s
- average wind speed, parallel: 3 m/s
- average wind speed, perpendicular: 2 m/s
- maximum relative humidity: 95%
- air temperature: 5 °C to 35 °C

2.4. Standard ambient conditions shall be as follows:

- pressure, $P_0$: 101.3 kPa
- temperature, $T_0$: 20 °C
- relative air density, $d_0$: 0.9197
- air volumetric mass, $\rho_0$: 1.189 kg/m$^3$

2.5. The relative air density when the vehicle is tested, calculated in accordance with the equation B.5.5.-1, shall not differ by more than 7.5% from the air density under the standard conditions.

2.6. The relative air density, $d_T$, shall be calculated using the following formula:

Equation B.5.5.-1

$$d_T = d_0 \cdot \frac{p_T}{p_0} \cdot \frac{T_0}{T_T}$$

where:

$d_0$ is the reference relative air density at reference conditions (0.9197)

$p_T$ is the mean ambient pressure during the test, in kPa;

$p_0$ is the reference ambient pressure (101.3 kPa);

$T_T$ is the mean ambient temperature during test, in K;

$T_0$ is the reference ambient temperature 20 °C.

**3. Condition of the test vehicle**

3.1. The test vehicle shall comply with the conditions described in point 1.1. of annex B.5.6.

3.2. When installing the measuring instruments on the test vehicle, care shall be taken to minimise their effects on the distribution of the load across the wheels. When installing the vehicle speed sensor outside the vehicle, care shall be taken to minimise the additional aerodynamic loss.

3.3. Checks

The following checks shall be made in accordance with the manufacturer's specifications for the use considered: wheels, wheel rims, tyres (make, type and pressure), front axle geometry, brake adjustment (elimination of parasitic drag), lubrication of front and rear axles, adjustment of the suspension and vehicle ground clearance, etc. Check that during freewheeling, there is no electrical braking.

**4. Specified coast-down vehicle speeds**

4.1. The coast-down times shall be measured between $v_1$ and $v_2$ as specified in Table B.5.5.-1, depending on the vehicle class as defined in point 3. of section B.1.

4.2

| Motorcycle Class | $v_j$ in km/h | $v_1$ in km/h | $v_2$ in km/h |
|---|---|---|---|
| 0-1 | 20 | 25 | 15 |
| | 15 | 20 | 10 |
| | 10 | 15 | 5 |
| 0-2 | 40 | 45 | 35 |
| | 30 | 35 | 25 |
| | 20 | 25 | 15 |
| 1 | 50 | 55 | 45 |
| | 40 | 45 | 35 |
| | 30 | 35 | 25 |
| | 20 | 25 | 15 |
| 2 | 100 | 110 | 90 |
| | 80※ | 90 | 70 |
| | 60※ | 70 | 50 |
| | 4 0※ | 45 | 35 |
| | 20※ | 25 | 15 |
| 3 | 120 | 130 | 110 |
| | 100※ | 110 | 90 |
| | 80※ | 90 | 70 |
| | 60※ | 70 | 50 |
| | 4 0※ | 45 | 35 |
| | 20※ | 25 | 15 |
| ※ Specified coast down speeds for motorcycles that have to drive the part in the "reduced speed" version. | | | |

Table B.5.5.-1: Coast-down time measurement beginning vehicle speed and ending vehicle speed.

4.3. When the running resistance is verified in accordance with point 4.2.2.3.2. of section B.2., the test can be executed at $v_j \pm 5$ km/h, provided that the coast-down time accuracy referred to in point 3.4.7. of section B.2. is ensured.

**5. Measurement of coast-down time**

5.1. After a warm-up period, the vehicle shall be accelerated to the coast-down starting vehicle speed, at which point the coast-down measurement procedure shall be started.

5.2. Since shifting the transmission to neutral can be dangerous and complicated by the construction of the vehicle, the coasting may be performed solely with the clutch disengaged. Vehicles that have no means of cutting the transmitted engine power off prior to coasting may be towed until they reach the coast-down starting vehicle speed. When the coast-down test is reproduced on the chassis dynamometer, the drive train and clutch shall be in the same condition as during the road test.

5.3. The vehicle steering shall be altered as little as possible and the brakes shall not be operated until the end of the coast-down measurement period.

5.4. The first coast-down time $\Delta t_{ai}$ corresponding to the specified vehicle speed $v_j$ shall be measured as the time taken for the vehicle to decelerate from $v_j + \Delta v$ to $v_j - \Delta v$.

5.5. The procedure described in points 5.1. to 5.4. shall be repeated in the opposite direction to measure the second coast-down time $\Delta t_{bi}$.

5.6. The average $\Delta t_i$ of the two coast-down times $\Delta t_{ai}$ and $\Delta t_{bi}$ shall be calculated using the following equation:

Equation B.5.5.-2:

$$\Delta t_i = \frac{\Delta t_{ai} + \Delta t_{bi}}{2}$$

5.7. At least four tests shall be performed and the average coast-down time $\Delta T_j$ calculated using the following equation:

Equation B.5.5.-3

$$\Delta t_j = \frac{1}{n} \cdot \sum_{i=1}^{n} \Delta t_i$$

5.8. Tests shall be performed until the statistical accuracy P is equal to or less than 3% ($P \leq 3\%$).

The statistical accuracy P (as a percentage) is calculated using the following equation:

Equation B.5.5.-4

$$P = \frac{t \cdot s}{\sqrt{n}} \cdot \frac{100}{\Delta t_j}$$

where:

t is the coefficient given in Table B.5.5.-2;

s is the standard deviation given by the following formula:

Equation B.5.5.-5

$$s = \sqrt{\sum_{i=1}^{n} \frac{(\Delta t_i - \Delta t_j)^2}{n-1}}$$

where:

n is the number of tests.

| n | t | $\frac{t}{\sqrt{n}}$ |
|---|---|---|
| 4 | 3.2 | 1.60 |
| 5 | 2.8 | 1.25 |
| 6 | 2.6 | 1.06 |
| 7 | 2.5 | 0.94 |
| 8 | 2.4 | 0.85 |
| 9 | 2.3 | 0.77 |
| 10 | 2.3 | 0.73 |
| 11 | 2.2 | 0.66 |
| 12 | 2.2 | 0.64 |
| 13 | 2.2 | 0.61 |
| 14 | 2.2 | 0.59 |
| 15 | 2.2 | 0.57 |

Table B.5.5.-2: Coefficients for statistical accuracy

5.9. In repeating the test, care shall be taken to start the coast-down after observing the same warm-up procedure and at the same coast-down starting vehicle speed.

5.10. The coast-down times for multiple specified vehicle speeds may be measured in a continuous coast-down. In this case, the coast-down shall be repeated after observing the same warm-up procedure and at the same coast-down starting vehicle speed.

5.11. The coast-down time shall be recorded. A specimen record form is given in the Regulation for administrative requirements.

## 6. Data processing

6.1. Calculation of running resistance force

6.1.1. The running resistance force $F_j$, in Newton, at the specified vehicle speed $v_j$ shall be calculated using the following equation:

Equation B.5.5.-6

$$F_j = \frac{1}{3.6} \cdot m_{ref} \cdot \frac{2 \cdot \Delta v}{\Delta t}$$

where:

$m_{ref}$ = reference mass (kg);

$\Delta v$ = vehicle speed deviation (km/h);

$\Delta t$ = calculated coast down time difference (s);

6.1.2. The running resistance force $F_j$ shall be corrected in accordance with point 6.2.

6.2. Running resistance curve fitting

The running resistance force F shall be calculated as follows:

6.2.1. The following equation shall be fitted to the data set of $F_j$ and $v_j$ obtained in points 6.1. and 4. respectively by linear regression to determine the coefficients $f_0$ and $f_2$,

Equation B.5.5.-7

$$F = f_0 + f_2 \times v^2$$

6.2.2. The coefficients $f_0$ and $f_2$ thus determined shall be corrected to the standard ambient conditions using the following equations:

Equation B.5.5.-8

$$f^*_0 = f_0 \left[1 + K_0 \left(T_T - T_0\right)\right]$$

Equation B.5.5.-9

$$f^*_2 = f_2 \times \frac{T_T}{T_0} \times \frac{p_0}{p_T}$$

where:

$K_0$ shall be determined on the basis of the empirical data for the particular vehicle and tyre tests or shall be assumed as follows, if the information is not available: $K_0 = 6 \cdot 10^{-3}\ K^{-1}$.

6.3. Target running resistance force $F^*$ for chassis dynamometer setting

The target running resistance force $F^*(v_0)$ on the chassis dynamometer at the reference vehicle speed $v_0$, in Newton, is determined using the following equation:

Equation B.5.5.-10

$$F^*\left(v_0\right) = f^*_0 + f^*_2 \times {v_0}^2$$

**B.5.6. Annex: chassis dynamometer system**

**1. Specification**

1.1. General requirements

1.1.1. The dynamometer shall be capable of simulating road load within one of the following classifications:

(a) dynamometer with fixed load curve, i.e. a dynamometer whose physical characteristics provide a fixed load curve shape;

(b) dynamometer with adjustable load curve, i.e. a dynamometer with at least two road load parameters that can be adjusted to shape the load curve.

1.1.2. Dynamometers with electric inertia simulation shall be demonstrated to be equivalent to mechanical inertia systems. The means by which equivalence is established are described in point 4.

1.1.3. Where the total resistance to progress on the road cannot be reproduced on the chassis dynamometer between vehicle speeds of 10 km/h and 120 km/h, it is recommended that a chassis dynamometer with the characteristics defined in point 1.2. should be used.

1.1.3.1. The load absorbed by the brake and the chassis dynamometer (internal frictional effects) between the vehicle speeds of 0 and 120 km/h is as follows:

Equation B.5.6.-1:

$F = (a + b \cdot v^2) \pm 0.1 \cdot F_{80}$ (without being negative)

where:

F = total load absorbed by the chassis dynamometer (N);

a = value equivalent to rolling resistance (N);

b = value equivalent to coefficient of air resistance ($N/(km/h)^2$);

v = vehicle speed (km/h);

$F_{80}$ = load at 80 km/h (N). Alternatively for vehicles that cannot attain 80 km/h the load at the reference vehicle speeds $v_j$ in table B.5.6.-1 in Annex B.5.5. or B.5.6. as applicable shall be determined.

1.2. Specific requirements

1.2.1. The setting of the dynamometer shall not be affected by the lapse of time. It shall not produce any vibrations perceptible to the vehicle and likely to impair the vehicle’s normal operations.

1.2.2. The chassis dynamometer may have one roller or two rollers in the cases of three-wheel vehicles with two front wheels and quadricycles. In such cases, the front roller shall drive, directly or indirectly, the inertial masses and the power-absorption device.

1.2.3. It shall be possible to measure and read the indicated load to an accuracy of ±5 percent.

1.2.4. In the case of a dynamometer with a fixed load curve, the accuracy of the load setting at 80 km/h or of the load setting at the reference vehicle speeds (30 km/h, respectively 15 km/h) referred to in point 1.1.3.1. for vehicles that cannot attain 80 km/h, shall be ±5 percent. In the case of a dynamometer with adjustable load curve, the accuracy of matching dynamometer load to road load shall be ±5 percent for vehicle speeds > 20 km/h and ± 10 percent for vehicle speeds ≤ 20 km/h. Below this vehicle speed, dynamometer absorption shall be positive.

1.2.5. The total inertia of the rotating parts (including the simulated inertia where applicable) shall be known and shall be within ± 10 kg of the inertia class for the test.

1.2.6. The speed of the vehicle shall be measured by the speed of rotation of the roller (the front roller in the case of a two-roller dynamometer from which the actual speed of the vehicle is calculated). It shall be measured with an accuracy of ±1 km/h at vehicle speeds over 10 km/h. The distance actually driven by the vehicle shall be measured by the movement of rotation of the roller (the front roller in the case of a two-roller dynamometer).

## 2. Dynamometer calibration procedure

2.1. Introduction

This section describes the method to be used to determine the load absorbed by a dynamometer brake. The load absorbed comprises the load absorbed by frictional effects and the load absorbed by the power-absorption device. The dynamometer is brought into operation beyond the range of test vehicle speeds. The device used for starting up the dynamometer is then disconnected; the rotational speed of the driven roller decreases. The kinetic energy of the rollers is dissipated by the power-absorption unit and by the frictional effects. This method disregards variations in the roller’s internal frictional effects caused by rollers with or without the vehicle. The frictional effects of the rear roller shall be disregarded when the roller is free.

2.2. Calibration of the load indicator at 80 km/h or of the load indicator referred to in point 1.1.3.1. for vehicles that cannot attain 80 km/h.

The following procedure shall be used for calibration of the load indicator to 80 km/h or the applicable load indicator referred to in point 1.1.3.1. for vehicles that cannot attain 80 km/h, as a function of the load absorbed (see also Figure B.5.6.-1):

2.2.1. Measure the rotational speed of the roller if this has not already been done. A fifth wheel, a revolution counter or some other method may be used.

2.2.2. Place the vehicle on the dynamometer or devise some other method for starting up the dynamometer.

2.2.3. Use the flywheel or any other system of inertia simulation for the particular inertia class to be used.

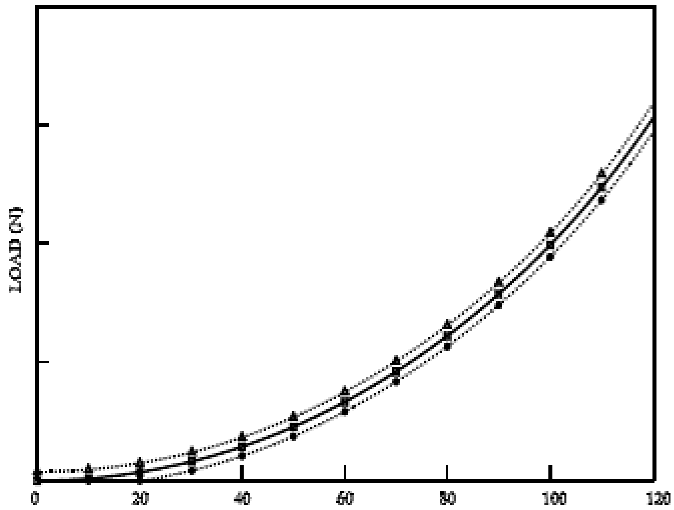



Figure B.5.6.-1: power absorbed by the chassis dynamometer

Legend:

□F = $a + b \cdot v^2$   ● = $(a + b \cdot v^2) — 0.1 \cdot F_{80}$   Δ = $(a + b \cdot v^2) + 0.1 \cdot F_{80}$

2.2.4. Bring the dynamometer to a vehicle speed of 80 km/h or to the reference vehicle speed referred to in point 1.1.3.1. for vehicles that cannot attain 80 km/h.

2.2.5. Note the load indicated $F_i$ (N).

2.2.6. Bring the dynamometer to a vehicle speed of 90 km/h or to the respective reference vehicle speed referred to in point 1.1.3.1. plus 5 km/h for vehicles that cannot attain 80 km/h

2.2.7. Disconnect the device used to start up the dynamometer.

2.2.8. Note the time taken by the dynamometer to pass from a vehicle speed of 85 to 75 km/h, or for vehicles that cannot attain 80 km/h referred to in Table B.5.5.-1: of annex B.5.5., note the time between $v_j$ + 5 km/h to $v_j$- 5 km/h.

2.2.9. Set the power-absorption device at a different level.

2.2.10. The requirements of points 2.2.4. to 2.2.9. shall be repeated sufficiently often to cover the range of loads used.

2.2.11. Calculate the load absorbed using the formula:

Equation B.5.6.-2:

$$F = \frac{m_i \cdot \Delta v}{\Delta t}$$

where:

F = load absorbed (N);

$m_i$ = equivalent inertia in kg (excluding the inertial effects of the free rear roller);

Δ v = vehicle speed deviation in m/s (10 km/h = 2.775 m/s);

Δ t = time taken by the roller to pass from 85 km/h to 75 km/h, or for vehicles that cannot attain 80 km/h from 35 – 25 km/h, respectively from 20 – 10 km/h, referred to in Table B.5.5. of Annex B.5.5.

2.2.12. Figure B.5.6.-2 shows the load indicated at 80 km/h in terms of load absorbed at 80 km/h.

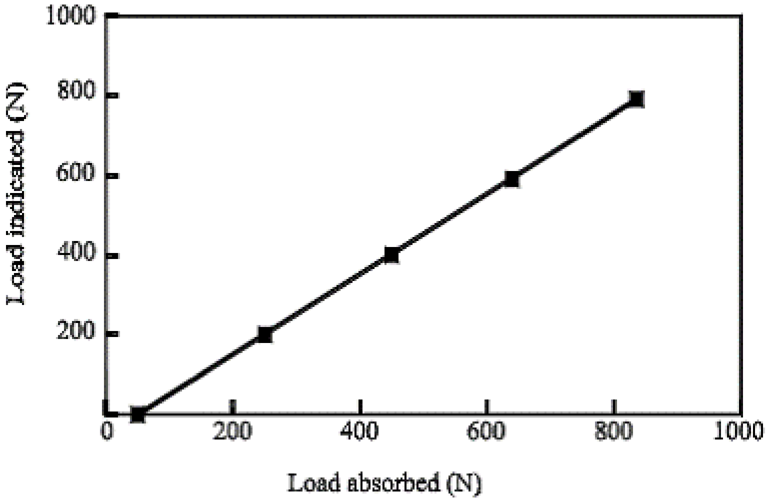



Figure B.5.6.-2: Load indicated at 80 km/h in terms of load absorbed at 80 km/h

2.2.13. The requirements laid down in points 2.2.3. to 2.2.12. shall be repeated for all inertia classes to be used.

2.3. Calibration of the load indicator at other vehicle speeds

The procedures described in point 2.2. shall be repeated as often as necessary for the chosen vehicle speeds.

2.4. Calibration of force or torque

The same procedure shall be used for force or torque calibration.

**3. Verification of the load curve**

3.1. Procedure

The load-absorption curve of the dynamometer from a reference setting at a vehicle speed of 80 km/h or for vehicles that cannot attain 80 km/h at the respective reference vehicle speeds referred to in point 1.1.3.1., shall be verified as follows:

3.1.1. Place the vehicle on the dynamometer or devise some other method for starting up the dynamometer.

3.1.2. Adjust the dynamometer to the absorbed load ($F_{80}$) at 80 km/h, or for vehicles that cannot attain 80 km/h to the absorbed load $F_{vj}$ at the respective target vehicle speed $v_j$ referred to in point 1.1.3.1.

3.1.3. Note the load absorbed at 120, 100, 80, 60, 40 and 20 km/h or for vehicles that cannot attain 80 km/h absorbed at the target vehicles speeds $v_j$ referred to in point 1.1.3.1.

3.1.4. Draw the curve F(v) and verify that it corresponds to the requirements of point 1.1.3.1.

3.1.5. Repeat the procedure set out in points 3.1.1. to 3.1.4. for other values of $F_{80}$ and for other values of inertia.

## 4 Verification of simulated inertia

4.1. Object

The method described in this Annex makes it possible to check that the simulated total inertia of the dynamometer is carried out satisfactorily in the running phase of the operating cycle. The manufacturer of the chassis dynamometer shall specify a method for verifying the specifications according to point 4.3.

4.2. Principle

4.2.1. Drawing-up working equations

Since the dynamometer is subjected to variations in the rotating speed of the roller(s), the force at the surface of the roller(s) can be expressed by:

Equation B.5.6.-3:

$$F = I \cdot \gamma = I_M \cdot \gamma + F_1$$

where:

F is the force at the surface of the roller(s) in N;

I is the total inertia of the dynamometer (equivalent inertia of the vehicle);

$I_M$ is the inertia of the mechanical masses of the dynamometer;

$\gamma$ is the tangential acceleration at roller surface;

$F_1$ is the inertia force.

Note: An explanation of this formula with reference to dynamometers with mechanically simulated inertia is appended.

Thus, total inertia is expressed as follows:

Equation B.5.6.-4:

$$I = I_m + F_1 / \gamma$$

where:

$I_m$ can be calculated or measured by traditional methods;

$F_1$ can be measured on the dynamometer;

$\gamma$ can be calculated from the peripheral rotation speed of the rollers.

The total inertia (I) will be determined during an acceleration or deceleration test with values no lower than those obtained on an operating cycle.

4.2.2. Specification for the calculation of total inertia

The test and calculation methods shall make it possible to determine the total inertia I with a relative error ($\Delta I/I$) of less than ±2 percent.

4.3. Specification

4.3.1. The mass of the simulated total inertia I shall remain the same as the theoretical value of the equivalent inertia (see Annex B.5.4.) within the following limits:

4.3.1.1. ±5 percent of the theoretical value for each instantaneous value;

4.3.1.2. ±2 percent of the theoretical value for the average value calculated for each sequence of the cycle.

The limit specified in point 4.3.1.1. is brought to ±50 percent for one second when starting and, for vehicles with manual transmission, for two seconds during gear changes.

4.4. Verification procedure

4.4.1. Verification is carried out during each test throughout the test cycles defined in Annex B.5.14.

4.4.2. However, if the requirements laid down in point 4.3. are met, with instantaneous accelerations which are at least three times greater or smaller than the values obtained in the sequences of the theoretical cycle, the verification described in point 4.4.1. will not be necessary.

## B.5.7. <u>Annex: exhaust dilution system</u>

### 1. System specification

1.1. System overview

A full-flow exhaust dilution system shall be used. This requires that the vehicle exhaust be continuously diluted with ambient air under controlled conditions. The total volume of the mixture of exhaust and dilution air shall be measured and a continuously proportional sample of the volume shall be collected for analysis. The quantities of pollutants are determined from the sample concentrations, corrected for the pollutant content of the ambient air and the totalised flow over the test period. The exhaust dilution system shall consist of a transfer tube, a mixing chamber and dilution tunnel, a dilution air conditioning, a suction device and a flow measurement device. Sampling probes shall be fitted in the dilution tunnel as specified in B.2.3.4.3.12. The mixing chamber described in this point shall be a vessel, such as those illustrated in Figures B.5.7.-1 and B.5.7.-2, in which vehicle exhaust gases and the dilution air are combined so as to produce a homogeneous mixture at the chamber outlet.

1.2. General requirements

1.2.1. The vehicle exhaust gases shall be diluted with a sufficient amount of ambient air to prevent any water condensation in the sampling and measuring system under any conditions which may occur during a test.

1.2.2. The mixture of air and exhaust gases shall be homogeneous at the point where the sampling probe is located (see point 1.3.3.). The sampling probe shall extract a representative sample of the diluted exhaust gas.

1.2.3. The system shall enable the total volume of the diluted exhaust gases to be measured.

1.2.4. The sampling system shall be gas-tight. The design of the variable dilution sampling system and the materials that go to make it up shall be such that they do not affect the pollutant concentration in the diluted exhaust gases. Should any component in the system (heat exchanger, cyclone separator, blower, etc.) change the concentration of any of the pollutants in the diluted exhaust gases and the fault cannot be corrected, sampling for that pollutant shall be carried out upstream from that component.

1.2.5. All parts of the dilution system that are in contact with raw and diluted exhaust gas shall be designed to minimise deposition or alteration of the particulates or particles. All parts shall be made of electrically conductive materials that do not react with exhaust gas components and shall be electrically grounded to prevent electrostatic effects.

1.2.6. If the vehicle being tested is equipped with an exhaust pipe comprising several branches, the connecting tubes shall be connected as near as possible to the vehicle without adversely affecting its operation.

1.2.7. The variable-dilution system shall be designed so as to enable the exhaust gases to be sampled without appreciably changing the back-pressure at the exhaust pipe outlet.

1.2.8. The connecting tube between the vehicle and dilution system shall be so designed as to minimise heat loss.

1.3. Specific requirements

1.3.1. Connection to vehicle exhaust

The connecting tube between the vehicle exhaust outlets and the dilution system shall be as short as possible and satisfy the following requirements:

(a) the tube shall be less than 3.6 m long, or less than 6.1 m long if heat insulated. Its internal diameter may not exceed 105 mm;

(b) it shall not cause the static pressure at the exhaust outlets on the test vehicle to differ by more than ±0.75kPa at 50 km/h, or more than ±1.25 kPa for the whole duration of the test, from the static pressures recorded when nothing is connected to the vehicle exhaust outlets. The pressure shall be measured in the exhaust outlet or in an extension having the same diameter, as near as possible to the end of the pipe. Sampling systems capable of maintaining the static pressure to within ±0.25 kPa may be used if a written request from a manufacturer to the technical service substantiates the need for the closer tolerance;

(c) it shall not change the nature of the exhaust gas;

(d) any elastomeric connectors employed shall be as thermally stable as possible and have minimum exposure to the exhaust gases.

1.3.2. Dilution air conditioning

The dilution air used for the primary dilution of the exhaust in the CVS tunnel shall be passed through a medium capable of reducing particles in the most penetrating particle size of the filter material by ≥ 99.95 percent, or through a filter of at least class H13 of EN 1822:1998. This represents the specification of High Efficiency Particulate Air (HEPA) filters. The dilution air may be charcoal scrubbed before being passed to the HEPA filter. It is recommended that an additional coarse particle filter is situated before the HEPA filter and after the charcoal scrubber, if used. At the vehicle manufacturer's request, the dilution air may be sampled according to good engineering practice to determine the tunnel contribution to background particulate mass levels, which can then be subtracted from the values measured in the diluted exhaust.

1.3.3. Dilution tunnel

Provision shall be made for the vehicle exhaust gases and the dilution air to be mixed. A mixing orifice may be used. In order to minimise the effects on the conditions at the exhaust outlet and to limit the drop in pressure inside the dilution-air conditioning device, if any, the pressure at the mixing point shall not differ by more than ±0.25 kPa from atmospheric pressure. The homogeneity of the mixture in any cross-section at the location of the sampling probe shall not vary by more than ±2 percent from the average of the values obtained for at least five points located at equal intervals on the diameter of the gas stream. For particulate and particle emissions sampling, a dilution tunnel shall be used which:

(a) shall consist of a straight tube of electrically-conductive material, which shall be earthed;

(b) shall be small enough in diameter to cause turbulent flow (Reynolds number ≥ 4000) and of sufficient length to cause complete mixing of the exhaust and dilution air;

(c) shall be at least 200 mm in diameter;

(d) may be insulated.

1.3.4. Suction device

This device may have a range of fixed rotation speeds to ensure sufficient flow to prevent any water condensation. This result is generally obtained if the flow is either:

(a) twice the maximum flow of exhaust gas produced by accelerations of the driving cycle; or

(b) sufficient to ensure that the $CO_2$ concentration in the dilute exhaust sample bag is less than 3 percent by volume for petrol and diesel.

1.3.5. Volume measurement in the primary dilution system

The method for measuring total dilute exhaust volume incorporated in the constant volume sampler shall be such that measurement is accurate to ± 2 percent under all operating conditions. If the device cannot compensate for variations in the temperature of the mixture of exhaust gases and dilution air at the measuring point, a heat exchanger shall be used to maintain the temperature to within ±6 °C of the specified operating temperature. If necessary, some form of protection for the volume measuring device may be used, e.g. a cyclone separator, bulk stream filter, etc. A temperature sensor shall be installed immediately before the volume measuring device. This sensor shall have an accuracy and a precision of ±1 °C and a response time of 0.1 s at 62 percent of a given temperature variation (value measured in silicone oil). The difference from atmospheric pressure shall be measured upstream and, if necessary, downstream from the volume measuring device. The pressure measurements shall have a precision and an accuracy of ±0.4 kPa during the test.

1.4. Recommended system descriptions

Figure B.5.7.-1 and Figure B.5.7.-2 are schematic drawings of two types of recommended exhaust dilution systems that meet the requirements of this Annex. Since various configurations can produce accurate results, exact conformity with these figures is not essential. Additional components such as instruments, valves, solenoids and switches may be used to provide additional information and coordinate the functions of the component system.

1.4.1. Full-flow dilution system with positive displacement pump

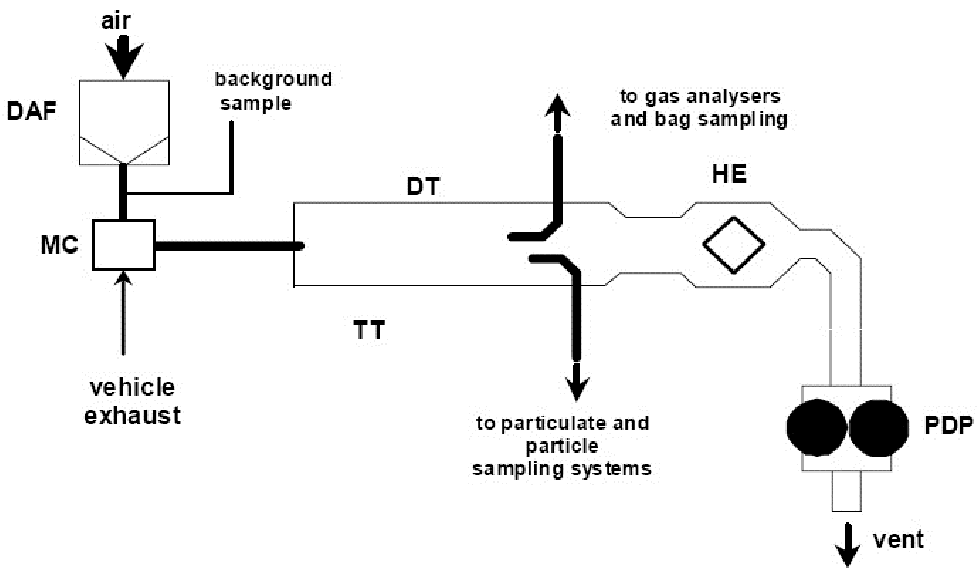



Figure B.5.7.-1: Positive displacement pump dilution system

The positive displacement pump (PDP) full-flow dilution system satisfies the requirements of this Annex by metering the flow of gas through the pump at constant temperature and pressure. The total volume is measured by counting the revolutions of the calibrated positive displacement pump. The proportional sample is achieved by sampling with pump, flow meter and flow control valve at a constant flow rate. The collecting equipment consists of:

1.4.1.1. A filter (refer to DAF in Figure B.5.7.-1) for the dilution air shall be installed, which can be preheated if necessary. This filter shall consist of the following filters in sequence: an optional activated charcoal filter (inlet side) and a high efficiency particulate air (HEPA) filter (outlet side). It is recommended that an additional coarse particle filter is situated before the HEPA filter and after the charcoal filter, if used. The purpose of the charcoal filter is to reduce and stabilise the hydrocarbon concentrations of ambient emissions in the dilution air;

1.4.1.2. A transfer tube (TT) by which vehicle exhaust is admitted into a dilution tunnel (DT) in which the exhaust gas and dilution air are mixed homogeneously;

1.4.1.3. The positive displacement pump (PDP), producing a constant-volume flow of the air/exhaust-gas mixture. The PDP revolutions, together with associated temperature and pressure measurement, are used to determine the flow rate;

1.4.1.4. A heat exchanger (HE) of a capacity sufficient to ensure that throughout the test the temperature of the air/exhaust-gas mixture measured at a point immediately upstream of the positive displacement pump is within 6.0 °C of the average operating temperature during the test. This device shall not affect the pollutant concentrations of diluted gases taken off afterwards for analysis.

1.4.1.5. A mixing chamber (MC) in which exhaust gas and air are mixed homogeneously and which may be located close to the vehicle so that the length of the transfer tube (TT) is minimised.

1.4.2. Full-flow dilution system with critical-flow venturi

**Critical-Flow Venturi Dilution System**

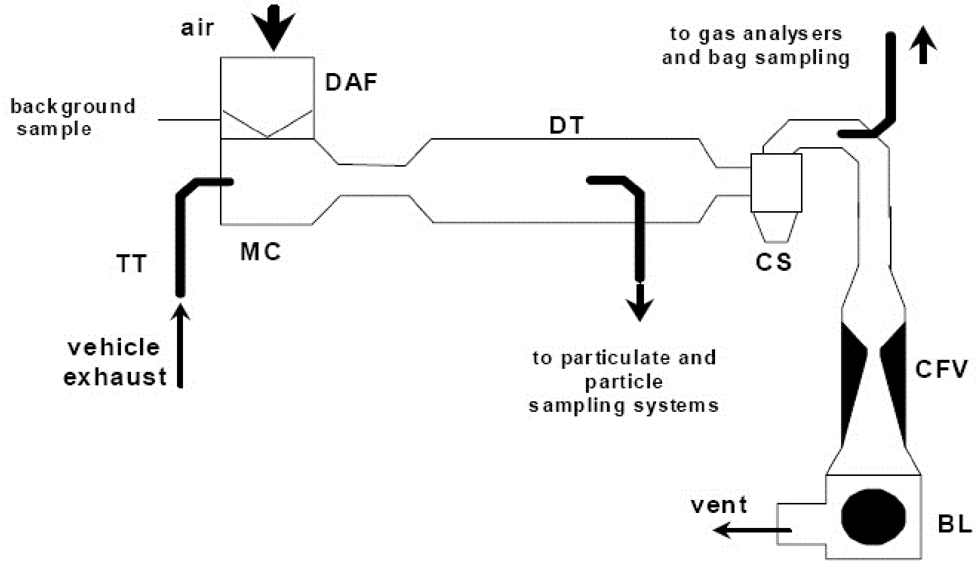



Figure B.5.7.-2: Critical-flow venturi dilution system

The use of a critical-flow venturi (CFV) for the full-flow dilution system is based on the principles of flow mechanics for critical flow. The variable mixture flow rate of dilution and exhaust gas is maintained at sonic velocity which is directly proportional to the square root of the gas temperature. Flow is continually monitored, computed and integrated throughout the test. The use of an additional critical-flow sampling venturi ensures the proportionality of the gas samples taken from the dilution tunnel. As pressure and temperature are both equal at the two venturi inlets, the volume of the gas flow diverted for sampling is proportional to the total volume of diluted exhaust-gas mixture produced, and thus the requirements of this Annex are met. The collecting equipment consists of:

1.4.2.1. A filter (DAF) for the dilution air which can be preheated if necessary. This filter shall consist of the following filters in sequence: an optional activated charcoal filter (inlet side) and a high efficiency particulate air (HEPA) filter (outlet side). It is recommended that an additional coarse particle filter is situated before the HEPA filter and after the charcoal filter, if used. The purpose of the charcoal filter is to reduce and stabilise the hydrocarbon concentrations of ambient emissions in the dilution air;

1.4.2.2. A mixing chamber (MC) in which exhaust gas and air are mixed homogeneously and which may be located close to the vehicle so that the length of the transfer tube (TT) is minimised;

1.4.2.3. A dilution tunnel (DT) from which particulates and particles are sampled;

1.4.2.4. Some form of protection for the measurement system may be used, e.g. a cyclone separator, bulk stream filter, etc.;

1.4.2.5. A measuring critical-flow venturi tube (CFV) to measure the flow volume of the diluted exhaust gas;

1.4.2.6. A blower (BL) of sufficient capacity to handle the total volume of diluted exhaust gas.

**2. CVS calibration procedure**

2.1. General requirements

The CVS system shall be calibrated by using an accurate flow-meter and a restricting device. The flow through the system shall be measured at various pressure readings and the control parameters of the system measured and related to the flows. The flow-meter shall be dynamic and suitable for the high flow-rate encountered in CVS testing. The device shall be of certified accuracy traceable to an approved national or international standard.

2.1.1. Various types of flow-meter may be used, e.g. calibrated venturi, laminar flow-meter, calibrated turbine-meter, provided that they are dynamic measurement systems and can meet the requirements of point 1.3.5. of this Annex.

2.1.2. The following points give details of methods of calibrating PDP and CFV units, using a laminar flow-meter which gives the required accuracy, together with a statistical check on the calibration validity.

2.2. Calibration of the positive displacement pump (PDP)

2.2.1. The following calibration procedure outlines the equipment, the test configuration and the various parameters that are measured to establish the flow-rate of the CVS pump. All the parameters relating to the pump are simultaneously measured with the parameters relating to the flow-meter which is connected in series with the pump. The calculated flow rate (given in $m^3$/min at pump inlet, absolute pressure and temperature) can then be plotted against a correlation function that is the value of a specific combination of pump parameters. The linear equation that relates the pump flow and the correlation function is then determined. If a CVS has a multiple rotation speed drive, a calibration shall be performed for each range used.

2.2.2. This calibration procedure is based on the measurement of the absolute values of the pump and flow-meter parameters that relate to the flow rate at each point. Three conditions shall be maintained to ensure the accuracy and integrity of the calibration curve:

2.2.2.1. The pump pressures shall be measured at tappings on the pump rather than at the external piping on the pump inlet and outlet. Pressure taps that are mounted at the top centre and bottom centre of the pump drive head plate are exposed to the actual pump cavity pressures and therefore reflect the absolute pressure differentials;

2.2.2.2. Temperature stability shall be maintained during the calibration. The laminar flow-meter is sensitive to inlet temperature oscillations which cause the data points to be scattered. Gradual changes of ±1 °C in temperature are acceptable as long as they occur over a period of several minutes;

2.2.2.3. All connections between the flow-meter and the CVS pump shall be free of any leakage.

2.2.3. During an exhaust emission test, the measurement of these same pump parameters enables the user to calculate the flow rate from the calibration equation.

2.2.4. Figure B.5.7.-3 of this Annex shows one possible test set-up. Variations are permissible, provided that the technical service approves them as being of comparable accuracy. If the set-up shown in Figure B.5.7.-3 is used, the following data shall be found within the limits of precision given:

Barometric pressure (corrected) ($P_b$) ±0.03 kPa

Ambient temperature (T) ±0.2 °C

Air temperature at LFE (ETI) ± 0.15 °C

Pressure depression upstream of LFE (EPI) ±0.01 kPa

Pressure drop across the LFE matrix (EDP) ±0.0015 kPa

Air temperature at CVS pump inlet (PTI) ±0.2 °C

Air temperature at CVS pump outlet (PTO) ± 0.2 °C

Pressure depression at CVS pump inlet (PPI) ±0.22 kPa

Pressure head at CVS pump outlet (PPO) ±0.22 kPa

Pump revolutions during test period (n) ±1 $min^{-1}$

Elapsed time for period (minimum 250 s) (t) ±0.1 s

Figure 8
**PDP Calibration Configuration**

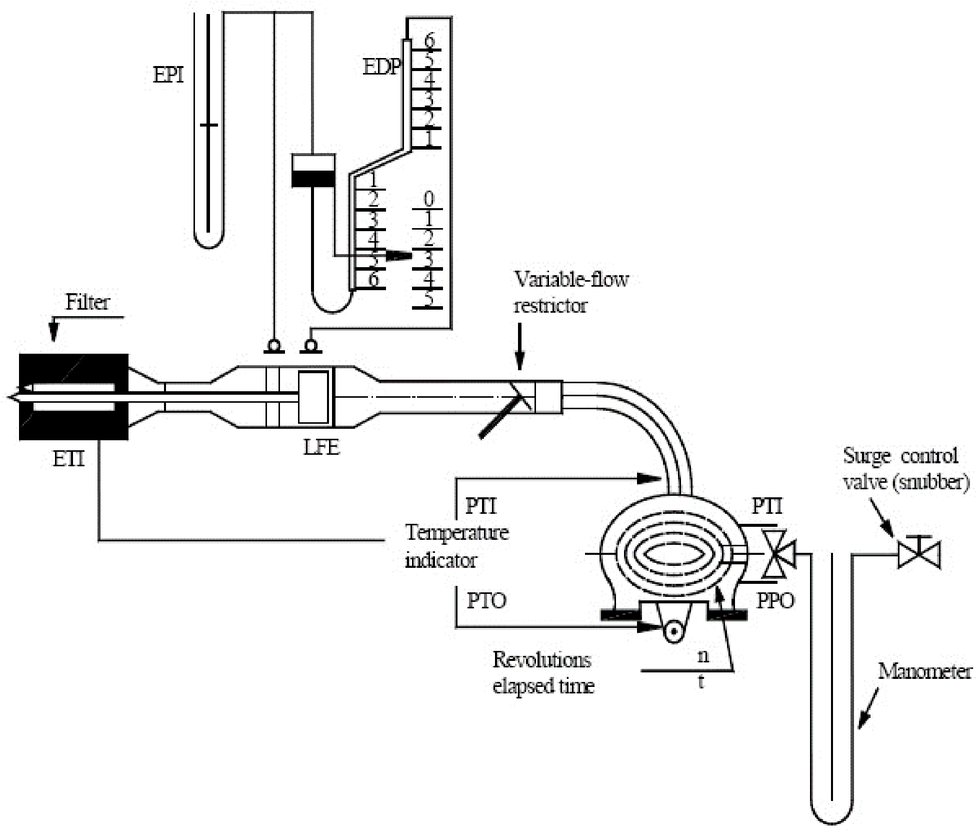



Figure B.5.7.-3 PDP calibration configuration

2.2.5. After the system has been connected as shown in Figure B.5.7.-3, set the variable restrictor in the wide-open position and run the CVS pump for 20 minutes before starting the calibration.

2.2.6. Reset the restrictor valve to a more restricted condition in an increment of pump inlet depression (about 1 kPa) that will yield a minimum of six data points for the total calibration. Allow the system to stabilise for three minutes and repeat the data acquisition.

2.2.7. The air flow rate (Qs) at each test point is calculated in standard $m^3$/min from the flow-meter data using the manufacturer's prescribed method.

2.2.8. The air flow-rate is then converted to pump flow (V0) in $m^3$/rev at absolute pump inlet temperature and pressure.

Equation B.5.7.-1:

$$V_0 = \frac{Q_s}{n} \cdot \frac{T_p}{273.2} \cdot \frac{101.33}{P_p}$$

where:

$V_0$ = pump flow rate at $T_p$ and $P_p$ ($m^3$/rev);

Qs = air flow at 101.33 kPa and 0 °C in ($m^3$/min);

$T_p$ = pump inlet temperature (K);

$P_p$ = absolute pump inlet pressure (kPa);

n = pump rotation speed (min-1).

2.2.9.

To compensate for the interaction of pump rotation speed pressure variations at the pump and the pump slip rate, the correlation function ($x_0$) between the pump rotation speed (n), the pressure differential from pump inlet to pump outlet, and the absolute pump outlet pressure is calculated as follows:

Equation B.5.7.-2:

$$x_0 = \frac{1}{n}\sqrt{\frac{\Delta P_p}{P_e}}$$

where:

$x_0$ = correlation function;

$\Delta P_p$ = pressure differential from pump inlet to pump outlet (kPa);

$P_e$ = absolute outlet pressure (PPO + $P_b$) (kPa).

2.2.9.1. A linear least-square fit is performed to generate the calibration equations which have the formula:

Equation B.5.7.-3:

$V_0 = D_0$ — M ($x_0$)

n = A — B ($\Delta P_p$)

$D_0$, M, A and B are the slope-intercept constants describing the lines.

2.2.10. A CVS system that has multiple pump rotation speeds shall be calibrated on each rotation speed used. The calibration curves generated for the ranges shall be approximately parallel and the intercept values (D0) shall increase as the pump flow range decreases.

2.2.11 If the calibration has been performed carefully, the calculated values from the equation will be within 0.5 percent of the measured value of V0.Values of M will vary from one pump to another. Calibration is performed at pump start-up and after major maintenance.

2.3. Calibration of the critical-flow venturi (CFV)

2.3.1. Calibration of the CFV is based on the flow equation for a critical-flow venturi:

Equation B.5.7.-4

$$Q_s = \frac{K_v P}{\sqrt{T}}$$

where:

$Q_s$ = flow;

$K_v$ = calibration coefficient;

P = absolute pressure (kPa);

T = absolute temperature (K).

Gas flow is a function of inlet pressure and temperature. The calibration procedure described in points 2.3.2. to 2.3.7. shall establish the value of the calibration coefficient at measured values of pressure, temperature and air flow.

2.3.2. The manufacturer’s recommended procedure shall be followed for calibrating electronic portions of the CFV.

2.3.3. Measurements for flow calibration of the critical-flow venturi are required and the following data shall be found within the limits of precision given:

Barometric pressure (corrected) (Pb) ±0.03 kPa

LFE air temperature, flow-meter (ETI) ±0.15 °C

Pressure depression upstream of LFE (EPI) ±0.01 kPa

Pressure drop across (EDP) LFE matrix ±0.0015 kPa

Air flow (Qs) ±0.5 percent

CFV inlet depression (PPI) ±0.02 kPa

Temperature at venturi inlet (Tv) ±0.2 °C.

2.3.4. The equipment shall be set up as shown in Figure B.5.7.-4 and checked for leaks. Any leaks between the flow-measuring device and the critical-flow venturi will seriously affect the accuracy of the calibration.

**CFV Calibration Configuration**

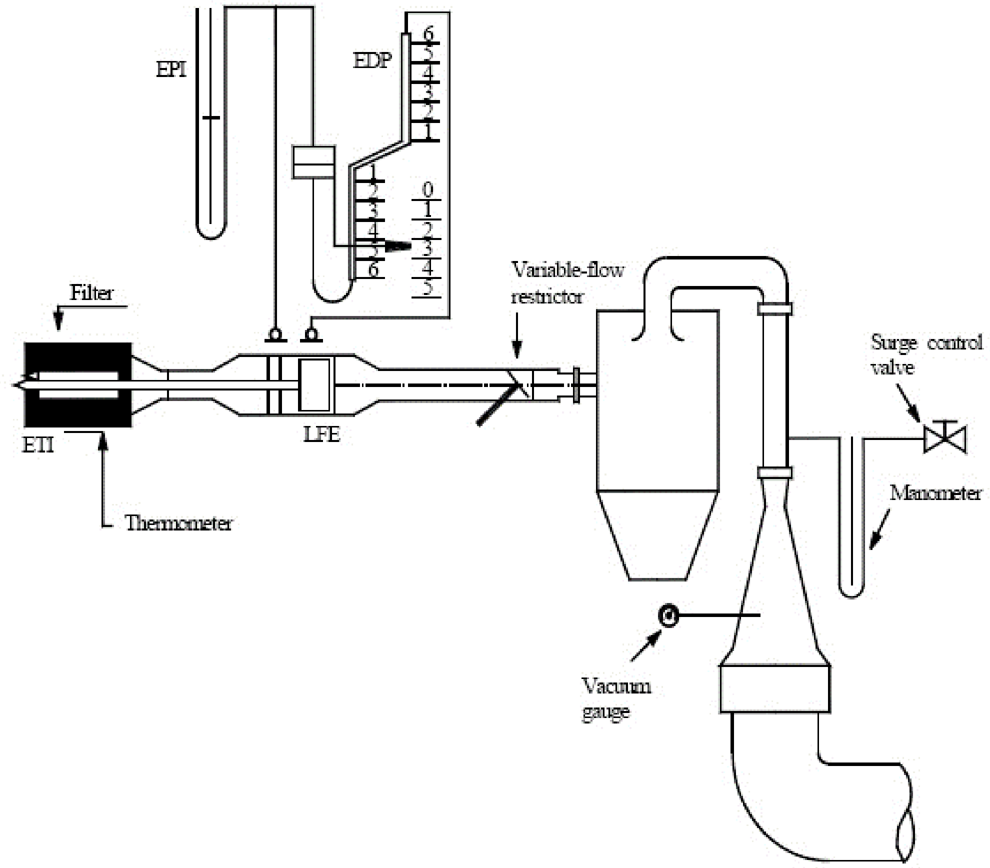



Figure B.5.7.-4 CFV calibration configuration

2.3.5. The variable-flow restrictor shall be set to the open position, the blower shall be started and the system stabilised. Data from all instruments shall be recorded.

2.3.6. The flow restrictor shall be varied and at least eight readings shall be taken across the critical flow range of the venturi.

2.3.7. The data recorded during the calibration shall be used in the following calculations. The air flow-rate (Qs) at each test point is calculated from the flow-meter data using the manufacturer's prescribed method. Calculate values of the calibration coefficient ($K_v$) for each test point:

Equation B.5.8.-5:

$$K_v = \frac{Q_s \sqrt{T_v}}{P_v}$$

where:

$Q_s$ = flow-rate in $m^3$/min at 0 °C and 101.3 kPa;

$T_v$ = temperature at the venturi inlet (K);

$P_v$ = absolute pressure at the venturi inlet (kPa).

Plot $K_v$ as a function of venturi inlet pressure. For sonic flow, $K_v$ will have a relatively constant value. As pressure decreases (vacuum increases), the venturi becomes unchoked and $K_v$ decreases. The resultant $K_v$ changes are not permissible. For a minimum of eight points in the critical region, calculate an average $K_v$ and the standard deviation. If the standard deviation exceeds 0.3 percent of the average $K_v$, take corrective action.

**3. System verification procedure**

3.1. General requirements

The total accuracy of the CVS sampling system and analytical system shall be determined by introducing a known mass of a pollutant gas into the system while it is being operated as if during a normal test and then analysing and calculating the pollutant mass according to the formula in point 4, except that the density of propane shall be taken as 1.967 grams per litre at standard conditions. The two techniques described in points 3.2. and 3.3. are known to give sufficient accuracy. The maximum permissible deviation between the quantity of gas introduced and the quantity of gas measured is 5 percent.

3.2. CFO method

3.2.1. Metering a constant flow of pure gas (CO or $C_3H_8$) using a critical-flow orifice device

3.2.2. A known quantity of pure gas (CO or $C_3H_8$) is fed into the CVS system through the calibrated critical orifice. If the inlet pressure is high enough, the flow-rate (q), which is adjusted by means of the critical-flow orifice, is independent of orifice outlet pressure (critical flow). If deviations exceeding 5 percent occur, the cause of the malfunction shall be determined and corrected. The CVS system is operated as in an exhaust emission test for about five to ten minutes. The gas collected in the sampling bag is analysed by the usual equipment and the results compared to the concentration of the gas samples which was known beforehand.

3.3. Gravimetric method

3.3.1. Metering a limited quantity of pure gas (CO or $C_3H_8$) by means of a gravimetric technique

3.3.2. The following gravimetric procedure may be used to verify the CVS system. The weight of a small cylinder filled with either carbon monoxide or propane is determined with a precision of ±0.01 g. For about five to ten minutes, the CVS system is operated as in a normal exhaust emission test, while CO or propane is injected into the system. The quantity of pure gas involved is determined by means of differential weighing. The gas accumulated in the bag is analysed using the equipment normally used for exhaust-gas analysis. The results are then compared to the concentration figures computed previously.

B.5.8. **~~Annex: [approval] / [certification] tests of a replacement pollution-control device type as separate technical unit~~**

1. **~~Scope of the annex~~**

~~This Annex applies to the [approval] / [certification] of pollution-control devices as separate technical units to be fitted as replacement parts on one or more types of vehicle.~~

2. **~~Application for environmental performance [approval] / [certification]~~**

2.1. ~~Applications for [approval] / [certification] of a type of replacement pollution-control device as a separate technical unit shall be submitted by the manufacturer of the system or by his authorised representative.~~

2.2. ~~A model for the information document is referred to in Annex B.5.11.~~

2.3. ~~For each type of replacement pollution-control device for which [approval] / [certification] is requested, the [approval] / [certification] application shall be accompanied by the following documents in triplicate, and by the following particulars:~~

2.3.1. ~~A description of the types of vehicles for which the device is intended, in terms of its characteristics;~~

2.3.2. ~~The numbers or symbols specific to the propulsion unit and vehicle type;~~

2.3.3. ~~Description of the replacement catalytic converter type stating the relative position of each of its components, together with the fitting instructions;~~

2.3.4. ~~Drawings of each component to facilitate location and identification, and statement of materials used. These drawings shall also indicate the intended location of the mandatory [approval] / [certification] mark.~~

2.4. ~~The following shall be submitted to the technical service responsible for the [approval] / [certification] test:~~

2.4.1. ~~Vehicle(s) of a type [approved] / [certified] in accordance with this annex equipped with a new original equipment pollution-control device type. This (these) vehicles shall be selected by the applicant with the agreement of the technical service to the satisfaction of the [approval authority] / [certification authority]. It (they) shall comply with the requirements of the type I test set out in section B.2.~~

2.4.2 ~~The test vehicles shall be without emission-control system defects and be properly maintained and used; any excessively worn out or malfunctioning emission-related original part shall be repaired or replaced. The test vehicles shall be tuned properly and set to the manufacturer's specification prior to emission testing.~~

2.4.3. One sample of the type of the replacement pollution-control device type. This sample shall be clearly and indelibly marked with the applicant's trade name or mark and its commercial designation.

**3. Requirements**

3.1. General requirements

The design, construction and mounting of the replacement pollution-control device type shall be such that:

3.1.1. the vehicle complies with the requirements of this GTR under normal conditions of use, and in particular regardless of any vibrations to which it may be subjected;

3.1.2. the replacement pollution-control device displays reasonable resistance to the corrosion phenomena to which it is exposed, with due regard to the normal conditions of use of the vehicle;

3.1.3. the ground clearance available with the original equipment pollution-control device type and the angle at which the vehicle can lean over are not reduced;

3.1.4. the surface of the device does not reach unduly high temperatures;

3.1.5. the outline of the device has no projections or sharp edges;

3.1.6. shock absorbers and suspension have adequate clearance;

3.1.7. adequate safety clearance is provided for pipes;

3.1.8. the replacement pollution-control device is impact-resistant in a way that is compatible with clearly-defined maintenance and installation requirements;

3.1.9. if the original equipment pollution-control includes thermal protection, the replacement pollution-control device shall include equivalent protection;

3.1.10. if (an) oxygen probe(s) and other sensors or actuators are originally installed on the exhaust line, the replacement pollution-control device type shall be installed at exactly the same position as the original equipment pollution-control device and the position on the exhaust line of the oxygen probe(s) and other sensors or actuators shall not be modified.

3.2. Requirements regarding emissions

3.2.1. The vehicle referred to in point 2.4.1, equipped with a replacement pollution-control device of the type for which [approval] / [certification] is requested, shall undergo the tests laid down in sections B.2., B.3, B.4. and B.4. (depending on the [approval] / [certification] of the vehicle)[1].

3.2.1.1. Evaluation of pollutant emissions from vehicles equipped with replacement

[1]As provided for in this GTR in the version applicable to the type-approval of that vehicle.

pollution-control devices

Requirements regarding tailpipe or evaporative emissions are deemed to be complied with if the test vehicle equipped with the replacement pollutant-control device complies with the limit values in point 9. of section B.1. (according to the [approval] / [certification] of the vehicle)[1].

3.2.1.2. • Where the [approval] / [certification] application is for different types of vehicles from the same manufacturer, the type I test may be limited to as few as two vehicles selected after agreement with the technical service to the satisfaction of the [approval authority] / [certification authority], provided that the different types of vehicle are fitted with the same type of original equipment pollution-control device.

3.2.2. • Requirements regarding permissible sound level

• The vehicles referred to in point 2.4.1, equipped with a replacement pollution-control device type that could allow worse noise emissions than the type for which [approval] / [certification] is requested, shall satisfy the applicable requirements of UN Regulations No 9, 41, 63 or 92. The test result for the vehicle in motion and for the stationary test shall be mentioned in the test report.

3.3. • Testing of the propulsion unit performance of the vehicle

3.3.1. • The replacement pollution-control device type shall be such as to ensure that the propulsion unit performance of the vehicle is comparable with that achieved with the original equipment pollution-control device type.

3.3.2. • The propulsion unit performance of the vehicle equipped with the replacement pollution-control device shall be compared with that of an original equipment pollution-control device, also in new condition, fitted in turn to the vehicle referred to in point 2.4.1.

3.3.3. • The maximum net power and maximum net torque as well as the maximum design vehicle speed, if applicable, measured with the replacement pollution-control device, shall not deviate by more than + 5% from those measured under the same conditions with the [approved] / [certified] original equipment pollution-control device type.

B.5.9. 1. **<u>Annex: vehicle propulsion unit family with regard to environmental performance demonstration tests</u>**

**1. 2. Introduction**

1.1. 3. In order to alleviate the test burden on manufacturers when demonstrating the environmental performance of vehicles these may be grouped as a vehicle propulsion unit family. One or more parent vehicles shall be selected from this group of vehicles by the manufacturer to the satisfaction of the [approval authority] / [certification authority] that shall be used to demonstrate environmental performance test types I, II and VII.

1.2. 4. A light motor vehicle may continue to be regarded as belonging to the same vehicle propulsion unit family provided that the vehicle variant, version, propulsion unit, pollution-control system listed in table B.5.9.-1 are identical or remain within the prescribed and declared tolerances.

1.3. 5. Vehicle and propulsion unit family attribution with regard to environmental tests

6. For the environmental test types I, II and VII a representative parent vehicle shall be selected within the boundaries set by the classification criteria laid down in point 2.

**2. Classification criteria**

7. (**'X'** in the following table means 'applicable')

| **8.** | **9. Classification criteria description** | **10. Test type I** | **11. Test type II** | **12. Test type VII** |
|---|---|---|---|---|
| **1.** | **Vehicle** | | | |
| 1.1. | category; | **X** | **X** | **X** |
| 1.2. | sub-category; | **X** | **X** | **X** |
| 1.3. | the inertia of a vehicle variant(s) or version(s) within two inertia categories above or below the nominal inertia category; | **X** | | **X** |
| 1.4. | overall gear ratios (+/- 8%); | **X** | | **X** |
| **2.** | **Propulsion family characteristics** | | | |
| 2.3. | number of cylinders of the combustion engine; | **X** | **X** | **X** |
| 2.4. | engine capacity (+/- 2 %)(1) of the combustion engine; | **X** | **X** | **X** |
| 2.5. | number and control (variable cam phasing or lift) of combustion engine valves; | **X** | **X** | **X** |

| | | | | |
|---|---|---|---|---|
| 2.6. | monofuel / bifuel / flex fuel $H_2NG$ / multifuel; | **X** | **X** | **X** |
| 2.7. | fuel system (carburettor / scavenging port / port fuel injection / direct fuel injection / common rail / pump-injector / other); | **X** | **X** | **X** |
| 2.8. | fuel storage(2); | 13. | 14. | 15. |
| 2.9. | 16. type of cooling system of combustion engine; | **X** | **X** | **X** |
| 2.10. | 17. combustion cycle (PI / CI / two-stroke / four-stroke / other); | **X** | **X** | **X** |
| 2.11. | 18. intake air system (naturally aspirated / charged (turbocharger / super-charger) / intercooler / boost control) and air induction control (mechanical throttle / electronic throttle control / no throttle); | **X** | **X** | **X** |
| **19. .** | **Pollution control system characteristics** | | | |
| 20. .1. | 21. propulsion unit exhaust (not) equipped with catalytic converter(s); | **X** | **X** | **X** |
| 3.1. | 22. catalytic converter(s) type; | **X** | **X** | **X** |
| 23. .1.1. | 24. number and elements of catalytic converters; | **X** | **X** | **X** |
| 25. .1.2. | 26. size of catalytic converters (volume of monolith(s) +/- 15 %); | **X** | **X** | **X** |
| 27. .1.3. | 28. operation principle of catalytic activity (oxidising, three-way, heated, SCR, other.); | **X** | **X** | **X** |
| 29. .1.4. | 30. precious metal load (identical or higher); | **X** | **X** | **X** |
| 31. .1. | 32. precious metal ratio (+/- 15 %); | **X** | **X** | **X** |
| 33. .1.5. | 34. substrate (structure and material); | **X** | **X** | **X** |
| 35. .1.6. | 36. cell density; | **X** | **X** | **X** |
| 37. .1.7. | 38. type of casing for the catalytic converter(s); | **X** | **X** | **X** |
| 39. .2. | 40. propulsion unit exhaust (not) equipped with particulate filter (PF); | **X** | **X** | **X** |
| 3.2.1. | 41. PF types; | **X** | **X** | **X** |

| | | | | |
|---|---|---|---|---|
| 3.2.2. | 42. number and elements of PF; | **X** | **X** | **X** |
| 3.2.3. | 43. size of PF (volume of filter element +/- 10 %); | **X** | **X** | **X** |
| 3.2.4. | 44. operation principle of PF (partial / wall-flow / other); | **X** | **X** | **X** |
| 3.2.5. | 45. active surface of PF; | **X** | **X** | **X** |
| 46. .3. | 47. Propulsion unit (not) equipped with periodically regenerating system; | **X** | **X** | **X** |
| 3.3.1. | 48. periodically regenerating system type; | **X** | **X** | **X** |
| 3.3.2. | 49. operation principle of periodically regenerating system; | **X** | **X** | **X** |
| 50. .4. | 51. propulsion (not) equipped with selective catalytic converter reduction (SCR) system; | **X** | **X** | **X** |
| 3.4.1. | 52. SCR system type; | **X** | **X** | **X** |
| 3.4.2. | 53. operation principle of periodically regenerating system; | **X** | **X** | **X** |
| 54. .5. | 55. Propulsion unit (not) equipped with lean NOx trap /absorber; | **X** | **X** | **X** |
| 56. .5.1. | 57. lean NOx trap / absorber type; | **X** | **X** | **X** |
| 58. .5.2. | 59. operation principle of lean NOx trap / absorber; | **X** | **X** | **X** |
| 60. .6. | Propulsion unit (not) equipped with a cold-start device or starting aid device(s); | **X** | **X** | **X** |
| 61. .6.1. | cold-start or starting aid device type; | **X** | **X** | **X** |
| 62. .6.2. | operation principle of cold start or starting aid device(s); | **X** | **X** | **X** |
| 63. .6.3. | Activation time of cold-start or starting aid device(s) and /or duty cycle (only limited time activated after cold start / continuous operation); | **X** | **X** | **X** |
| 64. .7. | propulsion unit (not) equipped with $O_2$ sensor for fuel control; | **X** | **X** | **X** |
| 65. .7.1. | $O_2$ sensor types; | **X** | **X** | **X** |
| 66. .7.2. | operation principle of $O_2$ sensor (binary / wide range / other); | **X** | **X** | **X** |
| 67. .7.3. | 68. $O_2$ sensor interaction with closed-loop fuelling system (stoichiometry / lean or rich operation); | **X** | **X** | **X** |
| 69. | propulsion unit (not) equipped with exhaust gas recirculation | **X** | **X** | **X** |

| | | | | |
|---|---|---|---|---|
| .8. | (EGR) system; | | | |
| 70. .8.1. | EGR system types; | **X** | **X** | **X** |
| 71. .8.2. | operation principle of EGR system (internal / external); | **X** | **X** | **X** |
| 3.8.3. | maximum EGR rate (+/- 5 %); | **X** | **X** | **X** |
| 72. Explanatory notes:<br>(1) maximum 30% acceptable for test type VIII<br>(2) Only for vehicles equipped with storage for gaseous fuel | | | | |

Table B.5.9.-1: Classification criteria propulsion unit family with regard to test types I, II and VII

## B.5.10. Annex: information document containing the essential characteristics of the propulsion units and the pollutant control systems

1. The manufacturer shall complete the applicable item numbers of the list below, and submit it as part of the information folder.

| **Item No.** | ~~**(Sub) categories**~~ | **Detailed information** |
|---|---|---|
| **0.** | | **GENERAL INFORMATION** |
| **A.** | | **General information concerning vehicles** |
| **0.1.** | ~~**L1e — L7e**~~ | **Make (trade name of manufacturer):...........................................................................** |
| **0.2.** | ~~**L1e — L7e**~~ | Type: ...................................................................................................................... |
| 0.2.1 | ~~L1e — L7e~~ | Variant(s): .............................................................................................................. |
| 0.2.2 | ~~L1e — L7e~~ | Version(s):................................................................................................................ |
| 0.2.3. | ~~L1e — L7e~~ | Commercial name(s) (if available):...................................................................... |
| **0.3.** | ~~**L1e — L7e**~~ | **Category, subcategory and sub-subcategory of vehicle:.............................................** |
| **0.4.** | ~~**L1e — L7e**~~ | **Company name and address of manufacturer: ............................................................** |
| 0.4.1. | ~~L1e — L7e~~ | Name(s) and address(es) of assembly plants:………………………………………………… |
| 0.4.2. | ~~L1e — L7e~~ | Name and address of manufacturer's authorised representative, if any:…………………….. |
| **0.5.** | ~~**L1e — L7e**~~ | **Manufacturer's statutory plate(s):** :.......................................................................... |
| 0.5.1. | ~~L1e — L7e~~ | Location of the manufacturer's statutory plate:............................................................ |
| 0.5.2. | ~~L1e — L7e~~ | Method of attachment: .................................................................................................. |
| 0.5.3. | ~~L1e — L7e~~ | Photographs and/or drawings of the statutory plate (completed example with dimensions): ............................................................................................................. |
| **0.6.** | ~~**L1e — L7e**~~ | **Location of the vehicle identification number: ..............................................................** |
| 0.6.1. | ~~L1e — L7e~~ | Photographs and/or drawings of the locations of the vehicle identification number (completed example with dimensions):............................................................................... |
| 0.6.1.1. | ~~L1e — L7e~~ | The serial number of the type begins with: ........................................................................ |
| **B.** | | **General information concerning systems, components or separate technical** |

| | | |
|---|---|---|
| | | **units** |
| **0.7.** | ~~L1e — L7e~~ | **Make(s) (trade name(s) of manufacturer): ..........** |
| **0.8.** | ~~**L1e — L7e**~~ | **Type: ..........** |
| 0.8.1. | ~~L1e — L7e~~ | Commercial name(s) (if available): .......... |
| 0.8.2. | ~~L1e — L7e~~ | Type-approval number(s) (if available): .......... |
| 0.8.3. | ~~L1e — L7e~~ | Type-approval(s) issued on (date, if available): .......... |
| **0.9.** | ~~L1e — L7e~~ | **Company name and address of manufacturer: ..........** |
| 0.9.1. | ~~L1e — L7e~~ | Name(s) and address(es) of assembly plants:………………………………………………… |
| 0.9.2. | ~~L1e — L7e~~ | Name and address of manufacturer’s authorised representative, if any:…………………….. |
| **0.10.** | | **Vehicle(s) for which the system/separate technical unit is intended for[(21)]:** |
| 0.10.1. | ~~L1e — L7e~~ | Type: .......... |
| 0.10.2. | ~~L1e — L7e~~ | Variant: .......... |
| 0.10.3. | ~~L1e — L7e~~ | Version: .......... |
| 0.10.4. | ~~L1e — L7e~~ | Commercial name(s) (if available): .......... |
| 0.10.5. | ~~L1e — L7e~~ | Category, subcategory and sub-subcategory of vehicle: .......... |
| **0.11.** | ~~L1e — L7e~~ | **Type-approval marks for components and separate technical units:** .......... |
| 0.11.1. | ~~L1e — L7e~~ | Method of attachment: .......... |
| 0.11.2. | ~~L1e — L7e~~ | Photographs and/or drawings of the location of the type-approval mark (completed example with dimensions): .......... |
| **C.** | | **General information regarding conformity of production** |
| **0.12.** | | **Conformity of production** |
| 0.12.1. | ~~L1e — L7e~~ | Description of overall quality-assurance management systems. |
| **1.** | | **GENERAL CONSTRUCTION CHARACTERISTICS** |
| 1.1. | ~~L1e — L7e~~ | Photographs and/or drawings of a representative vehicle: .......... |
| 1.2. | ~~L1e — L7e~~ | Scale drawing of the whole vehicle: .......... |
| 1.3. | ~~L1e — L7e~~ | Number of axles and wheels: .......... |
| 1.3.1. | ~~L1e — L7e~~ | Axles with twinned wheels: .......... |

| | | |
|---|---|---|
| 1.3.2. | ~~L1e – L7e~~ | Powered axles: .................................................................................................... |
| 1.4. | ~~L1e – L7e~~ | Chassis (if any) (overall drawing): ..................................................................... |
| 1.5. | ~~L2e, L5e-B, L6e-B, L7e-A2, L7e-B2, L7e-C~~ | ~~Material used for the bodywork: .....................................................................~~ |
| 1.6. | ~~L1e – L7e~~ | Position and arrangement of the propulsion unit(s): ....................................................... |
| 1.7. | ~~L4e, L5e-B, L6e-B, L7e-A2, L7e-B2, L7e-C~~ | ~~Hand of drive: left/right/centre(4): ....................................................................~~ |
| 1.7.1. | ~~L1e – L7e~~ | Vehicle is equipped to be driven in right/left-hand traffic and in countries that use metric/metric and imperial units.(4): .................................................................................. |
| **1.8.** | | **Propulsion unit performance** |
| 1.8.1. | ~~L3e, L4e, L5e, L7e-A, L7e-B2~~ | Declared maximum vehicle speed: .................................................................. km/h |
| 1.8.2. | ~~L1e, L2e, L6e, L7e-B1, L7e-C~~ | ~~Maximum design vehicle speed (22): ….. km/h and gear in which it is reached:…….~~ |
| 1.8.3. | ~~L1e – L7e~~ | Maximum net power combustion engine: ...... kW at ...... $min^{-1}$ at A/F ratio:...... |
| 1.8.4. | ~~L1e – L7e~~ | Maximum net torque combustion engine: ......Nm at ......$min^{-1}$ at A/F ratio:...... |
| **2.** | | **MASSES AND DIMENSIONS** (in kg and mm.) refer to drawings where applicable |
| **2.1** | | **Range of vehicle mass (overall)** |
| 2.1.1. | ~~L1e – L7e~~ | Mass in running order: ...... kg |
| 2.1.1.1. | ~~L1e – L7e~~ | Distribution of mass in running order between the axles: ...... kg |
| 2.1.2. | ~~L1e – L7e~~ | Actual mass: ...... kg |
| 2.1.8. | ~~L1e – L7e~~ | Mass of the optional equipment:...... kg |
| 2.1.9. | ~~L1e – L7e~~ | Mass of the superstructure:...... kg |
| 2.1.10. | ~~L1e – L7e~~ | Mass of the propulsion battery:..... kg |
| 2.1.11. | ~~L2e, L4e, L5e, L6e, L7e~~ | ~~Mass of the doors:..... kg~~ |
| 2.1.12. | ~~L2e-U, L5e-B, L6e-BU, L7e-CU~~ | ~~Mass of the machines or equipment installed on the load platform area:..... kg~~ |

| | | |
|---|---|---|
| 2.1.13. | ~~L1e — L7e~~ | Mass of the gaseous fuel system as well as storage tanks for gaseous fuel:..... kg |
| 2.1.14. | ~~L1e — L7e~~ | Mass of the storage tanks to store compressed air:..... kg |
| 2.1.15. | ~~L1e — L7e~~ | Reference mass:..... kg |
| **2.2.** | | **Range of vehicle dimensions (overall)** |
| 2.2.1. | ~~L1e — L7e~~ | Length:...... mm |
| 2.2.2. | ~~L1e — L7e~~ | Width:...... mm |
| 2.2.3. | ~~L1e — L7e~~ | Height:...... mm |
| 2.2.4. | ~~L1e — L7e~~ | Wheelbase:...... mm |
| 2.2.4.1. | ~~L4e~~ | Wheelbase sidecar: ……. mm |
| 2.2.5. | | Track width |
| 2.2.5.1. | ~~L1e — L7e if equipped with twinned wheels L2e, L4e, L5e, L6e, L7e~~ | Track width front: ...... mm. |
| 2.2.5.2. | ~~L1e — L7e if equipped with twinned wheels~~ | Track width rear: ...... mm. |
| 2.2.5.3. | ~~L2e, L4e, L5e, L6e, L7e~~ | ~~Track width sidecar: ...... mm.~~ |
| 2.2.6. | ~~L7e-B~~ | ~~Front overhang: ...... mm.~~ |
| 2.2.7. | ~~L7e-B~~ | ~~Rear overhang: ...... mm.~~ |
| 2.2.8. | | ~~Load platform dimensions~~ |
| 2.2.8.1. | ~~L2e-U, L5e-B, L6e-BU, L7e-B2, L7e-CU~~ | ~~Length of the load platform:...... mm~~ |
| 2.2.8.2. | ~~L2e-U, L5e-B, L6e-BU, L7e-B2, L7e-CU~~ | ~~Width of load platform:...... mm~~ |
| 2.2.8.3. | ~~L2e-U, L5e-B, L6e-BU, L7e-B2, L7e-~~ | ~~Height of load platform:...... mm~~ |

| | | |
|---|---|---|
| | ~~CU~~ | |
| 2.2.9.9. | ~~L3e-AxE, L3e-AxT~~ | ~~Seat height: ……. mm~~ |
| 2.2.9.10. | ~~L3e-AxE, L3e-AxT~~ | ~~Ground clearance: ……. mm~~ |
| **3.** | | **GENERAL POWERTRAIN CHARACTERISTICS** |
| **3.1** | | **Manufacturer of the propulsion unit** |
| *3.1.1.* | | *Combustion engine* |
| 3.1.1.1. | ~~L1e – L7e~~ | Manufacturer:............................................................................................... |
| 3.1.1.2. | ~~L1e – L7e~~ | Engine code (as marked on the engine or other means of identification): ................... |
| 3.1.1.3. | ~~L1e – L7e~~ | Fuel identification marking (if available): .................................................................. |
| 3.1.1.4. | ~~L1e – L7e~~ | Photographs and/or drawings of the location of the code(s) and/or type-approval numbers (completed example with dimensions)[20]:.................................................. |
| **3.2.** | | **Combustion engine** |
| *3.2.1.* | | *Specific engine information* |
| 3.2.1.1. | ~~L1e – L7e~~ | Number of combustion engines: .................................................................................. |
| 3.2.1.2. | ~~L1e – L7e~~ | Working principle: internal combustion engine (ICE)/positive ignition/compression ignition /external combustion engine (ECE)/turbine/compressed air[4]: ...................... |
| 3.2.1.3. | ~~L1e – L7e~~ | Cycle: four-stroke/two-stroke/rotary/other: ................................................................. |
| 3.2.1.4. | ~~L1e – L7e~~ | Cylinders |
| 3.2.1.4.1. | ~~L1e – L7e~~ | Number: ….. |
| 3.2.1.4.2. | ~~L1e – L7e~~ | Arrangement: …. |
| 3.2.1.4.3. | ~~L1e – L7e~~ | Bore: ...... mm |
| 3.2.1.4.4. | ~~L1e – L7e~~ | Stroke:...... mm |
| 3.2.1.4.5. | ~~L1e – L7e~~ | Number and configuration of stators in the case of rotary-piston engine: ................... |
| 3.2.1.4.6. | ~~L1e – L7e~~ | Volume of combustion chambers in the case of rotary-piston engine: ………..$cm^3$ |
| 3.2.1.4.7. | ~~L1e – L7e~~ | Firing order: ........................................................................................................ |
| 3.2.1.5. | ~~L1e – L7e~~ | Engine capacity: ......$cm^3$ |
| 3.2.1.6. | ~~L1e – L7e~~ | Volumetric compression ratio:........................................................................... |
| 3.2.1.7. | ~~L1e – L7e~~ | Number of inlet and exhaust valves |
| * 3.2.1.7.1. | ~~L1e – L7e~~ | Number and minimum cross-sectional areas of inlet and outlet ports: ........................ |
| * 3.2.1.7.2. | ~~L1e – L7e~~ | Valve timing or equivalent data:................................................................................ |

| | | |
|---|---|---|
| * 3.2.1.7.3. | ~~L1e — L7e~~ | Maximum lift of valves, angles of opening and closing, or timing details of alternative distribution systems, in relation to dead centres. For variable timing system, minimum and maximum timing:...................................................................... |
| * 3.2.1.7.4. | ~~L1e — L7e~~ | Reference and/or setting ranges: ................................................................................... |
| 3.2.1.8. | ~~L1e — L7e~~ | Drawings of combustion chamber, cylinder head, piston, piston rings: ....................... |
| 3.2.1.9. | ~~L1e — L7e~~ | Normal warm engine idling speed: ...... $min^{-1}$ |
| 3.2.1.10. | ~~L1e — L7e~~ | Stop-start system: yes/no |
| **3.2.2.* | | *Powertrain/propulsion unit/drive-train management system* |
| 3.2.2.1. | ~~L1e — L7e~~ | PCUs/ECUs software identification number(s):………… and calibration verification number(s) :………. |
| *3.2.3.* | | *Fuel* |
| 3.2.3.1. | ~~L1e — L7e~~ | Fuel type: |
| 3.2.3.2.. | ~~L1e — L7e~~ | Vehicle fuel configuration: mono-fuel/bi- fuel/flex fuel |
| 3.2.3.2.1. | ~~L1e — L7e~~ | Maximum amount of bio-fuel acceptable in fuel: ……..% by volume |
| *3.2.4.* | | *Fuel pressure delivery and control* |
| 3.2.4.1. | ~~L1e — L7e~~ | Brief description and schematic drawing of low-and/or high-pressure fuelling wet system(s): ........................................................................................................... |
| 3.2.4.2. | ~~L1e — L7e~~ | Low- and/or high-pressure fuel pump(s): yes/no |
| 3.2.4.2.1. | ~~L1e — L7e~~ | Fuel pump control: mechanical/on/off electric/continuous operation/electronically controlled variable operation: ..................................................................................... |
| 3.2.4.2.2. | ~~L1e — L7e~~ | For CI combustion engines and dual fuel engines only maximum fuel delivery: ...... g/s or $mm^3$/stroke or cycle at an engine speed of:…$min^{-1}$ or, alternatively, a characteristic diagram: ..................................................................................... (When boost control is supplied, state the characteristic fuel delivery and boost pressure versus engine speed) |
| 3.2.4.3. | ~~L1e — L7e~~ | Common rail: yes/no |
| 3.2.4.4. | ~~L1e — L7e~~ | Fuel distributor/rail/hoses: yes/no |
| 3.2.4.5. | ~~L1e — L7e~~ | Fuel pressure and/or fuel flow regulator(s): yes/no |
| *3.2.5.* | | *Fuel mass metering and control* |
| 3.2.5.1. | ~~L1e — L7e~~ | By carburettor(s): yes/no |
| * 3.2.5.1.1. | ~~L1e — L7e~~ | Operating principle and construction: ......................................................................... |
| * 3.2.5.1.2. | ~~L1e — L7e~~ | Maximum fuel-flow rate: ...... g/s at maximum power and torque:.............................. |

| | | |
|---|---|---|
| 3.2.5.1.3. | ~~L1e — L7e~~ | Carburettor(s) settings:........................................ |
| * 3.2.5.1.4. | ~~L1e — L7e~~ | Carburettor diffusers: ........................................ |
| * 3.2.5.1.5. | ~~L1e — L7e~~ | Carburettor fuel-level in float chamber:........................................ |
| * 3.2.5.1.5.1. | ~~L1e — L7e~~ | Carburettor mass of float: ........................................ |
| 3.2.5.1.6. | ~~L1e — L7e~~ | Carburettor cold-starting system: manual/automatic: yes/no |
| 3.2.5.1.6.1. | ~~L1e — L7e~~ | Carburettor cold-starting system operating principle(s):........................................ |
| 3.2.5.1.7. | ~~L1e — L7e~~ | Mixture scavenging port: yes/no |
| 3.2.5.1.7.1. | ~~L1e — L7e~~ | Mixture scavenging port dimensions: ........................................ |
| 3.2.5.2. | ~~L1e — L7e~~ | By mechanically/hydraulically controlled fuel injection: yes/no |
| 3.2.5.2.1. | ~~L1e — L7e~~ | Operation principle: ........................................ |
| 3.2.5.2.2. | ~~L1e — L7e~~ | Mechanical/electronic adjustment of maximum fuel mass delivery: yes/no |
| 3.2.5.3. | ~~L1e — L7e~~ | By electronically controlled fuel injection system: yes/no |
| 3.2.5.3.1. | ~~L1e — L7e~~ | Operation principle: port injection/direct injection/pre-chamber/swirl chamber: ......... |
| 3.2.5.3.2. | ~~L1e — L7e~~ | Fuel injector(s): single-/multi-point/direct injection/other (specify):........................ |
| 3.2.5.3.3. | ~~L1e — L7e~~ | Total and per cylinder amount of fuel injectors: ........................................ |
| 3.2.5.4. | ~~L1e — L7e~~ | Air-assisted fuel injector: yes/no:........................................ |
| 3.2.5.4.1. | ~~L1e — L7e~~ | Description and operating pressure of air-assist: ........................................ |
| 3.2.5.5. | ~~L1e — L7e~~ | Cold start system: yes/no |
| 3.2.5.5.1. | ~~L1e — L7e~~ | Description of  cold start system:........................................ |
| 3.2.5.6. | ~~L1e — L7e~~ | Auxiliary starting aid: yes/no |
| 3.2.5.7. | ~~L1e — L7e~~ | CI injection specific: yes/no |
| 3.2.5.7.1. | ~~L1e — L7e~~ | Static injection timing:........................................ |
| 3.2.5.7.2. | ~~L1e — L7e~~ | Injection advance curve: ........................................ |
| *3.2.6.* | | *Gaseous fuelling system and control* |
| 3.2.6.1. | ~~L1e — L7e~~ | Brief description and schematic drawing of gaseous fuelling system(s): .................... |
| 3.2.6.2.1. | ~~L1e — L7e~~ | Type-approval number according to UN Regulation No 67 : ..................................... |
| *3.2.7.* | | *Air-induction system* |
| 3.2.7.1. | ~~L1e — L7e~~ | Brief description and schematic drawing of gaseous intake air-flow and induction system: ........................................ |
| 3.2.7.2. | ~~L1e — L7e~~ | Intake manifold description and working principle (e.g. fixed length/variable |

| | | |
|---|---|---|
| | | length/swirl valves)(4) (include detailed drawings and/or photos):................................ |
| * 3.2.7.2.1. | ~~L1e — L7e~~ | Description and drawings of inlet pipes and their accessories (plenum chamber, heating device with control strategy, additional air intakes, etc.): ................................ |
| 3.2.7.3. | ~~L1e — L7e~~ | Intake air pressure charger: yes/no |
| 3.2.7.3.1. | ~~L1e — L7e~~ | Brief description and schematic drawing of the intake air-pressure charger system: ... |
| 3.2.7.3.2. | ~~L1e — L7e~~ | Working and control principles: ................................................................................ |
| 3.2.7.3.3. | ~~L1e — L7e~~ | Type(s) (turbo or supercharger, other): ......................................................................... |
| 3.2.7.3.4. | ~~L1e — L7e~~ | Maximum intake air-charge pressure and flow-rate at maximum torque and power:......kPa and g/s or charge pressure and flow-rate map:......kPa and g/s |
| 3.2.7.4. | ~~L1e — L7e~~ | Waste gate: yes/no |
| 3.2.7.5. | ~~L1e — L7e~~ | Intercooler: yes/no |
| 3.2.7.5.1. | ~~L1e — L7e~~ | Type: air-air/air-water/other |
| * 3.2.7.5.2. | ~~L1e — L7e~~ | Intake depression at rated engine speed and at 100 % load (compression ignition engines only):.......... kPa |
| 3.2.7.6. | ~~L1e — L7e~~ | Air filter, (drawings, photographs): ............................................................................. |
| 3.2.7.7. | ~~L1e — L7e~~ | Intake air-silencer description (drawings, photographs): ............................................. |
| *3.2.7.7.1. | ~~L1e — L7e~~ | Working principle: ......................................................................................... |
| *3.2.8.* | | *Air-mass metering and control* |
| 3.2.8.1. | ~~L1e — L7e~~ | Brief description and schematic drawing of air-mass metering and control system: .... |
| 3.2.8.2. | ~~L1e — L7e~~ | Mechanical throttle body: yes/no |
| 3.2.8.3. | ~~L1e — L7e~~ | Electronic throttle control (ETC): yes/no |
| 3.2.8.3.1. | ~~L1e — L7e~~ | Schematic drawing of electronic throttle control: ....................................................... |
| * 3.2.8.3.1.2. | ~~L1e — L7e~~ | Description of ETC hardware redundancies regarding sensors/actuators/electric power/ground/control electronics: ............................................................................. |
| *3.2.9.* | | *Spark delivery system and control* |
| 3.2.9.1. | ~~L1e — L7e~~ | Brief description and schematic drawing of spark delivery and control system: .......... |
| 3.2.9.1.1. | ~~L1e — L7e~~ | Working principle: ......................................................................................... |
| * 3.2.9.1.2. | ~~L1e — L7e~~ | Ignition advance curve or map at wide open throttle: …………………………. |
| 3.2.9.1.3. | ~~L1e — L7e~~ | Static ignition timing: ...... degrees before TDC at maximum torque and power |
| 3.2.9.2. | ~~L1e — L7e~~ | Ion sense capability: yes/no |

| | | |
|---|---|---|
| 3.2.9.3. | ~~L1e — L7e~~ | Spark plugs: |
| 3.2.9.3.1. | ~~L1e — L7e~~ | Gap setting: ……mm |
| 3.2.9.4. | ~~L1e — L7e~~ | Ignition coil(s): |
| * 3.2.9.4.1. | ~~L1e — L7e~~ | Working principle: ........................................ |
| * 3.2.9.4.2. | ~~L1e — L7e~~ | Dwell angle and timing at wide open throttle: ........................................ |
| *3.2.10.* | | *Powertrain cooling system and control* |
| 3.2.10.1. | ~~L1e — L7e~~ | Brief description and schematic drawing of powertrain cooling and control system: .. |
| 3.2.10.2. | ~~L1e — L7e~~ | Cooling system: liquid: yes/no |
| 3.2.10.2.1. | ~~L1e — L7e~~ | Maximum temperature at outlet: …… °C |
| 3.2.10.2.2. | ~~L1e — L7e~~ | Nominal setting of the engine temperature control mechanism: ........................................ |
| 3.2.10.2.3. | ~~L1e — L7e~~ | Nature of liquid: ........................................ |
| 3.2.10.2.4. | ~~L1e — L7e~~ | Circulating pump(s): yes/no |
| 3.2.10.2.4.1. | ~~L1e — L7e~~ | Characteristics: ........................................ |
| 3.2.10.2.5. | ~~L1e — L7e~~ | Drive ratio(s): ........................................ |
| 3.2.10.2.6. | ~~L1e — L7e~~ | Description of the fan and its drive mechanism: ........................................ |
| 3.2.10.3. | ~~L1e — L7e~~ | Air cooling: yes/no |
| 3.2.10.3.1. | ~~L1e — L7e~~ | Reference point: ........................................ |
| 3.2.10.3.2. | ~~L1e — L7e~~ | Maximum temperature at reference point: ……°C |
| 3.2.10.3.3. | ~~L1e — L7e~~ | Fan: yes/no |
| 3.2.10.3.3.1. | ~~L1e — L7e~~ | Characteristics: ........................................ |
| 3.2.10.3.3.2. | ~~L1e — L7e~~ | Drive ratio(s): ........................................ |
| *3.2.11.* | | *Powertrain lubrication system and control* |
| 3.2.11.1. | ~~L1e — L7e~~ | Brief description and schematic drawing of powertrain lubrication and control system: ........................................ |
| 3.2.11.2. | ~~L1e — L7e~~ | Lubrication system configuration(s) (wet sump, dry sump, other, pump/injection into induction system/mixed with the fuel, etc.): ........................................ |
| 3.2.11.3. | ~~L1e — L7e~~ | Location of oil reservoir (if any): ........................................ |
| 3.2.11.4. | ~~L1e — L7e~~ | Feed system (pump/injection into induction system/mixed with the fuel, etc.): .......... |
| 3.2.11.5. | ~~L1e — L7e~~ | Lubricating pump: yes/no ........................................ |
| 3.2.11.6. | ~~L1e — L7e~~ | Oil cooler: yes/no |
| 3.2.11.6.1. | ~~L1e — L7e~~ | Drawing ........................................ |

| | | | |
|---|---|---|---|
| 3.2.11.7. | ~~L1e~~ | ~~L7e~~ | Lubricant(s) characteristics: ........................................................................................ |
| 3.2.11.8. | ~~L1e~~ | ~~L7e~~ | Lubricant mixed with the fuel: yes/no: ......................................................................... |
| 3.2.11.8.1. | ~~L1e~~ | ~~L7e~~ | Percentage range of lubricant mixed with the fuel:.................................................... |
| *3.2.12.* | | | *Exhaust system and control* |
| 3.2.12.1. | ~~L1e~~ | ~~L7e~~ | Brief description and schematic drawing of exhaust devices for noise and tailpipe emission control: ............................................................................................ |
| 3.2.12.2. | ~~L1e~~ | ~~L7e~~ | Description and drawing of the exhaust manifold: ..................................................... |
| 3.2.12.3. | ~~L1e~~ | ~~L7e~~ | Description and detailed drawing of the exhaust device: ............................................ |
| 3.2.12.4. | ~~L1e~~ | ~~L7e~~ | Maximum permissible exhaust back-pressure at rated engine speed and at 100 % load: ...... kPa |
| 3.2.12.5. | ~~L1e~~ | ~~L7e~~ | Type, marking of exhaust noise-abatement device(s): ................................................ |
| * 3.2.12.6. | ~~L1e~~ | ~~L7e~~ | Noise-reducing measures in the engine compartment and on the engine where relevant for external noise: ........................................................................................... |
| 3.2.12.7. | ~~L1e~~ | ~~L7e~~ | Location of the exhaust outlet: ....................................................................................... |
| 3.2.12.8. | ~~L1e~~ | ~~L7e~~ | ~~Exhaust noise-abatement device containing fibrous materials: yes/no: .......................~~ |
| *3.2.13.* | | | *Other electrical systems and control than those intended for the electrical propulsion unit* |
| 3.2.13.1. | ~~L1e~~ | ~~L7e~~ | Rated voltage: ...... V, positive/negative ground |
| 3.2.13.2. | ~~L1e~~ | ~~L7e~~ | Generator: yes/no: |
| 3.2.13.2.1. | ~~L1e~~ | ~~L7e~~ | Nominal output: ...... VA |
| 3.2.13.3. | ~~L1e~~ | ~~L7e~~ | Battery(ies) : yes/no |
| 3.2.13.3.1. | ~~L1e~~ | ~~L7e~~ | Capacity and other characteristics (mass,…): ............................................................ |
| 3.2.13.4. | ~~L1e~~ | ~~L7e~~ | ~~Electric heating systems for the passenger compartment: yes/no~~ |
| **3.4.** | | | **Other engines, electric motors or combinations (specific information concerning the parts of these motors)** |
| *3.4.1.* | | | *Cooling system (temperatures permitted by the manufacturer)* |
| 3.4.1.1. | ~~L1e~~ | ~~L7e~~ | Liquid cooling: ................................................................................................... |
| 3.4.1.1.1. | ~~L1e~~ | ~~L7e~~ | Maximum temperature at outlet: .... °C |
| 3.4.1.2. | ~~L1e~~ | ~~L7e~~ | Air cooling: ........................................................................................................ |
| 3.4.1.2.1. | ~~L1e~~ | ~~L7e~~ | Reference point: ................................................................................................ |

3.4.1.2.2. ~~L1e — L7e~~ Maximum temperature at reference point: ...... °C

*3.4.2.* *Lubrication system*

3.4.2.1. ~~L1e — L7e~~ Description of lubrication system: ...............................................................................

3.4.2.2. ~~L1e — L7e~~ Location of oil reservoir (if any) : ....................................................................

3.4.2.3. ~~L1e — L7e~~ Feed system (pump/injection into induction system/mixed with the fuel, etc.): ...........

3.4.2.4. ~~L1e — L7e~~ Lubricant mixed with the fuel: ......................................................................

3.4.2.4.1. ~~L1e — L7e~~ Percentage: ..............................................................................................

3.4.2.5. ~~L1e — L7e~~ Oil cooler: yes/no: .....................................................................................

*3.4.2.5.1. ~~L1e — L7e~~ Drawing(s) : ................................................................................................

**3.5.** **Drive-train and control**)

3.5.1. ~~L1e — L7e~~ Brief description and schematic drawing of the vehicle drive-train and its control system (gear shift control, clutch control or any other element of drive-train): ...........

*3.5.2.* *Clutch*

3.5.2.1. ~~L1e — L7e~~ Brief description and schematic drawing of the clutch and its control system: ...........

*3.5.3.* *Transmission*

3.5.3.1. ~~L1e — L7e~~ Brief description and schematic drawing of gear shift system(s) and its control: .........

3.5.3.2. ~~L1e — L7e~~ Drawing of the transmission: ...........................................................................

3.5.3.3. ~~L1e — L7e~~ Type (mechanical, hydraulic, electric, manual/manual automated/automatic/CVT/ other (indicate).): ...........................................................................................................

3.5.3.4. ~~L1e — L7e~~ A brief description of the electrical/electronic components (if any): ...........................

3.5.3.5. ~~L1e — L7e~~ Location relative to the engine: ........................................................................

3.5.3.6. ~~L1e — L7e~~ Method of control: .........................................................................................

*3.5.4.* *Gear ratios*

~~L1e — L7e~~

**Overview gear ratios**

| Gear | Internal transmission ratios (ratios of engine to transmission output shaft revolutions) | Final drive ratio(s) (ratio of transmission output shaft to driven wheel revolutions) | Total gear ratios | Ratio (engine speed/vehicle speed) for manual transmission only |
|---|---|---|---|---|
| Maximum for CVT (+)<br>1 | | | | |

| | | | | |
|---|---|---|---|---|
| 2<br>3<br>...<br>Minimum for CVT(+) | | | | |
| Reverse | | | | |
| (+) Continuously variable transmission | | | | |

3.5.4.1. ~~L3e-AxE, L3e-AxT~~ Final drive ratio: …….

3.5.4.2. ~~L3e-AxE, L3e-AxT~~ Overall gear ratio in highest gear:…..

**3.6.** **~~Cycles designed to pedal~~**

3.6.1. ~~L1e~~ ~~Ratio manpower/electric power: ……~~

3.6.2. ~~L1e~~ ~~Maximum assistance factor::............................................................................................~~

3.6.3. ~~L1e~~ ~~Maximum vehicle speed for which the electric motor gives assistance:…….km/h~~

3.6.4. ~~L1e~~ ~~Switch-off distance:……..km~~

**4.** **GENERAL INFORMATION ON ENVIRONMENTAL AND PROPULSION PERFORMANCE**

**4.0** **General information on environmental and propulsion unit performance**

4.0.1. ~~L1e – L7e~~ ~~Environmental step: Euro ………………… (3/4/5)~~)

**4.1.** **Tailpipe emission-control system**

4.1.1. ~~L1e – L7e~~ Brief description and schematic drawing of the tailpipe emission-control system and its control: ..........................................................................................................................

*4.1.2.* *Catalytic converter*

4.1.2.1. ~~L1e – L7e~~ Configuration, number of catalytic converters and elements (information to be provided for each separate unit): ..........................................................................................

4.1.2.2. ~~L1e – L7e~~ Drawing with dimensions, shape and volume of the catalytic converter(s): ....................

4.1.2.3. ~~L1e – L7e~~ Catalytic reaction: ..................................................................................................

* 4.1.2.4. ~~L1e – L7e~~ Total charge of precious metals: .........................................................................

* 4.1.2.5. ~~L1e – L7e~~ Relative concentration:.......................................................................................

* 4.1.2.6. ~~L1e – L7e~~ Substrate (structure and material): ......................................................................

* 4.1.2.7. ~~L1e – L7e~~ Cell density: ........................................................................................................

* 4.1.2.8. ~~L1e – L7e~~ Casing for the catalytic converter(s): ..................................................................

| | | |
|---|---|---|
| 4.1.2.9. | ~~L1e — L7e~~ | Location of the catalytic converter(s) (place and reference distance in the exhaust line): ..................... |
| 4.1.2.10. | ~~L1e — L7e~~ | Catalyst heat-shield: yes/no |
| 4.1.2.11. | ~~L1e — L7e~~ | Brief description and schematic drawing of the regeneration system/method of exhaust after-treatment systems and its control system: ..................... |
| *4.1.2.11.1. | ~~L1e — L7e~~ | Normal operating temperature range: ………°C |
| 4.1.2.11.2. | ~~L1e — L7e~~ | Consumable reagents: yes/no |
| 4.1.2.11.3. | ~~L1e — L7e~~ | Brief description and schematic drawing of the reagent flow (wet) system and its control system: ..................... |
| 4.1.2.11.4. | ~~L1e — L7e~~ | Type and concentration of reagent needed for catalytic action: ..................... |
| *4.1.2.11.5. | ~~L1e — L7e~~ | Normal operational temperature range of reagent: ………°C |
| 4.1.2.11.6. | ~~L1e — L7e~~ | Frequency of reagent refill: continuous/maintenance |
| 4.1.2.12. | ~~L1e — L7e~~ | Identifying part number: ..................... |
| *4.1.3.* | | *Oxygen sensor(s)* |
| 4.1.3.1. | ~~L1e — L7e~~ | Oxygen sensor component(s) drawing(s): ..................... |
| 4.1.3.2. | ~~L1e — L7e~~ | Drawing of exhaust device with oxygen sensor location(s) (dimensions relative to exhaust valves): ..................... |
| 4.1.3.3. | ~~L1e — L7e~~ | Control range(s): ..................... |
| 4.1.3.4. | ~~L1e — L7e~~ | Identifying part number(s): ..................... |
| 4.1.3.5. | ~~L1e — L7e~~ | Description of oxygen sensor heating system and heating strategy: ..................... |
| 4.1.3.6. | ~~L1e — L7e~~ | Oxygen sensor heat shield(s): yes/no |
| *4.1.4.* | | *Secondary air-injection (air-inject in exhaust)* |
| 4.1.4.1. | ~~L1e — L7e~~ | Brief description and schematic drawing of the secondary air-injection system and its control system: ..................... |
| 4.1.4.2. | ~~L1e — L7e~~ | Configuration (mechanical, pulse air, air pump etc.): ..................... |
| 4.1.4.3. | ~~L1e — L7e~~ | Working principle: ..................... |
| *4.1.5.* | | *External exhaust gas recirculation (EGR)* |
| 4.1.5.1. | ~~L1e — L7e~~ | Brief description and schematic drawing of the EGR system (exhaust flow) and its control system: ..................... |
| 4.1.5.2. | ~~L1e — L7e~~ | Characteristics: ..................... |
| 4.1.5.3. | ~~L1e — L7e~~ | Water-cooled EGR system: yes/no |
| 4.1.5.4. | ~~L1e — L7e~~ | Air-cooled EGR system: yes/no |
| *4.1.6.* | | *Particulate filter* |

4.1.6.1. ~~L1e — L7e~~ PT component drawing with dimensions, shape and capacity of the particulate filter: ...

4.1.6.2. ~~L1e — L7e~~ Design of the particulate filter:..........................................................................................

4.1.6.3. ~~L1e — L7e~~ Brief description and schematic drawing of the particulate filter and its control system: ...................................................................................................................

4.1.6.4. ~~L1e — L7e~~ Location (reference distance in the exhaust line): ...........................................................

4.1.6.5. ~~L1e — L7e~~ Method or system of regeneration, description and drawing:: ........................................

4.1.6.6. ~~L1e — L7e~~ Identifying part number: ...................................................................................

*4.1.7.* *Lean NOx trap*

4.1.7.1. ~~L1e — L7e~~ Operation principle of lean NOx trap:.............................................................................

*4.1.8.* *Additional tailpipe emission-control devices (if any not covered under another heading)*

4.1.8.1. ~~L1e — L7e~~ Working principle: ..........................................................................................

**5. VEHICLE PROPULSION FAMILY**

5.1. ~~L1e — L7e~~ To define the vehicle propulsion unit family, the manufacturer shall submit the information required for classification criteria set out in point 2 of point B.5.9., if not already provided in the information document.

**B.5.11. Annex: test result reporting requirements and information concerning the conduct of tests**

**1. General requirements for the format of test reports**

1.1. The test reports shall comply with the provisions of Standard EN ISO/IEC 17025:2005. In particular it shall include the information mentioned in point 5.10.2, including footnote (1) of that standard.

1.2. The template of the test reports shall be drawn up by the [approval authority] / [certification authority] in accordance with its rules of good practice.

1.3. The test report shall be drafted in one of the official languages of the country where [approval] / [certification] is sought.

1.3.1. Where a test has been carried out in a country other than the one handling the [approval] / [certification] application, the [approval authority] / [certification authority] may require the applicant to provide a certified translation of the test report.

1.4. Only authenticated copies of a test report shall be submitted.

1.5. The test reports shall include a description of the vehicle tested including its unambiguous identification. The parts having significant influence role in determining the test results shall be described and their identification number indicated.

Examples of parts include the silencers for noise measurement and the engine management system (ECU) for measuring tailpipe emissions.

Moreover it shall include at least the following information:

1.5.1. A detailed description of the characteristics of the vehicle, system, component or separate technical unit characteristics in connection with the regulatory act;

1.5.2. Category of vehicle tested;

1.5.3. The information shall indicate the variant and/or version to which it applies. One version shall not have more than one test result. However, a combination of several test results per version, indicating the worst case, is permissible. In this case, a note shall state that for items marked (*) only worst-case results are given.

1.5.4. When the tests are conducted on a vehicle, system, component or technical unit which combines a number of least favourable features concerning the required performance level (the worst case), the test report shall include a reference stating how the selection was made by the manufacturer in agreement with the technical service.

1.5.5. Condition of the vehicle influencing the test, such as fitted accessories; actual masses; test voltage; tyre sizes; tyre pressures; etc.;

1.5.6. Identification of the system, component or separate technical unit tested;

1.5.7. ~~Ambient conditions influencing the test: steam pressure (kPa); relative humidity (%); ambient temperature (°C); wind speed and direction on test track (km/h), etc.;~~

1.5.8. ~~The measurement results specified in the relevant regulatory acts and, where required, the limits or thresholds to be met;~~

1.5.9. ~~With regard to each measurement mentioned in point 1.5.5., the relevant decision: passed or failed;~~

1.5.10. ~~A detailed statement of compliance with the various provisions to be met, i.e. provisions for which measurements were not required.~~

1.5.11. ~~When test methods other than those prescribed in the regulatory acts are permitted, the report shall describe the test method used. The same applies when alternative provisions to those in the regulatory acts may be applied;~~

1.5.12. ~~The number of photographs to be taken during testing shall be decided by the [approval authority] / [certification authority]. In the case of virtual testing, screen prints or other suitable evidence may replace photographs;~~

1.5.13. ~~Technical service and persons responsible for carrying out the test and their position in the organisation;~~

1.5.14. ~~Conclusions drawn up;~~

1.5.15. ~~When opinions, assumptions and interpretations have been made, they shall be documented properly and marked as such in the test report.~~

**2. ~~Minimum information to be included in the test reports~~**

2.1. ~~In addition to the general requirements set out in point 1., the test reports shall contain as a minimum the information set out in point 2.2. This information can be grouped in an executive summary of the test report(s) applicable to the vehicle, system, component and separate technical unit, or be included in the test report(s) itself/themselves.~~

2.2. ~~Minimum information of the test reports by subject as follows:~~

**2.2.1. ~~Generic information on environmental performance~~**

~~The test report shall contain the following generic test data (only needed once per test type):~~

2.2.1.1. ~~Description of propulsion unit, propulsion unit family and drive-train of test vehicle(s)~~ **~~Error! Bookmark not defined.~~**: ..........................................................................................................................

2.2.1.2. ~~Emission level of test vehicle: Euro 3, Euro 4, Euro 5~~**~~Error! Bookmark not defined. Error! Bookmark not defined.~~**

2.2.1.3. ~~Description of emission test bench(es), specifications and settings~~**~~Error! Bookmark not defined.~~**: ................

2.2.1.4. Chassis/engine dynamometer(s) specifications**Error! Bookmark not defined.**: ...............................................

2.2.1.5. Inertia (reference) mass and running resistance settings for single/dual**Error! Bookmark not defined.** roll chassis dynamometer**Error! Bookmark not defined.**: ...............................................

2.2.1.6. Comprehensive report of road test results for the determination of test bench settings, including coast down times for single/dual**Error! Bookmark not defined.** roll chassis dynamometer**Error! Bookmark not defined.**: ...............................................

2.2.1.7. Applicable test type I driving schedule (ECE R40 (with/without EUDC), ECE R47, WMTC stage 1, WMTC stage 2, revised WMTC) **Error! Bookmark not defined. Error! Bookmark not defined.**:

2.2.1.8. Description gearshift prescriptions for environmental testing**Error! Bookmark not defined.**: ...............................................

**2.2.2. Test type I: requirements: tailpipe emissions after cold start**

The following items specific to test type I shall be provided**Error! Bookmark not defined.**:

2.2.2.1. Description of tested vehicle(s) (prototype(s) or series production, hardware and software levels, VIN) **Error! Bookmark not defined.**: ...............................................

2.2.2.2. Any deviations by test vehicle(s) from data provided in information document, section B.5.11.: yes/no**Error! Bookmark not defined. Error! Bookmark not defined.**. If yes, please provide list with deviations.

2.2.2.3. [Approval] / [Certification] number if not parent vehicle**Error! Bookmark not defined.**: ...............................................

2.2.2.4. Mileage(s) of test vehicle(s) **Error! Bookmark not defined.**: ...............................................

2.2.2.5. Test fuel(s) used**Error! Bookmark not defined.**: ...............................................

2.2.2.7. Description of test type I measurement methods for gas-fuelled vehicles referred to in section B.2.2. **Error! Bookmark not defined.** ...............................................

2.2.2.8. Description of test type I measurement methods for vehicles equipped with a periodically regenerating system referred to in section B.2.3. **Error! Bookmark not defined.**: ...............................................

2.2.2.9. Information on regeneration strategy**Error! Bookmark not defined.**:

D (number of operating cycles between 2 cycles when regenerative phases occur) **Error! Bookmark not defined.**: ...............................................

d (number of operating cycles required for regeneration) **Error! Bookmark not defined.**: ...............................................

2.2.2.10. Description of weighting of type I test results as referred to in point 5.1.1.5. of section B.2. including equation number and weighting factors**Error! Bookmark not defined.**: ...............................................

2.2.2.11. Number of type I operating cycles between two cycles where regenerative phases occur under the conditions equivalent to type I test (Distance 'D' in Figure B.2.3. 1 in section B.2.3.) **Error! Bookmark not defined.**: ...............................................

2.2.2.12. Description of method employed to determine the number of cycles between two cycles where regenerative phases occur**Error! Bookmark not defined.**: ...............................................

2.2.2.13. Parameters to determine the level of loading required before regeneration occurs (i.e. temperature, pressure etc.) **Error! Bookmark not defined.**: ...............................................

2.2.2.14. Description of method used to load system in the test procedure described in point 3.1. of section B.2.3. Error! Bookmark not defined.: ……………………………………………………………

2.2.2.15. Test records according to point 6. of section B.2. Error! Bookmark not defined.: ……………………………

2.2.2.16. Type I test results Error! Bookmark not defined.:

| Test Type I Test Results ($TR_{TTIx}$) | Test No | CO | THC | NMHC | NOx | THC + NOx (ix) | PM |
|---|---|---|---|---|---|---|---|
| $TR_{TTI\ Measured\ x}$ (i) (iv) (mg/km) | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| $TR_{TTI\ Measured\ x\ Mean}$ (i) (iv) (mg/km) | | | | | | | |
| $K_i$ (i) (v) (vii) ( no unit ) | | | | | | (ii) | |
| $TR_{TTIx}$ (i) (vi) = $K_i \cdot TR_{TTI\ Measured\ x\ Mean}$ (mg/km) & (% of $L_x$) | | | | | | (iii) | |
| Limit value $L_x$ (viii) (mg/km) | | | | | | | |

(i) Where applicable.
(ii) Not applicable.
(iii) Mean value calculated by adding mean values ($M \cdot K_i$) calculated for THC and NOx.
(iv) Round to 2 decimal places.
(v) Round to 4 decimal places.
(vi) Round to 0 decimal places
(vii) Set $K_i$ = 1 in case:
(a) the vehicle is **not** equipped with a periodically regenerating emission abatement system or;
(b)the vehicle is **not** a hybrid electric vehicle.
(viii) Test limit x set out in point 9. of section B.1. x = 1 to 4 and refers to the numbering of the pollutant constituents in point 9. of section B.1., e.g. the Euro 5 limit for CO is referred to as $L_1$, the limit for THC is referred to as $L_2$, the limit for $NO_x$ as $L_3$ and the limit for PM as $L_4$.
(ix) The individual THC and NOx measurement values shall also be filled out in this list.

Table B.5.11. 1: Test type I results

**2.2.3. Test type II requirements: Tailpipe emissions at (increased idle)/free acceleration**

2.2.3.1. Details of test vehicle(s) if different from vehicle used for type I testing Error! Bookmark not defined.: (items 2.2.2.1. to 2.2.2.4. where different): ……………………………………………………

2.2.3.2. Description of propulsion unit idling activation method in case of stop-start system Error! Bookmark not defined.: ……………………………………………………………………………

2.2.3.3. Type II test results Error! Bookmark not defined.:

| Test | CO (% vol.) | Lambda | Engine speed (min-) | Engine oil temperature (°C) | Measured & corrected value of absorption coefficient ($m^{-1}$) |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| **PI: Low idle test** | | | | | - |
| **PI: High idle test** | | | | | - |
| **CI — Free acceleration test / Smoke opacity test results** | - | - | - | - | |

Table B.5.11. 2: Test type II results

**2.2.5. Test type VII requirements: Measurement of $CO_2$ emissions and fuel consumption**

2.2.5.1. Details of test vehicle(s), its powertrain and pollution-control devices explicitly documented and listed, emission test laboratory equipment and settings if different from data reported under items 2.2.2.1. to 2.2.2.10. **Error! Bookmark not defined.** ……………………………………………………………………

2.2.5.2. Documentation added according to UN Regulation No 101 (OJ L 138, 26.5.2012, p. 1): yes/no **Error! Bookmark not defined. Error! Bookmark not defined.**

2.2.5.3. The vehicle manufacturer has ensured that the $CO_2$ emissions and fuel consumption data are provided to the buyer of the vehicle at the time of purchase of a new vehicle: yes/no **Error! Bookmark not defined. Error! Bookmark not defined.**

2.2.5.4. A completed specimen of the test type VII result format used to inform the buyer of the new vehicle is added to the information document: yes/no **Error! Bookmark not defined. Error! Bookmark not defined.**

2.2.5.5. Type VII test results, where applicable and for each reference fuel tested **Error! Bookmark not defined.**:

2.2.5.6. $CO_2$ emissions and fuel consumption **Error! Bookmark not defined.**

| **Test Type VII Test Results ($TR_{TTVII}$)** | **Test No** | **$CO_2$ (g/km)** | **Fuel consumption (l/100km) or (kg/100 km)** |
|---|---|---|---|
| **$TR_{TTI\ Measured\ x}$ (i)(ii)** | **1** | | |
| | **2** | | |
| | **3** | | |
| **$TR_{TTI\ Measured\ Mean}$ (i) (ii)** | | | |
| **$K_i$ (i) (iii) (v)<br>( no unit )** | | | |
| **$TR_{TTVIIx}$ (i) (iv) = $K_i \cdot TR_{TTI\ Measured\ x\ Mean}$** | | | |

(i) Where applicable.
(ii) Round to 2 decimal places.
(iii) Round to 4 decimal places.
(iv) Round to 0 decimal places
(v) Set $K_i$ = 1 in case:
(a) the vehicle is **not** equipped with a periodically regenerating emission abatement system or;
(b)the vehicle is **not** a hybrid electric vehicle.

Table B.5.11. 6: Test Type VII result table for propulsion unit(s) equipped with a combustion engine only or equipped with not-externally-chargeable (NOVC) hybrid electric propulsion unit(s)

2.2.5.7. ~~$CO_2$ emissions/fuel consumption (manufacturer's declared values)~~ **~~Error! Bookmark not defined.~~**

2.2.5.7.1. ~~For light motor vehicles equipped with a passenger compartment, the maximum electrical consumption owing to auxiliary heating such as heating systems for the passenger compartment/seats/other~~**~~Error! Bookmark not defined.~~** **~~Error! Bookmark not defined.~~**~~: ...... kW~~

## B.5.12. Annex: template form to record coast down times

Trade name:.................... Production number (Body):....................

Date:...../...../..... Place of the test:.................... Name of recorder....................

Climate:.................... Atmospheric pressure:........kPa Atmospheric temperature:....................: °C

Wind speed (parallel/perpendicular):......../........m/s

Rider height:........m

| **Test Vehicle** speed km/h | Coast down time(s) in s | | | | Statistical accuracy in percent | Average coast down time in s | Running resistance in N | Target running resistance in N | Note |
|---|---|---|---|---|---|---|---|---|---|
| | First | | | | | | | | |
| | Second | | | | | | | | |
| | First | | | | | | | | |
| | Second | | | | | | | | |
| | First | | | | | | | | |
| | Second | | | | | | | | |
| | First | | | | | | | | |
| | Second | | | | | | | | |
| | First | | | | | | | | |
| | Second | | | | | | | | |
| | First | | | | | | | | |
| | Second | | | | | | | | |

Curve fitting: $F^{*}=...+...v^{2}$

## B.5.13. Annex: template form to record chassis dynamometer settings

Trade name: ____________ Production number (Body): ____________

Date: __/__/__ Place of the test: ____________ Name of recorder ____________

| **Test Vehicle** | Coast down time(s) | | | | Running resistance | | Setting | Note |
|---|---|---|---|---|---|---|---|---|
| | Test 1 | Test 2 | Test 3 | Average | Setting value | Target value | | |
| | | | | | | | | |
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Curve fitting: F*= + v2

## B.5.14. <u>Annex: driving cycles for the type I test</u>

### 1. World Harmonised Motorcycle Test Cycle (WMTC), description of the test cycle

The WMTC to be used on the chassis dynamometer shall be as depicted in the following graph and as specified in the following points:

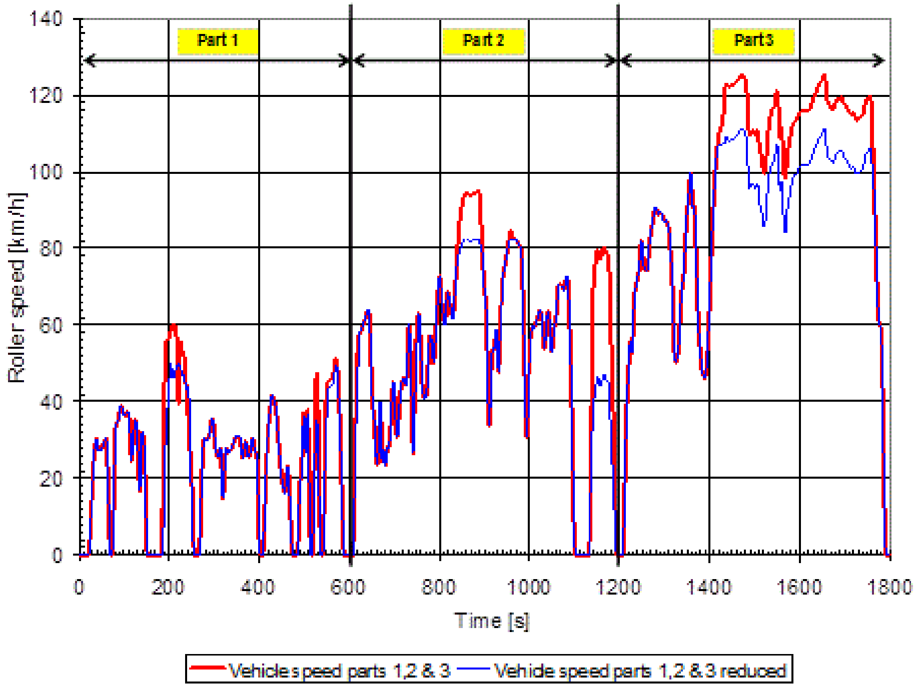


Figure B.5.14.-1: WMTC drive cycle

1.1. The WMTC lasts 1800 seconds and consists of three parts to be carried out without interruption. The characteristic driving conditions (idling, acceleration, steady vehicle speed, deceleration, etc.). are set out in the following points and tables.

## 1.2. WMTC, cycle part 1

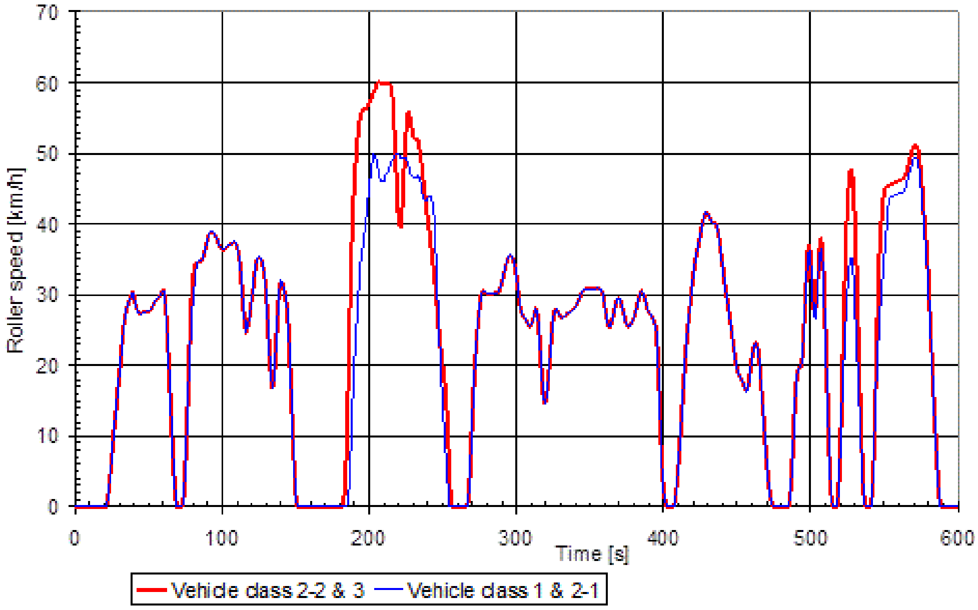


Figure B.5.14.-2: WMTC, part 1

1.2.1 The characteristic desired vehicle speed versus test time of WMTC, cycle part 1 is set out in the following tables.

1.2.2.1.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 0 | 0,0 | x | | | | 61 | 29,6 | | | | x | 121 | 31,2 | | | x | |
| 1 | 0,0 | x | | | | 62 | 26,9 | | | | x | 122 | 33,0 | | | x | |
| 2 | 0,0 | x | | | | 63 | 23,0 | | | | x | 123 | 34,4 | | | x | |
| 3 | 0,0 | x | | | | 64 | 18,6 | | | | x | 124 | 35,2 | | | x | |
| 4 | 0,0 | x | | | | 65 | 14,1 | | | | x | 125 | 35,4 | | | | x |
| 5 | 0,0 | x | | | | 66 | 9,3 | | | | x | 126 | 35,2 | | | | x |
| 6 | 0,0 | x | | | | 67 | 4,8 | | | | x | 127 | 34,7 | | | | x |
| 7 | 0,0 | x | | | | 68 | 1,9 | | | | x | 128 | 33,9 | | | | x |
| 8 | 0,0 | x | | | | 69 | 0,0 | x | | | | 129 | 32,4 | | | | x |
| 9 | 0,0 | x | | | | 70 | 0,0 | x | | | | 130 | 29,8 | | | | x |
| 10 | 0,0 | x | | | | 71 | 0,0 | x | | | | 131 | 26,1 | | | | x |
| 11 | 0,0 | x | | | | 72 | 0,0 | x | | | | 132 | 22,1 | | | | x |
| 12 | 0,0 | x | | | | 73 | 0,0 | x | | | | 133 | 18,6 | | | | x |
| 13 | 0,0 | x | | | | 74 | 1,7 | | x | | | 134 | 16,8 | | x | | |
| 14 | 0,0 | x | | | | 75 | 5,8 | | x | | | 135 | 17,7 | | x | | |
| 15 | 0,0 | x | | | | 76 | 11,8 | | x | | | 136 | 21,1 | | x | | |
| 16 | 0,0 | x | | | | 77 | 17,3 | | x | | | 137 | 25,4 | | x | | |
| 17 | 0,0 | x | | | | 78 | 22,0 | | x | | | 138 | 29,2 | | x | | |
| 18 | 0,0 | x | | | | 79 | 26,2 | | x | | | 139 | 31,6 | | x | | |
| 19 | 0,0 | x | | | | 80 | 29,4 | | x | | | 140 | 32,1 | | | | x |
| 20 | 0,0 | x | | | | 81 | 31,1 | | x | | | 141 | 31,6 | | | | x |
| 21 | 0,0 | x | | | | 82 | 32,9 | | x | | | 142 | 30,7 | | | | x |
| 22 | 1,0 | | x | | | 83 | 34,7 | | x | | | 143 | 29,7 | | | | x |
| 23 | 2,6 | | x | | | 84 | 34,8 | | x | | | 144 | 28,1 | | | | x |
| 24 | 4,8 | | x | | | 85 | 34,8 | | x | | | 145 | 25,0 | | | | x |
| 25 | 7,2 | | x | | | 86 | 34,9 | | x | | | 146 | 20,3 | | | | x |
| 26 | 9,6 | | x | | | 87 | 35,4 | | x | | | 147 | 15,0 | | | | x |
| 27 | 12,0 | | x | | | 88 | 36,2 | | x | | | 148 | 9,7 | | | | x |
| 28 | 14,3 | | x | | | 89 | 37,1 | | x | | | 149 | 5,0 | | | | x |
| 29 | 16,6 | | x | | | 90 | 38,0 | | x | | | 150 | 1,6 | | | | x |
| 30 | 18,9 | | x | | | 91 | 38,7 | | | x | | 151 | 0,0 | x | | | |
| 31 | 21,2 | | x | | | 92 | 38,9 | | | x | | 152 | 0,0 | x | | | |
| 32 | 23,5 | | x | | | 93 | 38,9 | | | x | | 153 | 0,0 | x | | | |
| 33 | 25,6 | | x | | | 94 | 38,8 | | | x | | 154 | 0,0 | x | | | |
| 34 | 27,1 | | x | | | 95 | 38,5 | | | x | | 155 | 0,0 | x | | | |
| 35 | 28,0 | | x | | | 96 | 38,1 | | | x | | 156 | 0,0 | x | | | |
| 36 | 28,7 | | x | | | 97 | 37,5 | | | x | | 157 | 0,0 | x | | | |
| 37 | 29,2 | | x | | | 98 | 37,0 | | | x | | 158 | 0,0 | x | | | |
| 38 | 29,8 | | x | | | 99 | 36,7 | | | x | | 159 | 0,0 | x | | | |
| 39 | 30,3 | | | x | | 100 | 36,5 | | | x | | 160 | 0,0 | x | | | |
| 40 | 29,6 | | | x | | 101 | 36,5 | | | x | | 161 | 0,0 | x | | | |
| 41 | 28,7 | | | x | | 102 | 36,6 | | | x | | 162 | 0,0 | x | | | |
| 42 | 27,9 | | | x | | 103 | 36,8 | | | x | | 163 | 0,0 | x | | | |
| 43 | 27,4 | | | x | | 104 | 37,0 | | | x | | 164 | 0,0 | x | | | |
| 44 | 27,3 | | | x | | 105 | 37,1 | | | x | | 165 | 0,0 | x | | | |
| 45 | 27,3 | | | x | | 106 | 37,3 | | | x | | 166 | 0,0 | x | | | |
| 46 | 27,4 | | | x | | 107 | 37,4 | | | x | | 167 | 0,0 | x | | | |
| 47 | 27,5 | | | x | | 108 | 37,5 | | | x | | 168 | 0,0 | x | | | |
| 48 | 27,6 | | | x | | 109 | 37,4 | | | x | | 169 | 0,0 | x | | | |
| 49 | 27,6 | | | x | | 110 | 36,9 | | | | x | 170 | 0,0 | x | | | |
| 50 | 27,6 | | | x | | 111 | 36,0 | | | | x | 171 | 0,0 | x | | | |
| 51 | 27,8 | | | x | | 112 | 34,8 | | | | x | 172 | 0,0 | x | | | |
| 52 | 28,1 | | | x | | 113 | 31,9 | | | | x | 173 | 0,0 | x | | | |
| 53 | 28,5 | | | x | | 114 | 29,0 | | | | x | 174 | 0,0 | x | | | |
| 54 | 28,9 | | | x | | 115 | 26,9 | | | | x | 175 | 0,0 | x | | | |
| 55 | 29,2 | | | x | | 116 | 24,7 | | | x | | 176 | 0,0 | x | | | |
| 56 | 29,4 | | | x | | 117 | 25,4 | | | x | | 177 | 0,0 | x | | | |
| 57 | 29,7 | | | x | | 118 | 26,4 | | | x | | 178 | 0,0 | x | | | |
| 58 | 30,0 | | | x | | 119 | 27,7 | | | x | | 179 | 0,0 | x | | | |
| 59 | 30,5 | | | x | | 120 | 29,4 | | | x | | 180 | 0,0 | x | | | |
| 60 | 30,6 | | | | x | | | | | | | | | | | | |

Table B.5.14.-1: WMTC, cycle part 1, reduced vehicle speed for vehicle classes 1 and 2-1, 0 to 180 s.

1.2.2.2.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 181 | 0,0 | x | | | | 241 | 43,9 | | | x | | 301 | 30,6 | | | x | |
| 182 | 0,0 | x | | | | 242 | 43,8 | | | | x | 302 | 29,0 | | | x | |
| 183 | 0,0 | x | | | | 243 | 43,0 | | | | x | 303 | 27,8 | | | x | |
| 184 | 0,0 | x | | | | 244 | 40,9 | | | | x | 304 | 27,2 | | | x | |
| 185 | 0,4 | | x | | | 245 | 36,9 | | | | x | 305 | 26,9 | | | x | |
| 186 | 1,8 | | x | | | 246 | 32,1 | | | | x | 306 | 26,5 | | | x | |
| 187 | 5,4 | | x | | | 247 | 26,6 | | | | x | 307 | 26,1 | | | x | |
| 188 | 11,1 | | x | | | 248 | 21,8 | | | | x | 308 | 25,7 | | | x | |
| 189 | 16,7 | | x | | | 249 | 17,2 | | | | x | 309 | 25,5 | | | x | |
| 190 | 21,3 | | x | | | 250 | 13,7 | | | | x | 310 | 25,7 | | | x | |
| 191 | 24,8 | | x | | | 251 | 10,3 | | | | x | 311 | 26,4 | | | x | |
| 192 | 28,4 | | x | | | 252 | 7,0 | | | | x | 312 | 27,3 | | | x | |
| 193 | 31,8 | | x | | | 253 | 3,5 | | | | x | 313 | 28,1 | | | x | |
| 194 | 34,6 | | x | | | 254 | 0,0 | x | | | | 314 | 27,9 | | | | x |
| 195 | 36,3 | | x | | | 255 | 0,0 | x | | | | 315 | 26,0 | | | | x |
| 196 | 37,8 | | x | | | 256 | 0,0 | x | | | | 316 | 22,7 | | | | x |
| 197 | 39,6 | | x | | | 257 | 0,0 | x | | | | 317 | 19,0 | | | | x |
| 198 | 41,3 | | x | | | 258 | 0,0 | x | | | | 318 | 16,0 | | | | x |
| 199 | 43,3 | | x | | | 259 | 0,0 | x | | | | 319 | 14,6 | | x | | |
| 200 | 45,1 | | x | | | 260 | 0,0 | x | | | | 320 | 15,2 | | x | | |
| 201 | 47,5 | | x | | | 261 | 0,0 | x | | | | 321 | 16,9 | | x | | |
| 202 | 49,0 | | x | | | 262 | 0,0 | x | | | | 322 | 19,3 | | x | | |
| 203 | 50,0 | | | x | | 263 | 0,0 | x | | | | 323 | 22,0 | | x | | |
| 204 | 49,5 | | | x | | 264 | 0,0 | x | | | | 324 | 24,6 | | x | | |
| 205 | 48,8 | | | x | | 265 | 0,0 | x | | | | 325 | 26,8 | | x | | |
| 206 | 47,6 | | | x | | 266 | 0,0 | x | | | | 326 | 27,9 | | x | | |
| 207 | 46,5 | | | x | | 267 | 0,5 | | x | | | 327 | 28,0 | | | x | |
| 208 | 46,1 | | | x | | 268 | 2,9 | | x | | | 328 | 27,7 | | | x | |
| 209 | 46,1 | | | x | | 269 | 8,2 | | x | | | 329 | 27,1 | | | x | |
| 210 | 46,6 | | | x | | 270 | 13,2 | | x | | | 330 | 26,8 | | | x | |
| 211 | 46,9 | | | x | | 271 | 17,8 | | x | | | 331 | 26,6 | | | x | |
| 212 | 47,2 | | | x | | 272 | 21,4 | | x | | | 332 | 26,8 | | | x | |
| 213 | 47,8 | | | x | | 273 | 24,1 | | x | | | 333 | 27,0 | | | x | |
| 214 | 48,4 | | | x | | 274 | 26,4 | | x | | | 334 | 27,2 | | | x | |
| 215 | 48,9 | | | x | | 275 | 28,4 | | x | | | 335 | 27,4 | | | x | |
| 216 | 49,2 | | | x | | 276 | 29,9 | | x | | | 336 | 27,5 | | | x | |
| 217 | 49,6 | | | x | | 277 | 30,5 | | | x | | 337 | 27,7 | | | x | |
| 218 | 49,9 | | | x | | 278 | 30,5 | | | x | | 338 | 27,9 | | | x | |
| 219 | 50,0 | | | x | | 279 | 30,3 | | | x | | 339 | 28,1 | | | x | |
| 220 | 49,8 | | | x | | 280 | 30,2 | | | x | | 340 | 28,3 | | | x | |
| 221 | 49,5 | | | x | | 281 | 30,1 | | | x | | 341 | 28,6 | | | x | |
| 222 | 49,2 | | | x | | 282 | 30,1 | | | x | | 342 | 29,1 | | | x | |
| 223 | 49,3 | | | x | | 283 | 30,1 | | | x | | 343 | 29,6 | | | x | |
| 224 | 49,4 | | | x | | 284 | 30,2 | | | x | | 344 | 30,1 | | | x | |
| 225 | 49,4 | | | x | | 285 | 30,2 | | | x | | 345 | 30,6 | | | x | |
| 226 | 48,6 | | | x | | 286 | 30,2 | | | x | | 346 | 30,8 | | | x | |
| 227 | 47,8 | | | x | | 287 | 30,2 | | | x | | 347 | 30,8 | | | x | |
| 228 | 47,0 | | | x | | 288 | 30,5 | | | x | | 348 | 30,8 | | | x | |
| 229 | 46,9 | | | x | | 289 | 31,0 | | | x | | 349 | 30,8 | | | x | |
| 230 | 46,6 | | | x | | 290 | 31,9 | | | x | | 350 | 30,8 | | | x | |
| 231 | 46,6 | | | x | | 291 | 32,8 | | | x | | 351 | 30,8 | | | x | |
| 232 | 46,6 | | | x | | 292 | 33,7 | | | x | | 352 | 30,8 | | | x | |
| 233 | 46,9 | | | x | | 293 | 34,5 | | | x | | 353 | 30,8 | | | x | |
| 234 | 46,4 | | | x | | 294 | 35,1 | | | x | | 354 | 30,9 | | | x | |
| 235 | 45,6 | | | x | | 295 | 35,5 | | | x | | 355 | 30,9 | | | x | |
| 236 | 44,4 | | | x | | 296 | 35,6 | | | x | | 356 | 30,9 | | | x | |
| 237 | 43,5 | | | x | | 297 | 35,4 | | | x | | 357 | 30,8 | | | x | |
| 238 | 43,2 | | | x | | 298 | 35,0 | | | x | | 358 | 30,4 | | | x | |
| 239 | 43,3 | | | x | | 299 | 34,0 | | | x | | 359 | 29,6 | | | x | |
| 240 | 43,7 | | | x | | 300 | 32,4 | | | x | | 360 | 28,4 | | | x | |

Table B.5.14.-2: WMTC, cycle part 1, reduced vehicle speed for vehicle classes 1 and 2-1, 181 to 360 s

1.2.2.3.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 361 | 27,1 | | | x | | 421 | 34,0 | | x | | | 481 | 0,0 | x | | | |
| 362 | 26,0 | | | x | | 422 | 35,4 | | x | | | 482 | 0,0 | x | | | |
| 363 | 25,4 | | | x | | 423 | 36,5 | | x | | | 483 | 0,0 | x | | | |
| 364 | 25,5 | | | x | | 424 | 37,5 | | x | | | 484 | 0,0 | x | | | |
| 365 | 26,3 | | | x | | 425 | 38,6 | | x | | | 485 | 0,0 | x | | | |
| 366 | 27,3 | | | x | | 426 | 39,6 | | x | | | 486 | 1,4 | | x | | |
| 367 | 28,3 | | | x | | 427 | 40,7 | | x | | | 487 | 4,5 | | x | | |
| 368 | 29,2 | | | x | | 428 | 41,4 | | x | | | 488 | 8,8 | | x | | |
| 369 | 29,5 | | | x | | 429 | 41,7 | | | x | | 489 | 13,4 | | x | | |
| 370 | 29,4 | | | x | | 430 | 41,4 | | | x | | 490 | 17,3 | | x | | |
| 371 | 28,9 | | | x | | 431 | 40,9 | | | x | | 491 | 19,2 | | x | | |
| 372 | 28,1 | | | x | | 432 | 40,5 | | | x | | 492 | 19,7 | | x | | |
| 373 | 27,1 | | | x | | 433 | 40,2 | | | x | | 493 | 19,8 | | x | | |
| 374 | 26,3 | | | x | | 434 | 40,1 | | | x | | 494 | 20,7 | | x | | |
| 375 | 25,7 | | | x | | 435 | 40,1 | | | x | | 495 | 23,7 | | x | | |
| 376 | 25,5 | | | x | | 436 | 39,8 | | | | x | 496 | 27,9 | | x | | |
| 377 | 25,6 | | | x | | 437 | 38,9 | | | | x | 497 | 31,9 | | x | | |
| 378 | 25,9 | | | x | | 438 | 37,4 | | | | x | 498 | 35,4 | | x | | |
| 379 | 26,3 | | | x | | 439 | 35,8 | | | | x | 499 | 36,2 | | | | x |
| 380 | 26,9 | | | x | | 440 | 34,1 | | | | x | 500 | 34,2 | | | | x |
| 381 | 27,6 | | | x | | 441 | 32,5 | | | | x | 501 | 30,2 | | | | x |
| 382 | 28,4 | | | x | | 442 | 30,9 | | | | x | 502 | 27,1 | | | | x |
| 383 | 29,3 | | | x | | 443 | 29,4 | | | | x | 503 | 26,6 | | x | | |
| 384 | 30,1 | | | x | | 444 | 27,9 | | | | x | 504 | 28,6 | | x | | |
| 385 | 30,4 | | | x | | 445 | 26,5 | | | | x | 505 | 32,6 | | x | | |
| 386 | 30,2 | | | x | | 446 | 25,0 | | | | x | 506 | 35,5 | | x | | |
| 387 | 29,5 | | | x | | 447 | 23,4 | | | | x | 507 | 36,6 | | | | x |
| 388 | 28,6 | | | x | | 448 | 21,8 | | | | x | 508 | 34,6 | | | | x |
| 389 | 27,9 | | | x | | 449 | 20,3 | | | | x | 509 | 30,0 | | | | x |
| 390 | 27,5 | | | x | | 450 | 19,3 | | | | x | 510 | 23,1 | | | | x |
| 391 | 27,2 | | | x | | 451 | 18,7 | | | | x | 511 | 16,7 | | | | x |
| 392 | 26,9 | | | | x | 452 | 18,3 | | | | x | 512 | 10,7 | | | | x |
| 393 | 26,4 | | | | x | 453 | 17,8 | | | | x | 513 | 4,7 | | | | x |
| 394 | 25,7 | | | | x | 454 | 17,4 | | | | x | 514 | 1,2 | | | | x |
| 395 | 24,9 | | | | x | 455 | 16,8 | | | | x | 515 | 0,0 | x | | | |
| 396 | 21,4 | | | | x | 456 | 16,3 | | | x | | 516 | 0,0 | x | | | |
| 397 | 15,9 | | | | x | 457 | 16,5 | | | x | | 517 | 0,0 | x | | | |
| 398 | 9,9 | | | | x | 458 | 17,6 | | | x | | 518 | 0,0 | x | | | |
| 399 | 4,9 | | | | x | 459 | 19,2 | | | x | | 519 | 3,0 | | x | | |
| 400 | 2,1 | | | | x | 460 | 20,8 | | | x | | 520 | 8,2 | | x | | |
| 401 | 0,9 | | | | x | 461 | 22,2 | | | x | | 521 | 14,3 | | x | | |
| 402 | 0,0 | x | | | | 462 | 23,0 | | | x | | 522 | 19,3 | | x | | |
| 403 | 0,0 | x | | | | 463 | 23,0 | | | | x | 523 | 23,5 | | x | | |
| 404 | 0,0 | x | | | | 464 | 22,0 | | | | x | 524 | 27,3 | | x | | |
| 405 | 0,0 | x | | | | 465 | 20,1 | | | | x | 525 | 30,8 | | x | | |
| 406 | 0,0 | x | | | | 466 | 17,7 | | | | x | 526 | 33,7 | | x | | |
| 407 | 0,0 | x | | | | 467 | 15,0 | | | | x | 527 | 35,2 | | x | | |
| 408 | 1,2 | | x | | | 468 | 12,1 | | | | x | 528 | 35,2 | | | | x |
| 409 | 3,2 | | x | | | 469 | 9,1 | | | | x | 529 | 32,5 | | | | x |
| 410 | 5,9 | | x | | | 470 | 6,2 | | | | x | 530 | 27,9 | | | | x |
| 411 | 8,8 | | x | | | 471 | 3,6 | | | | x | 531 | 23,2 | | | | x |
| 412 | 12,0 | | x | | | 472 | 1,8 | | | | x | 532 | 18,5 | | | | x |
| 413 | 15,4 | | x | | | 473 | 0,8 | | | | x | 533 | 13,8 | | | | x |
| 414 | 18,9 | | x | | | 474 | 0,0 | x | | | | 534 | 9,1 | | | | x |
| 415 | 22,1 | | x | | | 475 | 0,0 | x | | | | 535 | 4,5 | | | | x |
| 416 | 24,7 | | x | | | 476 | 0,0 | x | | | | 536 | 2,3 | | | | x |
| 417 | 26,8 | | x | | | 477 | 0,0 | x | | | | 537 | 0,0 | x | | | |
| 418 | 28,7 | | x | | | 478 | 0,0 | x | | | | 538 | 0,0 | x | | | |
| 419 | 30,6 | | x | | | 479 | 0,0 | x | | | | 539 | 0,0 | x | | | |
| 420 | 32,4 | | x | | | 480 | 0,0 | x | | | | 540 | 0,0 | x | | | |

Table B.5.14.-3: WMTC, cycle part 1, reduced vehicle speed for vehicle classes 1 and 2-1, 361 to 540 s

1.2.2.4.

| time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|
| | | stop | acc | cruise | dec |
| 541 | 0,0 | x | | | |
| 542 | 2,8 | | x | | |
| 543 | 8,1 | | x | | |
| 544 | 14,3 | | x | | |
| 545 | 19,2 | | x | | |
| 546 | 23,5 | | x | | |
| 547 | 27,2 | | x | | |
| 548 | 30,5 | | x | | |
| 549 | 33,1 | | x | | |
| 550 | 35,7 | | x | | |
| 551 | 38,3 | | x | | |
| 552 | 41,0 | | x | | |
| 553 | 43,6 | | | x | |
| 554 | 43,7 | | | x | |
| 555 | 43,8 | | | x | |
| 556 | 43,9 | | | x | |
| 557 | 44,0 | | | x | |
| 558 | 44,1 | | | x | |
| 559 | 44,2 | | | x | |
| 560 | 44,3 | | | x | |
| 561 | 44,4 | | | x | |
| 562 | 44,5 | | | x | |
| 563 | 44,6 | | | x | |
| 564 | 44,9 | | | x | |
| 565 | 45,5 | | | x | |
| 566 | 46,3 | | | x | |
| 567 | 47,1 | | | x | |
| 568 | 48,0 | | | x | |
| 569 | 48,7 | | | x | |
| 570 | 49,2 | | | x | |
| 571 | 49,4 | | | x | |
| 572 | 49,3 | | | x | |
| 573 | 48,7 | | | | x |
| 574 | 47,3 | | | | x |
| 575 | 45,0 | | | | x |
| 576 | 42,3 | | | | x |
| 577 | 39,5 | | | | x |
| 578 | 36,6 | | | | x |
| 579 | 33,7 | | | | x |
| 580 | 30,1 | | | | x |
| 581 | 26,0 | | | | x |
| 582 | 21,8 | | | | x |
| 583 | 17,7 | | | | x |
| 584 | 13,5 | | | | x |
| 585 | 9,4 | | | | x |
| 586 | 5,6 | | | | x |
| 587 | 2,1 | | | | x |
| 588 | 0,0 | x | | | |
| 589 | 0,0 | x | | | |
| 590 | 0,0 | x | | | |
| 591 | 0,0 | x | | | |
| 592 | 0,0 | x | | | |
| 593 | 0,0 | x | | | |
| 594 | 0,0 | x | | | |
| 595 | 0,0 | x | | | |
| 596 | 0,0 | x | | | |
| 597 | 0,0 | x | | | |
| 598 | 0,0 | x | | | |
| 599 | 0,0 | x | | | |
| 600 | 0,0 | x | | | |

Table B.5.14.-4: WMTC, cycle part 1, reduced vehicle speed for vehicle classes 1 and 2-1, 541 to 600 s

1.2.2.5.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 0 | 0,0 | x | | | | 61 | 29,7 | | | | x | 121 | 31,0 | | | x | |
| 1 | 0,0 | x | | | | 62 | 27,0 | | | | x | 122 | 32,8 | | | x | |
| 2 | 0,0 | x | | | | 63 | 23,0 | | | | x | 123 | 34,3 | | | x | |
| 3 | 0,0 | x | | | | 64 | 18,7 | | | | x | 124 | 35,1 | | | x | |
| 4 | 0,0 | x | | | | 65 | 14,2 | | | | x | 125 | 35,3 | | | | x |
| 5 | 0,0 | x | | | | 66 | 9,4 | | | | x | 126 | 35,1 | | | | x |
| 6 | 0,0 | x | | | | 67 | 4,9 | | | | x | 127 | 34,6 | | | | x |
| 7 | 0,0 | x | | | | 68 | 2,0 | | | | x | 128 | 33,7 | | | | x |
| 8 | 0,0 | x | | | | 69 | 0,0 | x | | | | 129 | 32,2 | | | | x |
| 9 | 0,0 | x | | | | 70 | 0,0 | x | | | | 130 | 29,6 | | | | x |
| 10 | 0,0 | x | | | | 71 | 0,0 | x | | | | 131 | 26,0 | | | | x |
| 11 | 0,0 | x | | | | 72 | 0,0 | x | | | | 132 | 22,0 | | | | x |
| 12 | 0,0 | x | | | | 73 | 0,0 | x | | | | 133 | 18,5 | | | | x |
| 13 | 0,0 | x | | | | 74 | 1,7 | | x | | | 134 | 16,6 | | x | | |
| 14 | 0,0 | x | | | | 75 | 5,8 | | x | | | 135 | 17,6 | | x | | |
| 15 | 0,0 | x | | | | 76 | 11,8 | | x | | | 136 | 21,0 | | x | | |
| 16 | 0,0 | x | | | | 77 | 18,3 | | x | | | 137 | 25,2 | | x | | |
| 17 | 0,0 | x | | | | 78 | 24,5 | | x | | | 138 | 29,1 | | x | | |
| 18 | 0,0 | x | | | | 79 | 29,4 | | x | | | 139 | 31,4 | | x | | |
| 19 | 0,0 | x | | | | 80 | 32,5 | | x | | | 140 | 31,9 | | | | x |
| 20 | 0,0 | x | | | | 81 | 34,2 | | x | | | 141 | 31,4 | | | | x |
| 21 | 0,0 | x | | | | 82 | 34,4 | | x | | | 142 | 30,6 | | | | x |
| 22 | 1,0 | | x | | | 83 | 34,5 | | x | | | 143 | 29,5 | | | | x |
| 23 | 2,6 | | x | | | 84 | 34,6 | | x | | | 144 | 28,0 | | | | x |
| 24 | 4,8 | | x | | | 85 | 34,7 | | x | | | 145 | 24,9 | | | | x |
| 25 | 7,2 | | x | | | 86 | 34,8 | | x | | | 146 | 20,2 | | | | x |
| 26 | 9,6 | | x | | | 87 | 35,2 | | x | | | 147 | 14,8 | | | | x |
| 27 | 12,0 | | x | | | 88 | 36,0 | | x | | | 148 | 9,5 | | | | x |
| 28 | 14,3 | | x | | | 89 | 37,0 | | x | | | 149 | 4,8 | | | | x |
| 29 | 16,6 | | x | | | 90 | 37,9 | | x | | | 150 | 1,4 | | | | x |
| 30 | 18,9 | | x | | | 91 | 38,6 | | x | | | 151 | 0,0 | x | | | |
| 31 | 21,2 | | x | | | 92 | 38,8 | | | x | | 152 | 0,0 | x | | | |
| 32 | 23,5 | | x | | | 93 | 38,8 | | | x | | 153 | 0,0 | x | | | |
| 33 | 25,6 | | x | | | 94 | 38,7 | | | x | | 154 | 0,0 | x | | | |
| 34 | 27,1 | | x | | | 95 | 38,5 | | | x | | 155 | 0,0 | x | | | |
| 35 | 28,0 | | x | | | 96 | 38,0 | | | x | | 156 | 0,0 | x | | | |
| 36 | 28,7 | | x | | | 97 | 37,4 | | | x | | 157 | 0,0 | x | | | |
| 37 | 29,2 | | x | | | 98 | 36,9 | | | x | | 158 | 0,0 | x | | | |
| 38 | 29,8 | | x | | | 99 | 36,6 | | | x | | 159 | 0,0 | x | | | |
| 39 | 30,4 | | | x | | 100 | 36,4 | | | x | | 160 | 0,0 | x | | | |
| 40 | 29,6 | | | x | | 101 | 36,4 | | | x | | 161 | 0,0 | x | | | |
| 41 | 28,7 | | | x | | 102 | 36,5 | | | x | | 162 | 0,0 | x | | | |
| 42 | 27,9 | | | x | | 103 | 36,7 | | | x | | 163 | 0,0 | x | | | |
| 43 | 27,5 | | | x | | 104 | 36,9 | | | x | | 164 | 0,0 | x | | | |
| 44 | 27,3 | | | x | | 105 | 37,0 | | | x | | 165 | 0,0 | x | | | |
| 45 | 27,4 | | | x | | 106 | 37,2 | | | x | | 166 | 0,0 | x | | | |
| 46 | 27,5 | | | x | | 107 | 37,3 | | | x | | 167 | 0,0 | x | | | |
| 47 | 27,6 | | | x | | 108 | 37,4 | | | x | | 168 | 0,0 | x | | | |
| 48 | 27,6 | | | x | | 109 | 37,3 | | | x | | 169 | 0,0 | x | | | |
| 49 | 27,6 | | | x | | 110 | 36,8 | | | x | | 170 | 0,0 | x | | | |
| 50 | 27,7 | | | x | | 111 | 35,8 | | | | x | 171 | 0,0 | x | | | |
| 51 | 27,8 | | | x | | 112 | 34,7 | | | | x | 172 | 0,0 | x | | | |
| 52 | 28,1 | | | x | | 113 | 31,8 | | | | x | 173 | 0,0 | x | | | |
| 53 | 28,6 | | | x | | 114 | 28,9 | | | | x | 174 | 0,0 | x | | | |
| 54 | 29,0 | | | x | | 115 | 26,7 | | | | x | 175 | 0,0 | x | | | |
| 55 | 29,2 | | | x | | 116 | 24,6 | | | x | | 176 | 0,0 | x | | | |
| 56 | 29,5 | | | x | | 117 | 25,2 | | | x | | 177 | 0,0 | x | | | |
| 57 | 29,7 | | | x | | 118 | 26,2 | | | x | | 178 | 0,0 | x | | | |
| 58 | 30,1 | | | x | | 119 | 27,6 | | | x | | 179 | 0,0 | x | | | |
| 59 | 30,5 | | | x | | 120 | 29,2 | | | x | | 180 | 0,0 | x | | | |
| 60 | 30,7 | | | x | | | | | | | | | | | | | |

Table B.5.14.-5: WMTC, cycle part 1 for vehicle classes 2-2 and 3, 0 to 180 s

1.2.2.6.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 181 | 0,0 | x | | | | 241 | 38,3 | | | | x | 301 | 30,6 | | | x | |
| 182 | 0,0 | x | | | | 242 | 36,4 | | | | x | 302 | 28,9 | | | x | |
| 183 | 2,0 | | x | | | 243 | 34,6 | | | | x | 303 | 27,8 | | | x | |
| 184 | 6,0 | | x | | | 244 | 32,7 | | | | x | 304 | 27,2 | | | x | |
| 185 | 12,4 | | x | | | 245 | 30,6 | | | | x | 305 | 26,9 | | | x | |
| 186 | 21,4 | | x | | | 246 | 28,1 | | | | x | 306 | 26,5 | | | x | |
| 187 | 30,0 | | x | | | 247 | 25,5 | | | | x | 307 | 26,1 | | | x | |
| 188 | 37,1 | | x | | | 248 | 23,1 | | | | x | 308 | 25,7 | | | x | |
| 189 | 42,5 | | x | | | 249 | 21,2 | | | | x | 309 | 25,5 | | | x | |
| 190 | 46,6 | | x | | | 250 | 19,5 | | | | x | 310 | 25,7 | | | x | |
| 191 | 49,8 | | x | | | 251 | 17,8 | | | | x | 311 | 26,4 | | | x | |
| 192 | 52,4 | | x | | | 252 | 15,3 | | | | x | 312 | 27,3 | | | x | |
| 193 | 54,4 | | x | | | 253 | 11,5 | | | | x | 313 | 28,1 | | | x | |
| 194 | 55,6 | | x | | | 254 | 7,2 | | | | x | 314 | 27,9 | | | | x |
| 195 | 56,1 | | | x | | 255 | 2,5 | | | | x | 315 | 26,0 | | | | x |
| 196 | 56,2 | | | x | | 256 | 0,0 | x | | | | 316 | 22,7 | | | | x |
| 197 | 56,2 | | | x | | 257 | 0,0 | x | | | | 317 | 19,0 | | | | x |
| 198 | 56,2 | | | x | | 258 | 0,0 | x | | | | 318 | 16,0 | | | | x |
| 199 | 56,7 | | | x | | 259 | 0,0 | x | | | | 319 | 14,6 | | x | | |
| 200 | 57,2 | | | x | | 260 | 0,0 | x | | | | 320 | 15,2 | | x | | |
| 201 | 57,7 | | | x | | 261 | 0,0 | x | | | | 321 | 16,9 | | x | | |
| 202 | 58,2 | | | x | | 262 | 0,0 | x | | | | 322 | 19,3 | | x | | |
| 203 | 58,7 | | | x | | 263 | 0,0 | x | | | | 323 | 22,0 | | x | | |
| 204 | 59,3 | | | x | | 264 | 0,0 | x | | | | 324 | 24,6 | | x | | |
| 205 | 59,8 | | | x | | 265 | 0,0 | x | | | | 325 | 26,8 | | x | | |
| 206 | 60,0 | | | x | | 266 | 0,0 | x | | | | 326 | 27,9 | | x | | |
| 207 | 60,0 | | | x | | 267 | 0,5 | | x | | | 327 | 28,1 | | | x | |
| 208 | 59,9 | | | x | | 268 | 2,9 | | x | | | 328 | 27,7 | | | x | |
| 209 | 59,9 | | | x | | 269 | 8,2 | | x | | | 329 | 27,2 | | | x | |
| 210 | 59,9 | | | x | | 270 | 13,2 | | x | | | 330 | 26,8 | | | x | |
| 211 | 59,9 | | | x | | 271 | 17,8 | | x | | | 331 | 26,6 | | | x | |
| 212 | 59,9 | | | x | | 272 | 21,4 | | x | | | 332 | 26,8 | | | x | |
| 213 | 59,8 | | | x | | 273 | 24,1 | | x | | | 333 | 27,0 | | | x | |
| 214 | 59,6 | | | | x | 274 | 26,4 | | x | | | 334 | 27,2 | | | x | |
| 215 | 59,1 | | | | x | 275 | 28,4 | | x | | | 335 | 27,4 | | | x | |
| 216 | 57,1 | | | | x | 276 | 29,9 | | x | | | 336 | 27,6 | | | x | |
| 217 | 53,2 | | | | x | 277 | 30,5 | | x | | | 337 | 27,7 | | | x | |
| 218 | 48,3 | | | | x | 278 | 30,5 | | | x | | 338 | 27,9 | | | x | |
| 219 | 43,9 | | | | x | 279 | 30,3 | | | x | | 339 | 28,1 | | | x | |
| 220 | 40,3 | | | | x | 280 | 30,2 | | | x | | 340 | 28,3 | | | x | |
| 221 | 39,5 | | | | x | 281 | 30,1 | | | x | | 341 | 28,6 | | | x | |
| 222 | 41,3 | | x | | | 282 | 30,1 | | | x | | 342 | 29,0 | | | x | |
| 223 | 45,2 | | x | | | 283 | 30,1 | | | x | | 343 | 29,6 | | | x | |
| 224 | 50,1 | | x | | | 284 | 30,1 | | | x | | 344 | 30,1 | | | x | |
| 225 | 53,7 | | x | | | 285 | 30,1 | | | x | | 345 | 30,5 | | | x | |
| 226 | 55,8 | | x | | | 286 | 30,1 | | | x | | 346 | 30,7 | | | x | |
| 227 | 55,8 | | | | x | 287 | 30,2 | | | x | | 347 | 30,8 | | | x | |
| 228 | 54,7 | | | | x | 288 | 30,4 | | | x | | 348 | 30,8 | | | x | |
| 229 | 53,3 | | | | x | 289 | 31,0 | | | x | | 349 | 30,8 | | | x | |
| 230 | 52,3 | | | | x | 290 | 31,8 | | | x | | 350 | 30,8 | | | x | |
| 231 | 52,0 | | | | x | 291 | 32,7 | | | x | | 351 | 30,8 | | | x | |
| 232 | 52,1 | | | | x | 292 | 33,6 | | | x | | 352 | 30,8 | | | x | |
| 233 | 51,8 | | | | x | 293 | 34,4 | | | x | | 353 | 30,8 | | | x | |
| 234 | 50,8 | | | | x | 294 | 35,0 | | | x | | 354 | 30,9 | | | x | |
| 235 | 49,2 | | | | x | 295 | 35,4 | | | x | | 355 | 30,9 | | | x | |
| 236 | 47,5 | | | | x | 296 | 35,5 | | | x | | 356 | 30,9 | | | x | |
| 237 | 45,7 | | | | x | 297 | 35,3 | | | x | | 357 | 30,8 | | | x | |
| 238 | 43,9 | | | | x | 298 | 34,9 | | | x | | 358 | 30,4 | | | x | |
| 239 | 42,0 | | | | x | 299 | 33,9 | | | x | | 359 | 29,6 | | | x | |
| 240 | 40,2 | | | | x | 300 | 32,4 | | | x | | 360 | 28,4 | | | x | |

Table B.5.14.-6: WMTC, cycle part 1 for vehicle classes 2-2 and 3, 181 to 360 s

1.2.2.7.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 361 | 27,1 | | | x | | 421 | 34,0 | | x | | | 481 | 0,0 | x | | | |
| 362 | 26,0 | | | x | | 422 | 35,4 | | x | | | 482 | 0,0 | x | | | |
| 363 | 25,4 | | | x | | 423 | 36,5 | | x | | | 483 | 0,0 | x | | | |
| 364 | 25,5 | | | x | | 424 | 37,5 | | x | | | 484 | 0,0 | x | | | |
| 365 | 26,3 | | | x | | 425 | 38,6 | | x | | | 485 | 0,0 | x | | | |
| 366 | 27,3 | | | x | | 426 | 39,7 | | x | | | 486 | 1,4 | | x | | |
| 367 | 28,4 | | | x | | 427 | 40,7 | | x | | | 487 | 4,5 | | x | | |
| 368 | 29,2 | | | x | | 428 | 41,5 | | x | | | 488 | 8,8 | | x | | |
| 369 | 29,5 | | | x | | 429 | 41,7 | | | x | | 489 | 13,4 | | x | | |
| 370 | 29,5 | | | x | | 430 | 41,5 | | | x | | 490 | 17,3 | | x | | |
| 371 | 29,0 | | | x | | 431 | 41,0 | | | x | | 491 | 19,2 | | x | | |
| 372 | 28,1 | | | x | | 432 | 40,6 | | | x | | 492 | 19,7 | | x | | |
| 373 | 27,2 | | | x | | 433 | 40,3 | | | x | | 493 | 19,8 | | x | | |
| 374 | 26,3 | | | x | | 434 | 40,2 | | | x | | 494 | 20,7 | | x | | |
| 375 | 25,7 | | | x | | 435 | 40,1 | | | x | | 495 | 23,6 | | x | | |
| 376 | 25,5 | | | x | | 436 | 39,8 | | | | x | 496 | 28,1 | | x | | |
| 377 | 25,6 | | | x | | 437 | 38,9 | | | | x | 497 | 32,8 | | x | | |
| 378 | 26,0 | | | x | | 438 | 37,5 | | | | x | 498 | 36,3 | | x | | |
| 379 | 26,4 | | | x | | 439 | 35,8 | | | | x | 499 | 37,1 | | | | x |
| 380 | 27,0 | | | x | | 440 | 34,2 | | | | x | 500 | 35,1 | | | | x |
| 381 | 27,7 | | | x | | 441 | 32,5 | | | | x | 501 | 31,1 | | | | x |
| 382 | 28,5 | | | x | | 442 | 30,9 | | | | x | 502 | 28,0 | | | | x |
| 383 | 29,4 | | | x | | 443 | 29,4 | | | | x | 503 | 27,5 | | x | | |
| 384 | 30,2 | | | x | | 444 | 28,0 | | | | x | 504 | 29,5 | | x | | |
| 385 | 30,5 | | | x | | 445 | 26,5 | | | | x | 505 | 34,0 | | x | | |
| 386 | 30,3 | | | x | | 446 | 25,0 | | | | x | 506 | 37,0 | | x | | |
| 387 | 29,5 | | | x | | 447 | 23,5 | | | | x | 507 | 38,0 | | | | x |
| 388 | 28,7 | | | x | | 448 | 21,9 | | | | x | 508 | 36,1 | | | | x |
| 389 | 27,9 | | | x | | 449 | 20,4 | | | | x | 509 | 31,5 | | | | x |
| 390 | 27,5 | | | x | | 450 | 19,4 | | | | x | 510 | 24,5 | | | | x |
| 391 | 27,3 | | | x | | 451 | 18,8 | | | | x | 511 | 17,5 | | | | x |
| 392 | 27,0 | | | | x | 452 | 18,4 | | | | x | 512 | 10,5 | | | | x |
| 393 | 26,5 | | | | x | 453 | 18,0 | | | | x | 513 | 4,5 | | | | x |
| 394 | 25,8 | | | | x | 454 | 17,5 | | | | x | 514 | 1,0 | | | | x |
| 395 | 25,0 | | | | x | 455 | 16,9 | | | | x | 515 | 0,0 | x | | | |
| 396 | 21,5 | | | | x | 456 | 16,4 | | | x | | 516 | 0,0 | x | | | |
| 397 | 16,0 | | | | x | 457 | 16,6 | | | x | | 517 | 0,0 | x | | | |
| 398 | 10,0 | | | | x | 458 | 17,7 | | | x | | 518 | 0,0 | x | | | |
| 399 | 5,0 | | | | x | 459 | 19,4 | | | x | | 519 | 2,9 | | x | | |
| 400 | 2,2 | | | | x | 460 | 20,9 | | | x | | 520 | 8,0 | | x | | |
| 401 | 1,0 | | | | x | 461 | 22,3 | | | x | | 521 | 16,0 | | x | | |
| 402 | 0,0 | x | | | | 462 | 23,2 | | | x | | 522 | 24,0 | | x | | |
| 403 | 0,0 | x | | | | 463 | 23,2 | | | | x | 523 | 32,0 | | x | | |
| 404 | 0,0 | x | | | | 464 | 22,2 | | | | x | 524 | 38,8 | | x | | |
| 405 | 0,0 | x | | | | 465 | 20,3 | | | | x | 525 | 43,1 | | x | | |
| 406 | 0,0 | x | | | | 466 | 17,9 | | | | x | 526 | 46,0 | | x | | |
| 407 | 0,0 | x | | | | 467 | 15,2 | | | | x | 527 | 47,5 | | | | x |
| 408 | 1,2 | | x | | | 468 | 12,3 | | | | x | 528 | 47,5 | | | | x |
| 409 | 3,2 | | x | | | 469 | 9,3 | | | | x | 529 | 44,8 | | | | x |
| 410 | 5,9 | | x | | | 470 | 6,4 | | | | x | 530 | 40,1 | | | | x |
| 411 | 8,8 | | x | | | 471 | 3,8 | | | | x | 531 | 33,8 | | | | x |
| 412 | 12,0 | | x | | | 472 | 2,0 | | | | x | 532 | 27,2 | | | | x |
| 413 | 15,4 | | x | | | 473 | 0,9 | | | | x | 533 | 20,0 | | | | x |
| 414 | 18,9 | | x | | | 474 | 0,0 | x | | | | 534 | 12,8 | | | | x |
| 415 | 22,1 | | x | | | 475 | 0,0 | x | | | | 535 | 7,0 | | | | x |
| 416 | 24,8 | | x | | | 476 | 0,0 | x | | | | 536 | 2,2 | | | | x |
| 417 | 26,8 | | x | | | 477 | 0,0 | x | | | | 537 | 0,0 | x | | | |
| 418 | 28,7 | | x | | | 478 | 0,0 | x | | | | 538 | 0,0 | x | | | |
| 419 | 30,6 | | x | | | 479 | 0,0 | x | | | | 539 | 0,0 | x | | | |
| 420 | 32,4 | | x | | | 480 | 0,0 | x | | | | 540 | 0,0 | x | | | |

Table B.5.14.-7: WMTC, cycle part 1 for vehicle classes 2-2 and 3, 361 to 540 s

1.2.2.8.

| time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|
| | | stop | acc | cruise | dec |
| 541 | 0,0 | x | | | |
| 542 | 2,7 | | x | | |
| 543 | 8,0 | | x | | |
| 544 | 16,0 | | x | | |
| 545 | 24,0 | | x | | |
| 546 | 32,0 | | x | | |
| 547 | 37,2 | | x | | |
| 548 | 40,4 | | x | | |
| 549 | 43,1 | | x | | |
| 550 | 44,6 | | x | | |
| 551 | 45,2 | | | x | |
| 552 | 45,3 | | | x | |
| 553 | 45,4 | | | x | |
| 554 | 45,5 | | | x | |
| 555 | 45,6 | | | x | |
| 556 | 45,7 | | | x | |
| 557 | 45,8 | | | x | |
| 558 | 45,9 | | | x | |
| 559 | 46,0 | | | x | |
| 560 | 46,1 | | | x | |
| 561 | 46,2 | | | x | |
| 562 | 46,3 | | | x | |
| 563 | 46,4 | | | x | |
| 564 | 46,7 | | | x | |
| 565 | 47,2 | | | x | |
| 566 | 48,0 | | | x | |
| 567 | 48,9 | | | x | |
| 568 | 49,8 | | | x | |
| 569 | 50,5 | | | x | |
| 570 | 51,0 | | | x | |
| 571 | 51,1 | | | x | |
| 572 | 51,0 | | | x | |
| 573 | 50,4 | | | | x |
| 574 | 49,0 | | | | x |
| 575 | 46,7 | | | | x |
| 576 | 44,0 | | | | x |
| 577 | 41,1 | | | | x |
| 578 | 38,3 | | | | x |
| 579 | 35,4 | | | | x |
| 580 | 31,8 | | | | x |
| 581 | 27,3 | | | | x |
| 582 | 22,4 | | | | x |
| 583 | 17,7 | | | | x |
| 584 | 13,4 | | | | x |
| 585 | 9,3 | | | | x |
| 586 | 5,5 | | | | x |
| 587 | 2,0 | | | | x |
| 588 | 0,0 | x | | | |
| 589 | 0,0 | x | | | |
| 590 | 0,0 | x | | | |
| 591 | 0,0 | x | | | |
| 592 | 0,0 | x | | | |
| 593 | 0,0 | x | | | |
| 594 | 0,0 | x | | | |
| 595 | 0,0 | x | | | |
| 596 | 0,0 | x | | | |
| 597 | 0,0 | x | | | |
| 598 | 0,0 | x | | | |
| 599 | 0,0 | x | | | |
| 600 | 0,0 | x | | | |

Table B.5.14.-8: WMTC, cycle part 1 for vehicle classes 2-2 and 3, 541 to 600 s

## 1.3. WMTC, part 2

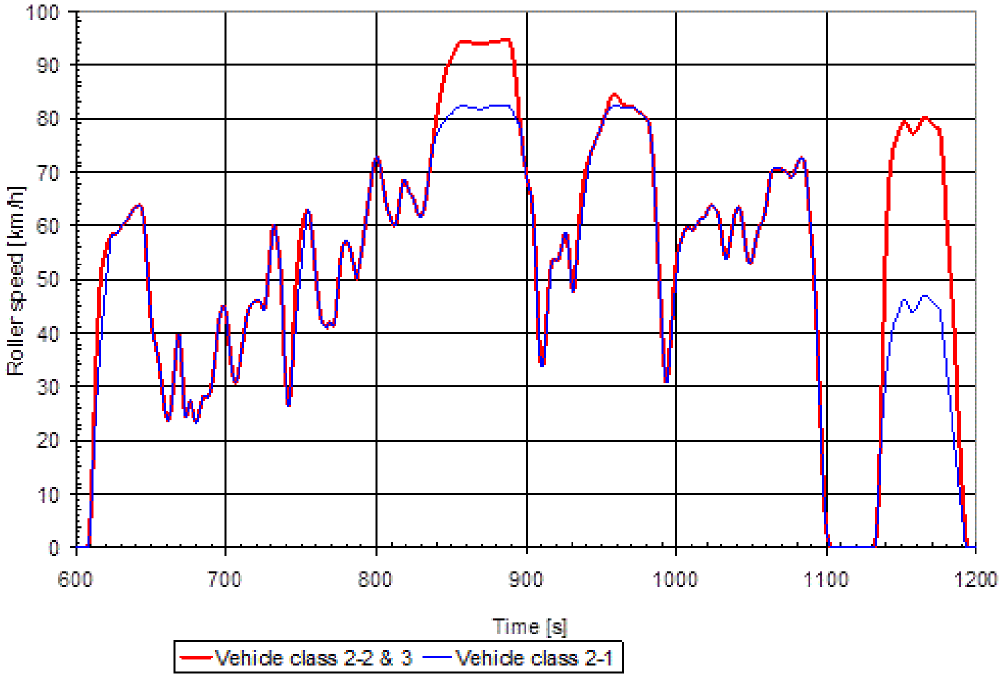


Figure B.5.14.-3: WMTC, part 2

3.1. The characteristic desired vehicle speed versus test time of WMTC, part 2 is set out in the following tables.

1.3.1.1.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 0 | 0,0 | x | | | | 61 | 23,7 | | x | | | 121 | 46,2 | | | x | |
| 1 | 0,0 | x | | | | 62 | 23,8 | | x | | | 122 | 46,1 | | | x | |
| 2 | 0,0 | x | | | | 63 | 25,0 | | x | | | 123 | 45,7 | | | x | |
| 3 | 0,0 | x | | | | 64 | 27,3 | | x | | | 124 | 45,0 | | | x | |
| 4 | 0,0 | x | | | | 65 | 30,4 | | x | | | 125 | 44,3 | | | x | |
| 5 | 0,0 | x | | | | 66 | 33,9 | | x | | | 126 | 44,7 | | x | | |
| 6 | 0,0 | x | | | | 67 | 37,3 | | x | | | 127 | 46,8 | | x | | |
| 7 | 0,0 | x | | | | 68 | 39,8 | | | | x | 128 | 49,9 | | x | | |
| 8 | 0,0 | x | | | | 69 | 39,5 | | | | x | 129 | 52,8 | | x | | |
| 9 | 2,3 | | x | | | 70 | 36,3 | | | | x | 130 | 55,6 | | x | | |
| 10 | 7,3 | | x | | | 71 | 31,4 | | | | x | 131 | 58,2 | | x | | |
| 11 | 13,6 | | x | | | 72 | 26,5 | | | | x | 132 | 60,2 | | | | x |
| 12 | 18,9 | | x | | | 73 | 24,2 | | | | x | 133 | 59,3 | | | | x |
| 13 | 23,6 | | x | | | 74 | 24,8 | | | | x | 134 | 57,5 | | | | x |
| 14 | 27,8 | | x | | | 75 | 26,6 | | | | x | 135 | 55,4 | | | | x |
| 15 | 31,8 | | x | | | 76 | 27,5 | | | | x | 136 | 52,5 | | | | x |
| 16 | 35,6 | | x | | | 77 | 26,8 | | | | x | 137 | 47,9 | | | | x |
| 17 | 39,3 | | x | | | 78 | 25,3 | | | | x | 138 | 41,4 | | | | x |
| 18 | 42,7 | | x | | | 79 | 24,0 | | | | x | 139 | 34,4 | | | | x |
| 19 | 46,0 | | x | | | 80 | 23,3 | | | x | | 140 | 30,0 | | | | x |
| 20 | 49,1 | | x | | | 81 | 23,7 | | | x | | 141 | 27,0 | | | | x |
| 21 | 52,1 | | x | | | 82 | 24,9 | | | x | | 142 | 26,5 | | x | | |
| 22 | 54,9 | | x | | | 83 | 26,4 | | | x | | 143 | 28,7 | | x | | |
| 23 | 57,5 | | x | | | 84 | 27,7 | | | x | | 144 | 32,7 | | x | | |
| 24 | 58,4 | | | x | | 85 | 28,3 | | | x | | 145 | 36,5 | | x | | |
| 25 | 58,5 | | | x | | 86 | 28,3 | | | x | | 146 | 40,0 | | x | | |
| 26 | 58,5 | | | x | | 87 | 28,1 | | | x | | 147 | 43,5 | | x | | |
| 27 | 58,6 | | | x | | 88 | 28,1 | | x | | | 148 | 46,7 | | x | | |
| 28 | 58,9 | | | x | | 89 | 28,6 | | x | | | 149 | 49,8 | | x | | |
| 29 | 59,3 | | | x | | 90 | 29,8 | | x | | | 150 | 52,7 | | x | | |
| 30 | 59,8 | | | x | | 91 | 31,6 | | x | | | 151 | 55,5 | | x | | |
| 31 | 60,2 | | | x | | 92 | 33,9 | | x | | | 152 | 58,1 | | x | | |
| 32 | 60,5 | | | x | | 93 | 36,5 | | x | | | 153 | 60,6 | | x | | |
| 33 | 60,8 | | | x | | 94 | 39,1 | | x | | | 154 | 62,9 | | x | | |
| 34 | 61,1 | | | x | | 95 | 41,5 | | x | | | 155 | 62,9 | | | | x |
| 35 | 61,5 | | | x | | 96 | 43,3 | | x | | | 156 | 61,7 | | | | x |
| 36 | 62,0 | | | x | | 97 | 44,5 | | x | | | 157 | 59,4 | | | | x |
| 37 | 62,5 | | | x | | 98 | 45,1 | | | | x | 158 | 56,6 | | | | x |
| 38 | 63,0 | | | x | | 99 | 45,1 | | | | x | 159 | 53,7 | | | | x |
| 39 | 63,4 | | | x | | 100 | 43,9 | | | | x | 160 | 50,7 | | | | x |
| 40 | 63,7 | | | x | | 101 | 41,4 | | | | x | 161 | 47,7 | | | | x |
| 41 | 63,8 | | | x | | 102 | 38,4 | | | | x | 162 | 45,0 | | | | x |
| 42 | 63,9 | | | x | | 103 | 35,5 | | | | x | 163 | 43,1 | | | | x |
| 43 | 63,8 | | | x | | 104 | 32,9 | | | | x | 164 | 41,9 | | | x | |
| 44 | 63,2 | | | | x | 105 | 31,3 | | | | x | 165 | 41,6 | | | x | |
| 45 | 61,7 | | | | x | 106 | 30,7 | | | | x | 166 | 41,3 | | | x | |
| 46 | 58,9 | | | | x | 107 | 31,0 | | | x | | 167 | 40,9 | | | x | |
| 47 | 55,2 | | | | x | 108 | 32,2 | | | x | | 168 | 41,8 | | | x | |
| 48 | 51,0 | | | | x | 109 | 34,0 | | | x | | 169 | 42,1 | | | x | |
| 49 | 46,7 | | | | x | 110 | 36,0 | | | x | | 170 | 41,8 | | | x | |
| 50 | 42,8 | | | | x | 111 | 37,9 | | | x | | 171 | 41,3 | | | x | |
| 51 | 40,2 | | | | x | 112 | 39,9 | | | x | | 172 | 41,5 | | x | | |
| 52 | 38,8 | | | | x | 113 | 41,6 | | | x | | 173 | 43,5 | | x | | |
| 53 | 37,9 | | | | x | 114 | 43,1 | | | x | | 174 | 46,5 | | x | | |
| 54 | 36,7 | | | | x | 115 | 44,3 | | | x | | 175 | 49,7 | | x | | |
| 55 | 35,1 | | | | x | 116 | 45,0 | | | x | | 176 | 52,6 | | x | | |
| 56 | 32,9 | | | | x | 117 | 45,5 | | | x | | 177 | 55,0 | | x | | |
| 57 | 30,4 | | | | x | 118 | 45,8 | | | x | | 178 | 56,5 | | x | | |
| 58 | 28,0 | | | | x | 119 | 46,0 | | | x | | 179 | 57,1 | | x | | |
| 59 | 25,9 | | | | x | 120 | 46,1 | | | x | | 180 | 57,3 | | | | x |
| 60 | 24,4 | | | | x | | | | | | | | | | | | |

Table B.5.14.-9: WMTC, cycle part 2, reduced vehicle speed for vehicle class 2-1, 0 to 180 s

1.3.1.2.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 181 | 57,0 | | | | x | 241 | 77,5 | | x | | | 301 | 68,3 | | | | x |
| 182 | 56,3 | | | | x | 242 | 78,1 | | | x | | 302 | 67,3 | | | | x |
| 183 | 55,2 | | | | x | 243 | 78,6 | | | x | | 303 | 66,1 | | | | x |
| 184 | 53,9 | | | | x | 244 | 79,0 | | | x | | 304 | 63,9 | | | | x |
| 185 | 52,6 | | | | x | 245 | 79,4 | | | x | | 305 | 60,2 | | | | x |
| 186 | 51,4 | | | | x | 246 | 79,7 | | | x | | 306 | 54,9 | | | | x |
| 187 | 50,1 | | x | | | 247 | 80,1 | | | x | | 307 | 48,1 | | | | x |
| 188 | 51,5 | | x | | | 248 | 80,7 | | | x | | 308 | 40,9 | | | | x |
| 189 | 53,1 | | x | | | 249 | 80,8 | | | x | | 309 | 36,0 | | | | x |
| 190 | 54,8 | | x | | | 250 | 81,0 | | | x | | 310 | 33,9 | | | | x |
| 191 | 56,6 | | x | | | 251 | 81,2 | | | x | | 311 | 33,9 | | x | | |
| 192 | 58,5 | | x | | | 252 | 81,6 | | | x | | 312 | 36,5 | | x | | |
| 193 | 60,6 | | x | | | 253 | 81,9 | | | x | | 313 | 40,1 | | x | | |
| 194 | 62,8 | | x | | | 254 | 82,1 | | | x | | 314 | 43,5 | | x | | |
| 195 | 64,9 | | x | | | 255 | 82,1 | | | x | | 315 | 46,8 | | x | | |
| 196 | 67,0 | | x | | | 256 | 82,3 | | | x | | 316 | 49,8 | | x | | |
| 197 | 69,1 | | x | | | 257 | 82,4 | | | x | | 317 | 52,8 | | x | | |
| 198 | 70,9 | | x | | | 258 | 82,4 | | | x | | 318 | 53,9 | | x | | |
| 199 | 72,2 | | x | | | 259 | 82,3 | | | x | | 319 | 53,9 | | x | | |
| 200 | 72,8 | | | | x | 260 | 82,3 | | | x | | 320 | 53,7 | | x | | |
| 201 | 72,8 | | | | x | 261 | 82,2 | | | x | | 321 | 53,7 | | x | | |
| 202 | 71,9 | | | | x | 262 | 82,2 | | | x | | 322 | 54,3 | | x | | |
| 203 | 70,5 | | | | x | 263 | 82,1 | | | x | | 323 | 55,4 | | x | | |
| 204 | 68,8 | | | | x | 264 | 82,1 | | | x | | 324 | 56,8 | | x | | |
| 205 | 67,1 | | | | x | 265 | 82,0 | | | x | | 325 | 58,1 | | x | | |
| 206 | 65,4 | | | | x | 266 | 82,0 | | | x | | 326 | 58,9 | | | | x |
| 207 | 63,9 | | | | x | 267 | 81,9 | | | x | | 327 | 58,2 | | | | x |
| 208 | 62,8 | | | | x | 268 | 81,9 | | | x | | 328 | 55,8 | | | | x |
| 209 | 61,8 | | | | x | 269 | 81,9 | | | x | | 329 | 52,6 | | | | x |
| 210 | 61,0 | | | | x | 270 | 81,9 | | | x | | 330 | 49,2 | | | | x |
| 211 | 60,4 | | | | x | 271 | 81,9 | | | x | | 331 | 47,6 | | x | | |
| 212 | 60,0 | | x | | | 272 | 82,0 | | | x | | 332 | 48,4 | | x | | |
| 213 | 60,2 | | x | | | 273 | 82,0 | | | x | | 333 | 51,4 | | x | | |
| 214 | 61,4 | | x | | | 274 | 82,1 | | | x | | 334 | 54,2 | | x | | |
| 215 | 63,3 | | x | | | 275 | 82,2 | | | x | | 335 | 56,9 | | x | | |
| 216 | 65,5 | | x | | | 276 | 82,3 | | | x | | 336 | 59,4 | | x | | |
| 217 | 67,4 | | x | | | 277 | 82,4 | | | x | | 337 | 61,8 | | x | | |
| 218 | 68,5 | | x | | | 278 | 82,5 | | | x | | 338 | 64,1 | | x | | |
| 219 | 68,7 | | | | x | 279 | 82,5 | | | x | | 339 | 66,2 | | x | | |
| 220 | 68,1 | | | | x | 280 | 82,5 | | | x | | 340 | 68,2 | | x | | |
| 221 | 67,3 | | | | x | 281 | 82,5 | | | x | | 341 | 70,2 | | x | | |
| 222 | 66,5 | | | | x | 282 | 82,4 | | | x | | 342 | 72,0 | | x | | |
| 223 | 65,9 | | | | x | 283 | 82,4 | | | x | | 343 | 73,7 | | x | | |
| 224 | 65,5 | | | | x | 284 | 82,4 | | | x | | 344 | 74,4 | | x | | |
| 225 | 64,9 | | | | x | 285 | 82,5 | | | x | | 345 | 75,1 | | x | | |
| 226 | 64,1 | | | | x | 286 | 82,5 | | | x | | 346 | 75,8 | | x | | |
| 227 | 63,0 | | | | x | 287 | 82,5 | | | x | | 347 | 76,5 | | x | | |
| 228 | 62,1 | | | | x | 288 | 82,4 | | | x | | 348 | 77,2 | | x | | |
| 229 | 61,6 | | x | | | 289 | 82,3 | | | x | | 349 | 77,8 | | x | | |
| 230 | 61,7 | | x | | | 290 | 81,6 | | | x | | 350 | 78,5 | | x | | |
| 231 | 62,3 | | x | | | 291 | 81,3 | | | x | | 351 | 79,2 | | x | | |
| 232 | 63,5 | | x | | | 292 | 80,3 | | | x | | 352 | 80,0 | | x | | |
| 233 | 65,3 | | x | | | 293 | 79,9 | | | x | | 353 | 81,0 | | | x | |
| 234 | 67,3 | | x | | | 294 | 79,2 | | | x | | 354 | 81,2 | | | x | |
| 235 | 69,2 | | x | | | 295 | 79,2 | | | x | | 355 | 81,8 | | | x | |
| 236 | 71,1 | | x | | | 296 | 78,4 | | | | x | 356 | 82,2 | | | x | |
| 237 | 73,0 | | x | | | 297 | 75,7 | | | | x | 357 | 82,2 | | | x | |
| 238 | 74,8 | | x | | | 298 | 73,2 | | | | x | 358 | 82,4 | | | x | |
| 239 | 75,7 | | x | | | 299 | 71,1 | | | | x | 359 | 82,5 | | | x | |
| 240 | 76,7 | | x | | | 300 | 69,5 | | | | x | 360 | 82,5 | | | x | |

Table B.5.14.-10: WMTC, cycle part 2, reduced vehicle speed for vehicle class 2-1, 181 to 360 s

1.3.1.3.

| time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|
| | | stop | acc | cruise | dec |
| 361 | 82,5 | | | x | |
| 362 | 82,5 | | | x | |
| 363 | 82,3 | | | x | |
| 364 | 82,1 | | | x | |
| 365 | 82,1 | | | x | |
| 366 | 82,1 | | | x | |
| 367 | 82,1 | | | x | |
| 368 | 82,1 | | | x | |
| 369 | 82,1 | | | x | |
| 370 | 82,1 | | | x | |
| 371 | 82,1 | | | x | |
| 372 | 82,1 | | | x | |
| 373 | 81,9 | | | x | |
| 374 | 81,6 | | | x | |
| 375 | 81,3 | | | x | |
| 376 | 81,1 | | | x | |
| 377 | 80,8 | | | x | |
| 378 | 80,6 | | | x | |
| 379 | 80,4 | | | x | |
| 380 | 80,1 | | | x | |
| 381 | 79,7 | | | | x |
| 382 | 78,6 | | | | x |
| 383 | 76,8 | | | | x |
| 384 | 73,7 | | | | x |
| 385 | 69,4 | | | | x |
| 386 | 64,0 | | | | x |
| 387 | 58,6 | | | | x |
| 388 | 53,2 | | | | x |
| 389 | 47,8 | | | | x |
| 390 | 42,4 | | | | x |
| 391 | 37,0 | | | | x |
| 392 | 33,0 | | | | x |
| 393 | 30,9 | | | | x |
| 394 | 30,9 | | x | | |
| 395 | 33,5 | | x | | |
| 396 | 37,2 | | x | | |
| 397 | 40,8 | | x | | |
| 398 | 44,2 | | x | | |
| 399 | 47,4 | | x | | |
| 400 | 50,4 | | x | | |
| 401 | 53,3 | | x | | |
| 402 | 56,1 | | x | | |
| 403 | 57,3 | | x | | |
| 404 | 58,1 | | x | | |
| 405 | 58,8 | | x | | |
| 406 | 59,4 | | x | | |
| 407 | 59,8 | | | x | |
| 408 | 59,7 | | | x | |
| 409 | 59,4 | | | x | |
| 410 | 59,2 | | | x | |
| 411 | 59,2 | | | x | |
| 412 | 59,6 | | | x | |
| 413 | 60,0 | | | x | |
| 414 | 60,5 | | | x | |
| 415 | 61,0 | | | x | |
| 416 | 61,2 | | | x | |
| 417 | 61,3 | | | x | |
| 418 | 61,4 | | | x | |
| 419 | 61,7 | | | x | |
| 420 | 62,3 | | | x | |

| time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|
| | | stop | acc | cruise | dec |
| 421 | 63,1 | | | x | |
| 422 | 63,6 | | | x | |
| 423 | 63,9 | | | x | |
| 424 | 63,8 | | | x | |
| 425 | 63,6 | | | x | |
| 426 | 63,3 | | | | x |
| 427 | 62,8 | | | | x |
| 428 | 61,9 | | | | x |
| 429 | 60,5 | | | | x |
| 430 | 58,6 | | | | x |
| 431 | 56,5 | | | | x |
| 432 | 54,6 | | | | x |
| 433 | 53,8 | | | x | |
| 434 | 54,5 | | | x | |
| 435 | 56,1 | | | x | |
| 436 | 57,9 | | | x | |
| 437 | 59,7 | | | x | |
| 438 | 61,2 | | | x | |
| 439 | 62,3 | | | x | |
| 440 | 63,1 | | | x | |
| 441 | 63,6 | | | | x |
| 442 | 63,5 | | | | x |
| 443 | 62,7 | | | | x |
| 444 | 60,9 | | | | x |
| 445 | 58,7 | | | | x |
| 446 | 56,4 | | | | x |
| 447 | 54,5 | | | | x |
| 448 | 53,3 | | | | x |
| 449 | 53,0 | | | x | |
| 450 | 53,5 | | | x | |
| 451 | 54,6 | | | x | |
| 452 | 56,1 | | | x | |
| 453 | 57,6 | | | x | |
| 454 | 58,9 | | | x | |
| 455 | 59,8 | | | x | |
| 456 | 60,3 | | | x | |
| 457 | 60,7 | | | x | |
| 458 | 61,3 | | | x | |
| 459 | 62,4 | | | x | |
| 460 | 64,1 | | | x | |
| 461 | 66,2 | | | x | |
| 462 | 68,1 | | | x | |
| 463 | 69,7 | | | x | |
| 464 | 70,4 | | | x | |
| 465 | 70,7 | | | x | |
| 466 | 70,7 | | | x | |
| 467 | 70,7 | | | x | |
| 468 | 70,7 | | | x | |
| 469 | 70,6 | | | x | |
| 470 | 70,5 | | | x | |
| 471 | 70,4 | | | x | |
| 472 | 70,2 | | | x | |
| 473 | 70,1 | | | x | |
| 474 | 69,8 | | | x | |
| 475 | 69,5 | | | x | |
| 476 | 69,1 | | | x | |
| 477 | 69,1 | | | x | |
| 478 | 69,5 | | | x | |
| 479 | 70,3 | | | x | |
| 480 | 71,2 | | | x | |

| time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|
| | | stop | acc | cruise | dec |
| 481 | 72,0 | | | x | |
| 482 | 72,6 | | | x | |
| 483 | 72,8 | | | x | |
| 484 | 72,7 | | | x | |
| 485 | 72,0 | | | | x |
| 486 | 70,4 | | | | x |
| 487 | 67,7 | | | | x |
| 488 | 64,4 | | | | x |
| 489 | 61,0 | | | | x |
| 490 | 57,6 | | | | x |
| 491 | 54,0 | | | | x |
| 492 | 49,7 | | | | x |
| 493 | 44,4 | | | | x |
| 494 | 38,2 | | | | x |
| 495 | 31,2 | | | | x |
| 496 | 24,0 | | | | x |
| 497 | 16,8 | | | | x |
| 498 | 10,4 | | | | x |
| 499 | 5,7 | | | | x |
| 500 | 2,8 | | | | x |
| 501 | 1,6 | | | | x |
| 502 | 0,3 | | | | x |
| 503 | 0,0 | x | | | |
| 504 | 0,0 | x | | | |
| 505 | 0,0 | x | | | |
| 506 | 0,0 | x | | | |
| 507 | 0,0 | x | | | |
| 508 | 0,0 | x | | | |
| 509 | 0,0 | x | | | |
| 510 | 0,0 | x | | | |
| 511 | 0,0 | x | | | |
| 512 | 0,0 | x | | | |
| 513 | 0,0 | x | | | |
| 514 | 0,0 | x | | | |
| 515 | 0,0 | x | | | |
| 516 | 0,0 | x | | | |
| 517 | 0,0 | x | | | |
| 518 | 0,0 | x | | | |
| 519 | 0,0 | x | | | |
| 520 | 0,0 | x | | | |
| 521 | 0,0 | x | | | |
| 522 | 0,0 | x | | | |
| 523 | 0,0 | x | | | |
| 524 | 0,0 | x | | | |
| 525 | 0,0 | x | | | |
| 526 | 0,0 | x | | | |
| 527 | 0,0 | x | | | |
| 528 | 0,0 | x | | | |
| 529 | 0,0 | x | | | |
| 530 | 0,0 | x | | | |
| 531 | 0,0 | x | | | |
| 532 | 0,0 | x | | | |
| 533 | 2,3 | | x | | |
| 534 | 7,2 | | x | | |
| 535 | 13,5 | | x | | |
| 536 | 18,7 | | x | | |
| 537 | 22,9 | | x | | |
| 538 | 26,7 | | x | | |
| 539 | 30,0 | | x | | |
| 540 | 32,8 | | x | | |

Table B.5.14.-11: WMTC, cycle part 2, reduced vehicle speed for vehicle class 2-1, 361 to 540 s

1.3.1.4.

| time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|
| | | stop | acc | cruise | dec |
| 541 | 35,2 | | x | | |
| 542 | 37,3 | | x | | |
| 543 | 39,1 | | x | | |
| 544 | 40,8 | | x | | |
| 545 | 41,8 | | x | | |
| 546 | 42,5 | | x | | |
| 547 | 43,3 | | x | | |
| 548 | 44,1 | | x | | |
| 549 | 45,0 | | x | | |
| 550 | 45,7 | | x | | |
| 551 | 46,2 | | | x | |
| 552 | 46,3 | | | x | |
| 553 | 46,1 | | | x | |
| 554 | 45,6 | | | x | |
| 555 | 44,9 | | | x | |
| 556 | 44,4 | | | x | |
| 557 | 44,0 | | | x | |
| 558 | 44,0 | | | x | |
| 559 | 44,3 | | | x | |
| 560 | 44,8 | | | x | |
| 561 | 45,3 | | | x | |
| 562 | 45,9 | | | x | |
| 563 | 46,5 | | | x | |
| 564 | 46,8 | | | x | |
| 565 | 47,1 | | | x | |
| 566 | 47,1 | | | x | |
| 567 | 47,0 | | | x | |
| 568 | 46,7 | | | x | |
| 569 | 46,3 | | | x | |
| 570 | 45,9 | | | x | |
| 571 | 45,6 | | | x | |
| 572 | 45,4 | | | x | |
| 573 | 45,2 | | | x | |
| 574 | 45,1 | | | x | |
| 575 | 44,8 | | | | x |
| 576 | 43,5 | | | | x |
| 577 | 40,9 | | | | x |
| 578 | 38,2 | | | | x |
| 579 | 35,6 | | | | x |
| 580 | 33,0 | | | | x |
| 581 | 30,4 | | | | x |
| 582 | 27,7 | | | | x |
| 583 | 25,1 | | | | x |
| 584 | 22,5 | | | | x |
| 585 | 19,8 | | | | x |
| 586 | 17,2 | | | | x |
| 587 | 14,6 | | | | x |
| 588 | 12,0 | | | | x |
| 589 | 9,3 | | | | x |
| 590 | 6,7 | | | | x |
| 591 | 4,1 | | | | x |
| 592 | 1,5 | | | | x |
| 593 | 0,0 | x | | | |
| 594 | 0,0 | x | | | |
| 595 | 0,0 | x | | | |
| 596 | 0,0 | x | | | |
| 597 | 0,0 | x | | | |
| 598 | 0,0 | x | | | |
| 599 | 0,0 | x | | | |
| 600 | 0,0 | x | | | |

Table B.5.14.-12: WMTC, cycle part 2, reduced vehicle speed for vehicle class 2-1, 541 to 600 s

1.3.1.5.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 0 | 0,0 | x | | | | 61 | 23,7 | | x | | | 121 | 46,2 | | | x | |
| 1 | 0,0 | x | | | | 62 | 23,8 | | x | | | 122 | 46,1 | | | x | |
| 2 | 0,0 | x | | | | 63 | 25,0 | | x | | | 123 | 45,7 | | | x | |
| 3 | 0,0 | x | | | | 64 | 27,3 | | x | | | 124 | 45,0 | | | x | |
| 4 | 0,0 | x | | | | 65 | 30,4 | | x | | | 125 | 44,3 | | | x | |
| 5 | 0,0 | x | | | | 66 | 33,9 | | x | | | 126 | 44,7 | | x | | |
| 6 | 0,0 | x | | | | 67 | 37,3 | | x | | | 127 | 46,8 | | x | | |
| 7 | 0,0 | x | | | | 68 | 39,8 | | x | | | 128 | 50,1 | | x | | |
| 8 | 0,0 | x | | | | 69 | 39,5 | | | | x | 129 | 53,6 | | x | | |
| 9 | 2,3 | | x | | | 70 | 36,3 | | | | x | 130 | 56,9 | | x | | |
| 10 | 7,3 | | x | | | 71 | 31,4 | | | | x | 131 | 59,4 | | x | | |
| 11 | 15,2 | | x | | | 72 | 26,5 | | | | x | 132 | 60,2 | | | | x |
| 12 | 23,9 | | x | | | 73 | 24,2 | | | | x | 133 | 59,3 | | | | x |
| 13 | 32,5 | | x | | | 74 | 24,8 | | | | x | 134 | 57,5 | | | | x |
| 14 | 39,2 | | x | | | 75 | 26,6 | | | | x | 135 | 55,4 | | | | x |
| 15 | 44,1 | | x | | | 76 | 27,5 | | | | x | 136 | 52,5 | | | | x |
| 16 | 48,1 | | x | | | 77 | 26,8 | | | | x | 137 | 47,9 | | | | x |
| 17 | 51,2 | | x | | | 78 | 25,3 | | | | x | 138 | 41,4 | | | | x |
| 18 | 53,3 | | x | | | 79 | 24,0 | | | | x | 139 | 34,4 | | | | x |
| 19 | 54,5 | | x | | | 80 | 23,3 | | | x | | 140 | 30,0 | | | | x |
| 20 | 55,7 | | x | | | 81 | 23,7 | | | x | | 141 | 27,0 | | | | x |
| 21 | 56,9 | | | x | | 82 | 24,9 | | | x | | 142 | 26,5 | | x | | |
| 22 | 57,5 | | | x | | 83 | 26,4 | | | x | | 143 | 28,7 | | x | | |
| 23 | 58,0 | | | x | | 84 | 27,7 | | | x | | 144 | 33,8 | | x | | |
| 24 | 58,4 | | | x | | 85 | 28,3 | | | x | | 145 | 40,3 | | x | | |
| 25 | 58,5 | | | x | | 86 | 28,3 | | | x | | 146 | 46,6 | | x | | |
| 26 | 58,5 | | | x | | 87 | 28,1 | | | x | | 147 | 50,4 | | x | | |
| 27 | 58,6 | | | x | | 88 | 28,1 | | | x | | 148 | 54,0 | | x | | |
| 28 | 58,9 | | | x | | 89 | 28,6 | | | x | | 149 | 56,9 | | x | | |
| 29 | 59,3 | | | x | | 90 | 29,8 | | | x | | 150 | 59,1 | | x | | |
| 30 | 59,8 | | | x | | 91 | 31,6 | | | x | | 151 | 60,6 | | x | | |
| 31 | 60,2 | | | x | | 92 | 33,9 | | | x | | 152 | 61,7 | | x | | |
| 32 | 60,5 | | | x | | 93 | 36,5 | | | x | | 153 | 62,6 | | x | | |
| 33 | 60,8 | | | x | | 94 | 39,1 | | | x | | 154 | 63,1 | | | | x |
| 34 | 61,1 | | | x | | 95 | 41,5 | | | x | | 155 | 62,9 | | | | x |
| 35 | 61,5 | | | x | | 96 | 43,3 | | | x | | 156 | 61,7 | | | | x |
| 36 | 62,0 | | | x | | 97 | 44,5 | | | x | | 157 | 59,4 | | | | x |
| 37 | 62,5 | | | x | | 98 | 45,1 | | | | x | 158 | 56,6 | | | | x |
| 38 | 63,0 | | | x | | 99 | 45,1 | | | | x | 159 | 53,7 | | | | x |
| 39 | 63,4 | | | x | | 100 | 43,9 | | | | x | 160 | 50,7 | | | | x |
| 40 | 63,7 | | | x | | 101 | 41,4 | | | | x | 161 | 47,7 | | | | x |
| 41 | 63,8 | | | x | | 102 | 38,4 | | | | x | 162 | 45,0 | | | | x |
| 42 | 63,9 | | | x | | 103 | 35,5 | | | | x | 163 | 43,1 | | | | x |
| 43 | 63,8 | | | x | | 104 | 32,9 | | | | x | 164 | 41,9 | | | x | |
| 44 | 63,2 | | | | x | 105 | 31,3 | | | | x | 165 | 41,6 | | | x | |
| 45 | 61,7 | | | | x | 106 | 30,7 | | | | x | 166 | 41,3 | | | x | |
| 46 | 58,9 | | | | x | 107 | 31,0 | | | x | | 167 | 40,9 | | | x | |
| 47 | 55,2 | | | | x | 108 | 32,2 | | | x | | 168 | 41,8 | | | x | |
| 48 | 51,0 | | | | x | 109 | 34,0 | | | x | | 169 | 42,1 | | | x | |
| 49 | 46,7 | | | | x | 110 | 36,0 | | | x | | 170 | 41,8 | | | x | |
| 50 | 42,8 | | | | x | 111 | 37,9 | | | x | | 171 | 41,3 | | | x | |
| 51 | 40,2 | | | | x | 112 | 39,9 | | | x | | 172 | 41,5 | | x | | |
| 52 | 38,8 | | | | x | 113 | 41,6 | | | x | | 173 | 43,5 | | x | | |
| 53 | 37,9 | | | | x | 114 | 43,1 | | | x | | 174 | 46,5 | | x | | |
| 54 | 36,7 | | | | x | 115 | 44,3 | | | x | | 175 | 49,7 | | x | | |
| 55 | 35,1 | | | | x | 116 | 45,0 | | | x | | 176 | 52,6 | | x | | |
| 56 | 32,9 | | | | x | 117 | 45,5 | | | x | | 177 | 55,0 | | x | | |
| 57 | 30,4 | | | | x | 118 | 45,8 | | | x | | 178 | 56,5 | | x | | |
| 58 | 28,0 | | | | x | 119 | 46,0 | | | x | | 179 | 57,1 | | x | | |
| 59 | 25,9 | | | | x | 120 | 46,1 | | | x | | 180 | 57,3 | | | | x |
| 60 | 24,4 | | | | x | | | | | | | | | | | | |

Table B.5.14.-13: WMTC, cycle part 2 for vehicle classes 2-2 and 3, 0 to 180 s

1.3.1.6.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 181 | 57,0 | | | | x | 241 | 81,5 | | x | | | 301 | 68,3 | | | | x |
| 182 | 56,3 | | | | x | 242 | 83,1 | | x | | | 302 | 67,3 | | | | x |
| 183 | 55,2 | | | | x | 243 | 84,6 | | x | | | 303 | 66,1 | | | | x |
| 184 | 53,9 | | | | x | 244 | 86,0 | | x | | | 304 | 63,9 | | | | x |
| 185 | 52,6 | | | | x | 245 | 87,4 | | x | | | 305 | 60,2 | | | | x |
| 186 | 51,4 | | | | x | 246 | 88,7 | | x | | | 306 | 54,9 | | | | x |
| 187 | 50,1 | | x | | | 247 | 89,6 | | x | | | 307 | 48,1 | | | | x |
| 188 | 51,5 | | x | | | 248 | 90,2 | | x | | | 308 | 40,9 | | | | x |
| 189 | 53,1 | | x | | | 249 | 90,7 | | x | | | 309 | 36,0 | | | | x |
| 190 | 54,8 | | x | | | 250 | 91,2 | | x | | | 310 | 33,9 | | | | x |
| 191 | 56,6 | | x | | | 251 | 91,8 | | x | | | 311 | 33,9 | | x | | |
| 192 | 58,5 | | x | | | 252 | 92,4 | | x | | | 312 | 36,5 | | x | | |
| 193 | 60,6 | | x | | | 253 | 93,0 | | x | | | 313 | 41,0 | | x | | |
| 194 | 62,8 | | x | | | 254 | 93,6 | | x | | | 314 | 45,3 | | x | | |
| 195 | 64,9 | | x | | | 255 | 94,1 | | | x | | 315 | 49,2 | | x | | |
| 196 | 67,0 | | x | | | 256 | 94,3 | | | x | | 316 | 51,5 | | x | | |
| 197 | 69,1 | | x | | | 257 | 94,4 | | | x | | 317 | 53,2 | | x | | |
| 198 | 70,9 | | x | | | 258 | 94,4 | | | x | | 318 | 53,9 | | x | | |
| 199 | 72,2 | | x | | | 259 | 94,3 | | | x | | 319 | 53,9 | | x | | |
| 200 | 72,8 | | | | x | 260 | 94,3 | | | x | | 320 | 53,7 | | x | | |
| 201 | 72,8 | | | | x | 261 | 94,2 | | | x | | 321 | 53,7 | | x | | |
| 202 | 71,9 | | | | x | 262 | 94,2 | | | x | | 322 | 54,3 | | x | | |
| 203 | 70,5 | | | | x | 263 | 94,2 | | | x | | 323 | 55,4 | | x | | |
| 204 | 68,8 | | | | x | 264 | 94,1 | | | x | | 324 | 56,8 | | x | | |
| 205 | 67,1 | | | | x | 265 | 94,0 | | | x | | 325 | 58,1 | | x | | |
| 206 | 65,4 | | | | x | 266 | 94,0 | | | x | | 326 | 58,9 | | | | x |
| 207 | 63,9 | | | | x | 267 | 93,9 | | | x | | 327 | 58,2 | | | | x |
| 208 | 62,8 | | | | x | 268 | 93,9 | | | x | | 328 | 55,8 | | | | x |
| 209 | 61,8 | | | | x | 269 | 93,9 | | | x | | 329 | 52,6 | | | | x |
| 210 | 61,0 | | | | x | 270 | 93,9 | | | x | | 330 | 49,2 | | | | x |
| 211 | 60,4 | | | | x | 271 | 93,9 | | | x | | 331 | 47,6 | | x | | |
| 212 | 60,0 | | | | x | 272 | 94,0 | | | x | | 332 | 48,4 | | x | | |
| 213 | 60,2 | | | x | | 273 | 94,0 | | | x | | 333 | 51,8 | | x | | |
| 214 | 61,4 | | | x | | 274 | 94,1 | | | x | | 334 | 55,7 | | x | | |
| 215 | 63,3 | | | x | | 275 | 94,2 | | | x | | 335 | 59,6 | | x | | |
| 216 | 65,5 | | | x | | 276 | 94,3 | | | x | | 336 | 63,0 | | x | | |
| 217 | 67,4 | | | x | | 277 | 94,4 | | | x | | 337 | 65,9 | | x | | |
| 218 | 68,5 | | | x | | 278 | 94,5 | | | x | | 338 | 68,1 | | x | | |
| 219 | 68,7 | | | | x | 279 | 94,5 | | | x | | 339 | 69,8 | | x | | |
| 220 | 68,1 | | | | x | 280 | 94,5 | | | x | | 340 | 71,1 | | x | | |
| 221 | 67,3 | | | | x | 281 | 94,5 | | | x | | 341 | 72,1 | | x | | |
| 222 | 66,5 | | | | x | 282 | 94,4 | | | x | | 342 | 72,9 | | x | | |
| 223 | 65,9 | | | | x | 283 | 94,5 | | | x | | 343 | 73,7 | | x | | |
| 224 | 65,5 | | | | x | 284 | 94,6 | | | x | | 344 | 74,4 | | x | | |
| 225 | 64,9 | | | | x | 285 | 94,7 | | | x | | 345 | 75,1 | | x | | |
| 226 | 64,1 | | | | x | 286 | 94,8 | | | x | | 346 | 75,8 | | x | | |
| 227 | 63,0 | | | | x | 287 | 94,9 | | | x | | 347 | 76,5 | | x | | |
| 228 | 62,1 | | | | x | 288 | 94,8 | | | x | | 348 | 77,2 | | x | | |
| 229 | 61,6 | | x | | | 289 | 94,3 | | | | x | 349 | 77,8 | | x | | |
| 230 | 61,7 | | x | | | 290 | 93,3 | | | | x | 350 | 78,5 | | x | | |
| 231 | 62,3 | | x | | | 291 | 91,8 | | | | x | 351 | 79,2 | | x | | |
| 232 | 63,5 | | x | | | 292 | 89,6 | | | | x | 352 | 80,0 | | x | | |
| 233 | 65,3 | | x | | | 293 | 87,0 | | | | x | 353 | 81,0 | | x | | |
| 234 | 67,3 | | x | | | 294 | 84,1 | | | | x | 354 | 82,0 | | x | | |
| 235 | 69,3 | | x | | | 295 | 81,2 | | | | x | 355 | 83,0 | | x | | |
| 236 | 71,4 | | x | | | 296 | 78,4 | | | | x | 356 | 83,7 | | x | | |
| 237 | 73,5 | | x | | | 297 | 75,7 | | | | x | 357 | 84,2 | | | x | |
| 238 | 75,6 | | x | | | 298 | 73,2 | | | | x | 358 | 84,4 | | | x | |
| 239 | 77,7 | | x | | | 299 | 71,1 | | | | x | 359 | 84,5 | | | x | |
| 240 | 79,7 | | x | | | 300 | 69,5 | | | | x | 360 | 84,4 | | | x | |

Table B.5.14.-14: WMTC, cycle part 2 for vehicle classes 2-2 and 3, 181 to 360 s

1.3.1.7.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 361 | 84,1 | | | x | | 421 | 63,1 | | | x | | 481 | 72,0 | | | x | |
| 362 | 83,7 | | | x | | 422 | 63,6 | | | x | | 482 | 72,6 | | | x | |
| 363 | 83,2 | | | x | | 423 | 63,9 | | | x | | 483 | 72,8 | | | x | |
| 364 | 82,8 | | | x | | 424 | 63,8 | | | x | | 484 | 72,7 | | | x | |
| 365 | 82,6 | | | x | | 425 | 63,6 | | | x | | 485 | 72,0 | | | | x |
| 366 | 82,5 | | | x | | 426 | 63,3 | | | | x | 486 | 70,4 | | | | x |
| 367 | 82,4 | | | x | | 427 | 62,8 | | | | x | 487 | 67,7 | | | | x |
| 368 | 82,3 | | | x | | 428 | 61,9 | | | | x | 488 | 64,4 | | | | x |
| 369 | 82,2 | | | x | | 429 | 60,5 | | | | x | 489 | 61,0 | | | | x |
| 370 | 82,2 | | | x | | 430 | 58,6 | | | | x | 490 | 57,6 | | | | x |
| 371 | 82,2 | | | x | | 431 | 56,5 | | | | x | 491 | 54,0 | | | | x |
| 372 | 82,1 | | | x | | 432 | 54,6 | | | | x | 492 | 49,7 | | | | x |
| 373 | 81,9 | | | x | | 433 | 53,8 | | | x | | 493 | 44,4 | | | | x |
| 374 | 81,6 | | | x | | 434 | 54,5 | | | x | | 494 | 38,2 | | | | x |
| 375 | 81,3 | | | x | | 435 | 56,1 | | | x | | 495 | 31,2 | | | | x |
| 376 | 81,1 | | | x | | 436 | 57,9 | | | x | | 496 | 24,0 | | | | x |
| 377 | 80,8 | | | x | | 437 | 59,7 | | | x | | 497 | 16,8 | | | | x |
| 378 | 80,6 | | | x | | 438 | 61,2 | | | x | | 498 | 10,4 | | | | x |
| 379 | 80,4 | | | x | | 439 | 62,3 | | | x | | 499 | 5,7 | | | | x |
| 380 | 80,1 | | | x | | 440 | 63,1 | | | x | | 500 | 2,8 | | | | x |
| 381 | 79,7 | | | | x | 441 | 63,6 | | | | x | 501 | 1,6 | | | | x |
| 382 | 78,6 | | | | x | 442 | 63,5 | | | | x | 502 | 0,3 | | | | x |
| 383 | 76,8 | | | | x | 443 | 62,7 | | | | x | 503 | 0,0 | x | | | |
| 384 | 73,7 | | | | x | 444 | 60,9 | | | | x | 504 | 0,0 | x | | | |
| 385 | 69,4 | | | | x | 445 | 58,7 | | | | x | 505 | 0,0 | x | | | |
| 386 | 64,0 | | | | x | 446 | 56,4 | | | | x | 506 | 0,0 | x | | | |
| 387 | 58,6 | | | | x | 447 | 54,5 | | | | x | 507 | 0,0 | x | | | |
| 388 | 53,2 | | | | x | 448 | 53,3 | | | | x | 508 | 0,0 | x | | | |
| 389 | 47,8 | | | | x | 449 | 53,0 | | | x | | 509 | 0,0 | x | | | |
| 390 | 42,4 | | | | x | 450 | 53,5 | | | x | | 510 | 0,0 | x | | | |
| 391 | 37,0 | | | | x | 451 | 54,6 | | | x | | 511 | 0,0 | x | | | |
| 392 | 33,0 | | | | x | 452 | 56,1 | | | x | | 512 | 0,0 | x | | | |
| 393 | 30,9 | | | | x | 453 | 57,6 | | | x | | 513 | 0,0 | x | | | |
| 394 | 30,9 | | x | | | 454 | 58,9 | | | x | | 514 | 0,0 | x | | | |
| 395 | 33,5 | | x | | | 455 | 59,8 | | | x | | 515 | 0,0 | x | | | |
| 396 | 38,0 | | x | | | 456 | 60,3 | | | x | | 516 | 0,0 | x | | | |
| 397 | 42,5 | | x | | | 457 | 60,7 | | | x | | 517 | 0,0 | x | | | |
| 398 | 47,0 | | x | | | 458 | 61,3 | | | x | | 518 | 0,0 | x | | | |
| 399 | 51,0 | | x | | | 459 | 62,4 | | | x | | 519 | 0,0 | x | | | |
| 400 | 53,5 | | x | | | 460 | 64,1 | | | x | | 520 | 0,0 | x | | | |
| 401 | 55,1 | | x | | | 461 | 66,2 | | | x | | 521 | 0,0 | x | | | |
| 402 | 56,4 | | x | | | 462 | 68,1 | | | x | | 522 | 0,0 | x | | | |
| 403 | 57,3 | | x | | | 463 | 69,7 | | | x | | 523 | 0,0 | x | | | |
| 404 | 58,1 | | x | | | 464 | 70,4 | | | x | | 524 | 0,0 | x | | | |
| 405 | 58,8 | | x | | | 465 | 70,7 | | | x | | 525 | 0,0 | x | | | |
| 406 | 59,4 | | x | | | 466 | 70,7 | | | x | | 526 | 0,0 | x | | | |
| 407 | 59,8 | | | x | | 467 | 70,7 | | | x | | 527 | 0,0 | x | | | |
| 408 | 59,7 | | | x | | 468 | 70,7 | | | x | | 528 | 0,0 | x | | | |
| 409 | 59,4 | | | x | | 469 | 70,6 | | | x | | 529 | 0,0 | x | | | |
| 410 | 59,2 | | | x | | 470 | 70,5 | | | x | | 530 | 0,0 | x | | | |
| 411 | 59,2 | | | x | | 471 | 70,4 | | | x | | 531 | 0,0 | x | | | |
| 412 | 59,6 | | | x | | 472 | 70,2 | | | x | | 532 | 0,0 | x | | | |
| 413 | 60,0 | | | x | | 473 | 70,1 | | | x | | 533 | 2,3 | | x | | |
| 414 | 60,5 | | | x | | 474 | 69,8 | | | x | | 534 | 7,2 | | x | | |
| 415 | 61,0 | | | x | | 475 | 69,5 | | | x | | 535 | 14,6 | | x | | |
| 416 | 61,2 | | | x | | 476 | 69,1 | | | x | | 536 | 23,5 | | x | | |
| 417 | 61,3 | | | x | | 477 | 69,1 | | | x | | 537 | 33,0 | | x | | |
| 418 | 61,4 | | | x | | 478 | 69,5 | | | x | | 538 | 42,7 | | x | | |
| 419 | 61,7 | | | x | | 479 | 70,3 | | | x | | 539 | 51,8 | | x | | |
| 420 | 62,3 | | | x | | 480 | 71,2 | | | x | | 540 | 59,4 | | x | | |

Table B.5.14.-15: WMTC, cycle part 2 for vehicle classes 2-2 and 3, 361 to 540 s

1.3.1.8.

| time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|
| | | stop | acc | cruise | dec |
| 541 | 65,3 | | x | | |
| 542 | 69,6 | | x | | |
| 543 | 72,3 | | x | | |
| 544 | 73,9 | | x | | |
| 545 | 75,0 | | x | | |
| 546 | 75,7 | | x | | |
| 547 | 76,5 | | x | | |
| 548 | 77,3 | | x | | |
| 549 | 78,2 | | x | | |
| 550 | 78,9 | | x | | |
| 551 | 79,4 | | | x | |
| 552 | 79,6 | | | x | |
| 553 | 79,3 | | | x | |
| 554 | 78,8 | | | x | |
| 555 | 78,1 | | | x | |
| 556 | 77,5 | | | x | |
| 557 | 77,2 | | | x | |
| 558 | 77,2 | | | x | |
| 559 | 77,5 | | | x | |
| 560 | 77,9 | | | x | |
| 561 | 78,5 | | | x | |
| 562 | 79,1 | | | x | |
| 563 | 79,6 | | | x | |
| 564 | 80,0 | | | x | |
| 565 | 80,2 | | | x | |
| 566 | 80,3 | | | x | |
| 567 | 80,1 | | | x | |
| 568 | 79,8 | | | x | |
| 569 | 79,5 | | | x | |
| 570 | 79,1 | | | x | |
| 571 | 78,8 | | | x | |
| 572 | 78,6 | | | x | |
| 573 | 78,4 | | | x | |
| 574 | 78,3 | | | x | |
| 575 | 78,0 | | | | x |
| 576 | 76,7 | | | | x |
| 577 | 73,7 | | | | x |
| 578 | 69,5 | | | | x |
| 579 | 64,8 | | | | x |
| 580 | 60,3 | | | | x |
| 581 | 56,2 | | | | x |
| 582 | 52,5 | | | | x |
| 583 | 49,0 | | | | x |
| 584 | 45,2 | | | | x |
| 585 | 40,8 | | | | x |
| 586 | 35,4 | | | | x |
| 587 | 29,4 | | | | x |
| 588 | 23,4 | | | | x |
| 589 | 17,7 | | | | x |
| 590 | 12,6 | | | | x |
| 591 | 8,0 | | | | x |
| 592 | 4,1 | | | | x |
| 593 | 1,3 | | | | x |
| 594 | 0,0 | x | | | |
| 595 | 0,0 | x | | | |
| 596 | 0,0 | x | | | |
| 597 | 0,0 | x | | | |
| 598 | 0,0 | x | | | |
| 599 | 0,0 | x | | | |
| 600 | 0,0 | x | | | |

Table B.5.14.-16: WMTC, cycle part 2 for vehicle classes 2-2 and 3, 541 to 600 s

## 1.4. WMTC, part 3

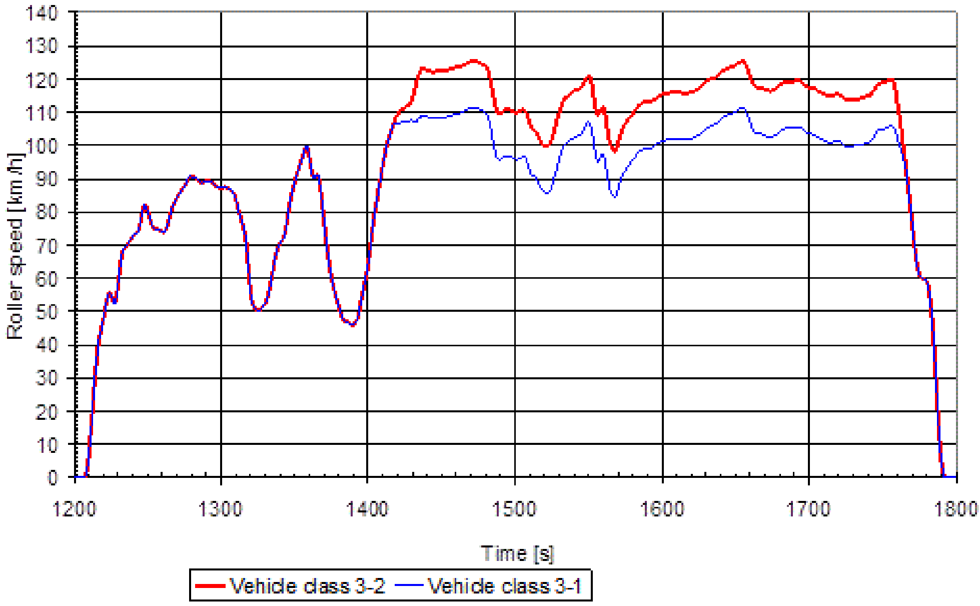


Figure B.5.14.-4: WMTC, part 3.

1.4.1 The characteristic desired vehicle speed versus test time of WMTC, part 3 is set out in the following tables.

1.4.1.1.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 0 | 0,0 | x | | | | 61 | 73,9 | | | | x | 121 | 53,0 | | | | x |
| 1 | 0,0 | x | | | | 62 | 74,1 | | x | | | 122 | 51,6 | | | | x |
| 2 | 0,0 | x | | | | 63 | 75,1 | | x | | | 123 | 50,9 | | | | x |
| 3 | 0,0 | x | | | | 64 | 76,8 | | x | | | 124 | 50,5 | | | | x |
| 4 | 0,0 | x | | | | 65 | 78,7 | | x | | | 125 | 50,2 | | | | x |
| 5 | 0,0 | x | | | | 66 | 80,4 | | x | | | 126 | 50,3 | | x | | |
| 6 | 0,0 | x | | | | 67 | 81,7 | | x | | | 127 | 50,6 | | x | | |
| 7 | 0,0 | x | | | | 68 | 82,6 | | x | | | 128 | 51,2 | | x | | |
| 8 | 0,9 | | x | | | 69 | 83,5 | | x | | | 129 | 51,8 | | x | | |
| 9 | 3,2 | | x | | | 70 | 84,4 | | x | | | 130 | 52,5 | | x | | |
| 10 | 7,3 | | x | | | 71 | 85,1 | | x | | | 131 | 53,4 | | x | | |
| 11 | 12,4 | | x | | | 72 | 85,7 | | x | | | 132 | 54,9 | | x | | |
| 12 | 17,9 | | x | | | 73 | 86,3 | | x | | | 133 | 57,0 | | x | | |
| 13 | 23,5 | | x | | | 74 | 87,0 | | x | | | 134 | 59,4 | | x | | |
| 14 | 29,1 | | x | | | 75 | 87,9 | | x | | | 135 | 61,9 | | x | | |
| 15 | 34,3 | | x | | | 76 | 88,8 | | x | | | 136 | 64,3 | | x | | |
| 16 | 38,6 | | x | | | 77 | 89,7 | | x | | | 137 | 66,4 | | x | | |
| 17 | 41,6 | | x | | | 78 | 90,3 | | | x | | 138 | 68,1 | | x | | |
| 18 | 43,9 | | x | | | 79 | 90,6 | | | x | | 139 | 69,6 | | x | | |
| 19 | 45,9 | | x | | | 80 | 90,6 | | | x | | 140 | 70,7 | | x | | |
| 20 | 48,1 | | x | | | 81 | 90,5 | | | x | | 141 | 71,4 | | x | | |
| 21 | 50,3 | | x | | | 82 | 90,4 | | | x | | 142 | 71,8 | | x | | |
| 22 | 52,6 | | x | | | 83 | 90,1 | | | x | | 143 | 72,8 | | x | | |
| 23 | 54,8 | | x | | | 84 | 89,7 | | | x | | 144 | 75,0 | | x | | |
| 24 | 55,8 | | x | | | 85 | 89,3 | | | x | | 145 | 77,8 | | x | | |
| 25 | 55,2 | | x | | | 86 | 89,0 | | | x | | 146 | 80,7 | | x | | |
| 26 | 53,9 | | x | | | 87 | 88,8 | | | x | | 147 | 83,3 | | x | | |
| 27 | 52,7 | | x | | | 88 | 88,9 | | | x | | 148 | 85,4 | | x | | |
| 28 | 52,8 | | x | | | 89 | 89,1 | | | x | | 149 | 87,3 | | x | | |
| 29 | 55,0 | | x | | | 90 | 89,3 | | | x | | 150 | 89,1 | | x | | |
| 30 | 58,5 | | x | | | 91 | 89,4 | | | x | | 151 | 90,6 | | x | | |
| 31 | 62,3 | | x | | | 92 | 89,4 | | | x | | 152 | 91,9 | | x | | |
| 32 | 65,7 | | x | | | 93 | 89,2 | | | x | | 153 | 93,2 | | x | | |
| 33 | 68,1 | | x | | | 94 | 88,9 | | | x | | 154 | 94,6 | | x | | |
| 34 | 69,1 | | x | | | 95 | 88,5 | | | x | | 155 | 96,0 | | x | | |
| 35 | 69,5 | | x | | | 96 | 88,0 | | | x | | 156 | 97,5 | | x | | |
| 36 | 69,9 | | x | | | 97 | 87,5 | | | x | | 157 | 99,0 | | x | | |
| 37 | 70,6 | | x | | | 98 | 87,2 | | | x | | 158 | 99,8 | | | | x |
| 38 | 71,3 | | x | | | 99 | 87,1 | | | x | | 159 | 99,0 | | | | x |
| 39 | 72,2 | | x | | | 100 | 87,2 | | | x | | 160 | 96,7 | | | | x |
| 40 | 72,8 | | x | | | 101 | 87,3 | | | x | | 161 | 93,7 | | | | x |
| 41 | 73,2 | | x | | | 102 | 87,4 | | | x | | 162 | 91,3 | | | | x |
| 42 | 73,4 | | x | | | 103 | 87,5 | | | x | | 163 | 90,4 | | | | x |
| 43 | 73,8 | | x | | | 104 | 87,4 | | | x | | 164 | 90,6 | | | | x |
| 44 | 74,8 | | x | | | 105 | 87,1 | | | x | | 165 | 91,1 | | | | x |
| 45 | 76,7 | | x | | | 106 | 86,8 | | | x | | 166 | 90,9 | | | | x |
| 46 | 79,1 | | x | | | 107 | 86,4 | | | x | | 167 | 89,0 | | | | x |
| 47 | 81,1 | | x | | | 108 | 85,9 | | | x | | 168 | 85,6 | | | | x |
| 48 | 82,1 | | | | x | 109 | 85,2 | | | | x | 169 | 81,6 | | | | x |
| 49 | 81,7 | | | | x | 110 | 84,0 | | | | x | 170 | 77,6 | | | | x |
| 50 | 80,3 | | | | x | 111 | 82,2 | | | | x | 171 | 73,6 | | | | x |
| 51 | 78,8 | | | | x | 112 | 80,3 | | | | x | 172 | 69,7 | | | | x |
| 52 | 77,3 | | | | x | 113 | 78,6 | | | | x | 173 | 66,0 | | | | x |
| 53 | 75,9 | | | | x | 114 | 77,2 | | | | x | 174 | 62,7 | | | | x |
| 54 | 75,0 | | | | x | 115 | 75,9 | | | | x | 175 | 60,0 | | | | x |
| 55 | 74,7 | | | | x | 116 | 73,8 | | | | x | 176 | 58,0 | | | | x |
| 56 | 74,7 | | | | x | 117 | 70,4 | | | | x | 177 | 56,4 | | | | x |
| 57 | 74,7 | | | | x | 118 | 65,7 | | | | x | 178 | 54,8 | | | | x |
| 58 | 74,6 | | | | x | 119 | 60,5 | | | | x | 179 | 53,3 | | | | x |
| 59 | 74,4 | | | | x | 120 | 55,9 | | | | x | 180 | 51,7 | | | | x |
| 60 | 74,1 | | | | x | | | | | | | | | | | | |

Table B.5.14.-17: WMTC, cycle part 3, reduced vehicle speed for vehicle class 3-1, 1 to 180 s

1.4.1.2.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 181 | 50,2 | | | | x | 241 | 108,4 | | | x | | 301 | 95,8 | | | x | |
| 182 | 48,7 | | | | x | 242 | 108,3 | | | x | | 302 | 95,9 | | | x | |
| 183 | 47,2 | | | x | | 243 | 108,2 | | | x | | 303 | 96,2 | | | x | |
| 184 | 47,1 | | | x | | 244 | 108,2 | | | x | | 304 | 96,4 | | | x | |
| 185 | 47,0 | | | x | | 245 | 108,2 | | | x | | 305 | 96,7 | | | x | |
| 186 | 46,9 | | | x | | 246 | 108,2 | | | x | | 306 | 96,7 | | | x | |
| 187 | 46,6 | | | x | | 247 | 108,3 | | | x | | 307 | 96,3 | | | x | |
| 188 | 46,3 | | | x | | 248 | 108,4 | | | x | | 308 | 95,3 | | | | x |
| 189 | 46,1 | | | x | | 249 | 108,5 | | | x | | 309 | 94,0 | | | | x |
| 190 | 46,1 | | x | | | 250 | 108,5 | | | x | | 310 | 92,5 | | | | x |
| 191 | 46,5 | | x | | | 251 | 108,5 | | | x | | 311 | 91,4 | | | | x |
| 192 | 47,1 | | x | | | 252 | 108,5 | | | x | | 312 | 90,9 | | | | x |
| 193 | 48,1 | | x | | | 253 | 108,5 | | | x | | 313 | 90,7 | | | | x |
| 194 | 49,8 | | x | | | 254 | 108,7 | | | x | | 314 | 90,3 | | | | x |
| 195 | 52,2 | | x | | | 255 | 108,8 | | | x | | 315 | 89,6 | | | | x |
| 196 | 54,8 | | x | | | 256 | 109,0 | | | x | | 316 | 88,6 | | | | x |
| 197 | 57,3 | | x | | | 257 | 109,2 | | | x | | 317 | 87,7 | | | | x |
| 198 | 59,5 | | x | | | 258 | 109,3 | | | x | | 318 | 86,8 | | | | x |
| 199 | 61,7 | | x | | | 259 | 109,4 | | | x | | 319 | 86,2 | | | | x |
| 200 | 64,4 | | x | | | 260 | 109,5 | | | x | | 320 | 85,8 | | | | x |
| 201 | 67,7 | | x | | | 261 | 109,5 | | | x | | 321 | 85,7 | | | | x |
| 202 | 71,4 | | x | | | 262 | 109,6 | | | x | | 322 | 85,7 | | | | x |
| 203 | 74,9 | | x | | | 263 | 109,8 | | | x | | 323 | 86,0 | | | x | |
| 204 | 78,2 | | x | | | 264 | 110,0 | | | x | | 324 | 86,7 | | | x | |
| 205 | 81,1 | | x | | | 265 | 110,2 | | | x | | 325 | 87,8 | | | x | |
| 206 | 83,9 | | x | | | 266 | 110,5 | | | x | | 326 | 89,2 | | | x | |
| 207 | 86,6 | | x | | | 267 | 110,7 | | | x | | 327 | 90,9 | | | x | |
| 208 | 89,1 | | x | | | 268 | 111,0 | | | x | | 328 | 92,6 | | | x | |
| 209 | 91,6 | | x | | | 269 | 111,1 | | | x | | 329 | 94,3 | | | x | |
| 210 | 94,0 | | x | | | 270 | 111,2 | | | x | | 330 | 95,9 | | | x | |
| 211 | 96,3 | | x | | | 271 | 111,3 | | | x | | 331 | 97,4 | | | x | |
| 212 | 98,4 | | x | | | 272 | 111,3 | | | x | | 332 | 98,7 | | | x | |
| 213 | 100,4 | | x | | | 273 | 111,3 | | | x | | 333 | 99,7 | | | x | |
| 214 | 102,1 | | x | | | 274 | 111,2 | | | x | | 334 | 100,3 | | | x | |
| 215 | 103,6 | | x | | | 275 | 111,0 | | | x | | 335 | 100,6 | | | x | |
| 216 | 104,9 | | x | | | 276 | 110,8 | | | x | | 336 | 101,0 | | | x | |
| 217 | 106,2 | | | x | | 277 | 110,6 | | | x | | 337 | 101,4 | | | x | |
| 218 | 106,5 | | | x | | 278 | 110,4 | | | x | | 338 | 101,8 | | | x | |
| 219 | 106,5 | | | x | | 279 | 110,3 | | | x | | 339 | 102,2 | | | x | |
| 220 | 106,6 | | | x | | 280 | 109,9 | | | x | | 340 | 102,5 | | | x | |
| 221 | 106,6 | | | x | | 281 | 109,3 | | | | x | 341 | 102,6 | | | x | |
| 222 | 107,0 | | | x | | 282 | 108,1 | | | | x | 342 | 102,7 | | | x | |
| 223 | 107,3 | | | x | | 283 | 106,3 | | | | x | 343 | 102,8 | | | x | |
| 224 | 107,3 | | | x | | 284 | 104,0 | | | | x | 344 | 103,0 | | | x | |
| 225 | 107,2 | | | x | | 285 | 101,5 | | | | x | 345 | 103,5 | | | x | |
| 226 | 107,2 | | | x | | 286 | 99,2 | | | | x | 346 | 104,3 | | | x | |
| 227 | 107,2 | | | x | | 287 | 97,2 | | | | x | 347 | 105,2 | | | x | |
| 228 | 107,3 | | | x | | 288 | 96,1 | | | | x | 348 | 106,1 | | | x | |
| 229 | 107,5 | | | x | | 289 | 95,7 | | | x | | 349 | 106,8 | | | x | |
| 230 | 107,3 | | | x | | 290 | 95,8 | | | x | | 350 | 107,1 | | | | x |
| 231 | 107,3 | | | x | | 291 | 96,1 | | | x | | 351 | 106,7 | | | | x |
| 232 | 107,3 | | | x | | 292 | 96,4 | | | x | | 352 | 105,0 | | | | x |
| 233 | 107,3 | | | x | | 293 | 96,7 | | | x | | 353 | 102,3 | | | | x |
| 234 | 108,0 | | | x | | 294 | 96,9 | | | x | | 354 | 99,1 | | | | x |
| 235 | 108,2 | | | x | | 295 | 96,9 | | | x | | 355 | 96,3 | | | | x |
| 236 | 108,9 | | | x | | 296 | 96,8 | | | x | | 356 | 95,0 | | | | x |
| 237 | 109,0 | | | x | | 297 | 96,7 | | | x | | 357 | 95,4 | | | | x |
| 238 | 108,9 | | | x | | 298 | 96,4 | | | x | | 358 | 96,4 | | | | x |
| 239 | 108,8 | | | x | | 299 | 96,1 | | | x | | 359 | 97,3 | | | | x |
| 240 | 108,6 | | | x | | 300 | 95,9 | | | x | | 360 | 97,5 | | | | x |

Table B.5.14.-18: WMTC, cycle part 3, reduced vehicle speed for vehicle class 3-1, 181 to 360 s

1.4.1.3.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 361 | 96,1 | | | | x | 421 | 102,2 | | | x | | 481 | 104,5 | | | x | |
| 362 | 93,4 | | | | x | 422 | 102,4 | | | x | | 482 | 104,8 | | | x | |
| 363 | 90,4 | | | | x | 423 | 102,6 | | | x | | 483 | 104,9 | | | x | |
| 364 | 87,8 | | | | x | 424 | 102,8 | | | x | | 484 | 105,1 | | | x | |
| 365 | 86,0 | | | | x | 425 | 103,1 | | | x | | 485 | 105,1 | | | x | |
| 366 | 85,1 | | | | x | 426 | 103,4 | | | x | | 486 | 105,2 | | | x | |
| 367 | 84,7 | | | | x | 427 | 103,9 | | | x | | 487 | 105,2 | | | x | |
| 368 | 84,2 | | | x | | 428 | 104,4 | | | x | | 488 | 105,2 | | | x | |
| 369 | 85,0 | | | x | | 429 | 104,9 | | | x | | 489 | 105,3 | | | x | |
| 370 | 86,5 | | | x | | 430 | 105,2 | | | x | | 490 | 105,3 | | | x | |
| 371 | 88,3 | | | x | | 431 | 105,5 | | | x | | 491 | 105,4 | | | x | |
| 372 | 89,9 | | | x | | 432 | 105,7 | | | x | | 492 | 105,5 | | | x | |
| 373 | 91,0 | | | x | | 433 | 105,9 | | | x | | 493 | 105,5 | | | x | |
| 374 | 91,8 | | | x | | 434 | 106,1 | | | x | | 494 | 105,3 | | | x | |
| 375 | 92,5 | | | x | | 435 | 106,3 | | | x | | 495 | 105,1 | | | x | |
| 376 | 93,1 | | | x | | 436 | 106,5 | | | x | | 496 | 104,7 | | | x | |
| 377 | 93,7 | | | x | | 437 | 106,8 | | | x | | 497 | 104,2 | | | x | |
| 378 | 94,4 | | | x | | 438 | 107,1 | | | x | | 498 | 103,9 | | | x | |
| 379 | 95,0 | | | x | | 439 | 107,5 | | | x | | 499 | 103,6 | | | x | |
| 380 | 95,6 | | | x | | 440 | 108,0 | | | x | | 500 | 103,5 | | | x | |
| 381 | 96,3 | | | x | | 441 | 108,3 | | | x | | 501 | 103,5 | | | x | |
| 382 | 96,9 | | | x | | 442 | 108,6 | | | x | | 502 | 103,4 | | | x | |
| 383 | 97,5 | | | x | | 443 | 108,9 | | | x | | 503 | 103,3 | | | x | |
| 384 | 98,0 | | | x | | 444 | 109,1 | | | x | | 504 | 103,0 | | | x | |
| 385 | 98,3 | | | x | | 445 | 109,2 | | | x | | 505 | 102,7 | | | x | |
| 386 | 98,6 | | | x | | 446 | 109,4 | | | x | | 506 | 102,4 | | | x | |
| 387 | 98,9 | | | x | | 447 | 109,5 | | | x | | 507 | 102,1 | | | x | |
| 388 | 99,1 | | | x | | 448 | 109,7 | | | x | | 508 | 101,9 | | | x | |
| 389 | 99,3 | | | x | | 449 | 109,9 | | | x | | 509 | 101,7 | | | x | |
| 390 | 99,3 | | | x | | 450 | 110,2 | | | x | | 510 | 101,5 | | | x | |
| 391 | 99,2 | | | x | | 451 | 110,5 | | | x | | 511 | 101,3 | | | x | |
| 392 | 99,2 | | | x | | 452 | 110,8 | | | x | | 512 | 101,2 | | | x | |
| 393 | 99,3 | | | x | | 453 | 111,0 | | | x | | 513 | 101,0 | | | x | |
| 394 | 99,5 | | | x | | 454 | 111,2 | | | x | | 514 | 100,9 | | | x | |
| 395 | 99,9 | | | x | | 455 | 111,3 | | | x | | 515 | 100,9 | | | x | |
| 396 | 100,3 | | | x | | 456 | 111,1 | | | x | | 516 | 101,0 | | | x | |
| 397 | 100,6 | | | x | | 457 | 110,4 | | | x | | 517 | 101,2 | | | x | |
| 398 | 100,9 | | | x | | 458 | 109,3 | | | x | | 518 | 101,3 | | | x | |
| 399 | 101,1 | | | x | | 459 | 108,1 | | | x | | 519 | 101,4 | | | x | |
| 400 | 101,3 | | | x | | 460 | 106,8 | | | x | | 520 | 101,4 | | | x | |
| 401 | 101,4 | | | x | | 461 | 105,5 | | | x | | 521 | 101,2 | | | x | |
| 402 | 101,5 | | | x | | 462 | 104,4 | | | x | | 522 | 100,8 | | | x | |
| 403 | 101,6 | | | x | | 463 | 103,8 | | | x | | 523 | 100,4 | | | x | |
| 404 | 101,8 | | | x | | 464 | 103,6 | | | x | | 524 | 99,9 | | | x | |
| 405 | 101,9 | | | x | | 465 | 103,5 | | | x | | 525 | 99,6 | | | x | |
| 406 | 102,0 | | | x | | 466 | 103,5 | | | x | | 526 | 99,5 | | | x | |
| 407 | 102,0 | | | x | | 467 | 103,4 | | | x | | 527 | 99,5 | | | x | |
| 408 | 102,0 | | | x | | 468 | 103,3 | | | x | | 528 | 99,6 | | | x | |
| 409 | 102,0 | | | x | | 469 | 103,1 | | | x | | 529 | 99,7 | | | x | |
| 410 | 101,9 | | | x | | 470 | 102,9 | | | x | | 530 | 99,8 | | | x | |
| 411 | 101,9 | | | x | | 471 | 102,6 | | | x | | 531 | 99,9 | | | x | |
| 412 | 101,9 | | | x | | 472 | 102,5 | | | x | | 532 | 100,0 | | | x | |
| 413 | 101,8 | | | x | | 473 | 102,4 | | | x | | 533 | 100,0 | | | x | |
| 414 | 101,8 | | | x | | 474 | 102,4 | | | x | | 534 | 100,1 | | | x | |
| 415 | 101,8 | | | x | | 475 | 102,5 | | | x | | 535 | 100,2 | | | x | |
| 416 | 101,8 | | | x | | 476 | 102,7 | | | x | | 536 | 100,4 | | | x | |
| 417 | 101,8 | | | x | | 477 | 103,0 | | | x | | 537 | 100,5 | | | x | |
| 418 | 101,8 | | | x | | 478 | 103,3 | | | x | | 538 | 100,6 | | | x | |
| 419 | 101,9 | | | x | | 479 | 103,7 | | | x | | 539 | 100,7 | | | x | |
| 420 | 102,0 | | | x | | 480 | 104,1 | | | x | | 540 | 100,8 | | | x | |

Table B.5.14.-19: WMTC, cycle part 3, reduced vehicle speed for vehicle class 3-1, 361 to 540 s

1.4.1.4.

| time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|
| | | stop | acc | cruise | dec |
| 541 | 101,0 | | | x | |
| 542 | 101,3 | | | x | |
| 543 | 102,0 | | | x | |
| 544 | 102,7 | | | x | |
| 545 | 103,5 | | | x | |
| 546 | 104,2 | | | x | |
| 547 | 104,6 | | | x | |
| 548 | 104,7 | | | x | |
| 549 | 104,8 | | | x | |
| 550 | 104,8 | | | x | |
| 551 | 104,9 | | | x | |
| 552 | 105,1 | | | x | |
| 553 | 105,4 | | | x | |
| 554 | 105,7 | | | x | |
| 555 | 105,9 | | | x | |
| 556 | 106,0 | | | x | |
| 557 | 105,7 | | | | x |
| 558 | 105,4 | | | | x |
| 559 | 103,9 | | | | x |
| 560 | 102,2 | | | | x |
| 561 | 100,5 | | | | x |
| 562 | 99,2 | | | | x |
| 563 | 98,0 | | | | x |
| 564 | 96,4 | | | | x |
| 565 | 94,8 | | | | x |
| 566 | 92,8 | | | | x |
| 567 | 88,9 | | | | x |
| 568 | 84,9 | | | | x |
| 569 | 80,6 | | | | x |
| 570 | 76,3 | | | | x |
| 571 | 72,3 | | | | x |
| 572 | 68,7 | | | | x |
| 573 | 65,5 | | | | x |
| 574 | 63,0 | | | | x |
| 575 | 61,2 | | | | x |
| 576 | 60,5 | | | | x |
| 577 | 60,0 | | | | x |
| 578 | 59,7 | | | | x |
| 579 | 59,4 | | | | x |
| 580 | 59,4 | | | | x |
| 581 | 58,0 | | | | x |
| 582 | 55,0 | | | | x |
| 583 | 51,0 | | | | x |
| 584 | 46,0 | | | | x |
| 585 | 38,8 | | | | x |
| 586 | 31,6 | | | | x |
| 587 | 24,4 | | | | x |
| 588 | 17,2 | | | | x |
| 589 | 10,0 | | | | x |
| 590 | 5,0 | | | | x |
| 591 | 2,0 | | | | x |
| 592 | 0,0 | x | | | |
| 593 | 0,0 | x | | | |
| 594 | 0,0 | x | | | |
| 595 | 0,0 | x | | | |
| 596 | 0,0 | x | | | |
| 597 | 0,0 | x | | | |
| 598 | 0,0 | x | | | |
| 599 | 0,0 | x | | | |
| 600 | 0,0 | x | | | |

Table B.5.14.-20: WMTC, cycle part 3, reduced vehicle speed for vehicle class 3-1, 541 to 600 s

1.4.1.5.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 0 | 0,0 | x | | | | 61 | 73,9 | | | | x | 121 | 53,0 | | | | x |
| 1 | 0,0 | x | | | | 62 | 74,1 | | x | | | 122 | 51,6 | | | | x |
| 2 | 0,0 | x | | | | 63 | 75,1 | | x | | | 123 | 50,9 | | | | x |
| 3 | 0,0 | x | | | | 64 | 76,8 | | x | | | 124 | 50,5 | | | | x |
| 4 | 0,0 | x | | | | 65 | 78,7 | | x | | | 125 | 50,2 | | | | x |
| 5 | 0,0 | x | | | | 66 | 80,4 | | x | | | 126 | 50,3 | | x | | |
| 6 | 0,0 | x | | | | 67 | 81,7 | | x | | | 127 | 50,6 | | x | | |
| 7 | 0,0 | x | | | | 68 | 82,6 | | x | | | 128 | 51,2 | | x | | |
| 8 | 0,9 | | x | | | 69 | 83,5 | | x | | | 129 | 51,8 | | x | | |
| 9 | 3,2 | | x | | | 70 | 84,4 | | x | | | 130 | 52,5 | | x | | |
| 10 | 7,3 | | x | | | 71 | 85,1 | | x | | | 131 | 53,4 | | x | | |
| 11 | 12,4 | | x | | | 72 | 85,7 | | x | | | 132 | 54,9 | | x | | |
| 12 | 17,9 | | x | | | 73 | 86,3 | | x | | | 133 | 57,0 | | x | | |
| 13 | 23,5 | | x | | | 74 | 87,0 | | x | | | 134 | 59,4 | | x | | |
| 14 | 29,1 | | x | | | 75 | 87,9 | | x | | | 135 | 61,9 | | x | | |
| 15 | 34,3 | | x | | | 76 | 88,8 | | x | | | 136 | 64,3 | | x | | |
| 16 | 38,6 | | x | | | 77 | 89,7 | | x | | | 137 | 66,4 | | x | | |
| 17 | 41,6 | | x | | | 78 | 90,3 | | | x | | 138 | 68,1 | | x | | |
| 18 | 43,9 | | x | | | 79 | 90,6 | | | x | | 139 | 69,6 | | x | | |
| 19 | 45,9 | | x | | | 80 | 90,6 | | | x | | 140 | 70,7 | | x | | |
| 20 | 48,1 | | x | | | 81 | 90,5 | | | x | | 141 | 71,4 | | x | | |
| 21 | 50,3 | | x | | | 82 | 90,4 | | | x | | 142 | 71,8 | | x | | |
| 22 | 52,6 | | x | | | 83 | 90,1 | | | x | | 143 | 72,8 | | x | | |
| 23 | 54,8 | | x | | | 84 | 89,7 | | | x | | 144 | 75,0 | | x | | |
| 24 | 55,8 | | x | | | 85 | 89,3 | | | x | | 145 | 77,8 | | x | | |
| 25 | 55,2 | | x | | | 86 | 89,0 | | | x | | 146 | 80,7 | | x | | |
| 26 | 53,9 | | x | | | 87 | 88,8 | | | x | | 147 | 83,3 | | x | | |
| 27 | 52,7 | | x | | | 88 | 88,9 | | | x | | 148 | 85,4 | | x | | |
| 28 | 52,8 | | x | | | 89 | 89,1 | | | x | | 149 | 87,3 | | x | | |
| 29 | 55,0 | | x | | | 90 | 89,3 | | | x | | 150 | 89,1 | | x | | |
| 30 | 58,5 | | x | | | 91 | 89,4 | | | x | | 151 | 90,6 | | x | | |
| 31 | 62,3 | | x | | | 92 | 89,4 | | | x | | 152 | 91,9 | | x | | |
| 32 | 65,7 | | x | | | 93 | 89,2 | | | x | | 153 | 93,2 | | x | | |
| 33 | 68,1 | | x | | | 94 | 88,9 | | | x | | 154 | 94,6 | | x | | |
| 34 | 69,1 | | x | | | 95 | 88,5 | | | x | | 155 | 96,0 | | x | | |
| 35 | 69,5 | | x | | | 96 | 88,0 | | | x | | 156 | 97,5 | | x | | |
| 36 | 69,9 | | x | | | 97 | 87,5 | | | x | | 157 | 99,0 | | x | | |
| 37 | 70,6 | | x | | | 98 | 87,2 | | | x | | 158 | 99,8 | | | | x |
| 38 | 71,3 | | x | | | 99 | 87,1 | | | x | | 159 | 99,0 | | | | x |
| 39 | 72,2 | | x | | | 100 | 87,2 | | | x | | 160 | 96,7 | | | | x |
| 40 | 72,8 | | x | | | 101 | 87,3 | | | x | | 161 | 93,7 | | | | x |
| 41 | 73,2 | | x | | | 102 | 87,4 | | | x | | 162 | 91,3 | | | | x |
| 42 | 73,4 | | x | | | 103 | 87,5 | | | x | | 163 | 90,4 | | | | x |
| 43 | 73,8 | | x | | | 104 | 87,4 | | | x | | 164 | 90,6 | | | | x |
| 44 | 74,8 | | x | | | 105 | 87,1 | | | x | | 165 | 91,1 | | | | x |
| 45 | 76,7 | | x | | | 106 | 86,8 | | | x | | 166 | 90,9 | | | | x |
| 46 | 79,1 | | x | | | 107 | 86,4 | | | x | | 167 | 89,0 | | | | x |
| 47 | 81,1 | | x | | | 108 | 85,9 | | | x | | 168 | 85,6 | | | | x |
| 48 | 82,1 | | | | x | 109 | 85,2 | | | | x | 169 | 81,6 | | | | x |
| 49 | 81,7 | | | | x | 110 | 84,0 | | | | x | 170 | 77,6 | | | | x |
| 50 | 80,3 | | | | x | 111 | 82,2 | | | | x | 171 | 73,6 | | | | x |
| 51 | 78,8 | | | | x | 112 | 80,3 | | | | x | 172 | 69,7 | | | | x |
| 52 | 77,3 | | | | x | 113 | 78,6 | | | | x | 173 | 66,0 | | | | x |
| 53 | 75,9 | | | | x | 114 | 77,2 | | | | x | 174 | 62,7 | | | | x |
| 54 | 75,0 | | | | x | 115 | 75,9 | | | | x | 175 | 60,0 | | | | x |
| 55 | 74,7 | | | | x | 116 | 73,8 | | | | x | 176 | 58,0 | | | | x |
| 56 | 74,7 | | | | x | 117 | 70,4 | | | | x | 177 | 56,4 | | | | x |
| 57 | 74,7 | | | | x | 118 | 65,7 | | | | x | 178 | 54,8 | | | | x |
| 58 | 74,6 | | | | x | 119 | 60,5 | | | | x | 179 | 53,3 | | | | x |
| 59 | 74,4 | | | | x | 120 | 55,9 | | | | x | 180 | 51,7 | | | | x |
| 60 | 74,1 | | | | x | | | | | | | | | | | | |

Table B.5.14.-21: WMTC, cycle part 3 for vehicle class 3-2, 0 to 180 s

1.4.1.6.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 181 | 50,2 | | | | x | 241 | 122,4 | | | x | | 301 | 109,8 | | | x | |
| 182 | 48,7 | | | | x | 242 | 122,3 | | | x | | 302 | 109,9 | | | x | |
| 183 | 47,2 | | | x | | 243 | 122,2 | | | x | | 303 | 110,2 | | | x | |
| 184 | 47,1 | | | x | | 244 | 122,2 | | | x | | 304 | 110,4 | | | x | |
| 185 | 47,0 | | | x | | 245 | 122,2 | | | x | | 305 | 110,7 | | | x | |
| 186 | 46,9 | | | x | | 246 | 122,2 | | | x | | 306 | 110,7 | | | x | |
| 187 | 46,6 | | | x | | 247 | 122,3 | | | x | | 307 | 110,3 | | | x | |
| 188 | 46,3 | | | x | | 248 | 122,4 | | | x | | 308 | 109,3 | | | | x |
| 189 | 46,1 | | | x | | 249 | 122,5 | | | x | | 309 | 108,0 | | | | x |
| 190 | 46,1 | | x | | | 250 | 122,5 | | | x | | 310 | 106,5 | | | | x |
| 191 | 46,5 | | x | | | 251 | 122,5 | | | x | | 311 | 105,4 | | | | x |
| 192 | 47,1 | | x | | | 252 | 122,5 | | | x | | 312 | 104,9 | | | | x |
| 193 | 48,1 | | x | | | 253 | 122,5 | | | x | | 313 | 104,7 | | | | x |
| 194 | 49,8 | | x | | | 254 | 122,7 | | | x | | 314 | 104,3 | | | | x |
| 195 | 52,2 | | x | | | 255 | 122,8 | | | x | | 315 | 103,6 | | | | x |
| 196 | 54,8 | | x | | | 256 | 123,0 | | | x | | 316 | 102,6 | | | | x |
| 197 | 57,3 | | x | | | 257 | 123,2 | | | x | | 317 | 101,7 | | | | x |
| 198 | 59,5 | | x | | | 258 | 123,3 | | | x | | 318 | 100,8 | | | | x |
| 199 | 61,7 | | x | | | 259 | 123,4 | | | x | | 319 | 100,2 | | | | x |
| 200 | 64,4 | | x | | | 260 | 123,5 | | | x | | 320 | 99,8 | | | | x |
| 201 | 67,7 | | x | | | 261 | 123,5 | | | x | | 321 | 99,7 | | | | x |
| 202 | 71,4 | | x | | | 262 | 123,6 | | | x | | 322 | 99,7 | | | | x |
| 203 | 74,9 | | x | | | 263 | 123,8 | | | x | | 323 | 100,0 | | | x | |
| 204 | 78,2 | | x | | | 264 | 124,0 | | | x | | 324 | 100,7 | | | x | |
| 205 | 81,1 | | x | | | 265 | 124,2 | | | x | | 325 | 101,8 | | | x | |
| 206 | 83,9 | | x | | | 266 | 124,5 | | | x | | 326 | 103,2 | | | x | |
| 207 | 86,6 | | x | | | 267 | 124,7 | | | x | | 327 | 104,9 | | | x | |
| 208 | 89,1 | | x | | | 268 | 125,0 | | | x | | 328 | 106,6 | | | x | |
| 209 | 91,6 | | x | | | 269 | 125,1 | | | x | | 329 | 108,3 | | | x | |
| 210 | 94,0 | | x | | | 270 | 125,2 | | | x | | 330 | 109,9 | | | x | |
| 211 | 96,3 | | x | | | 271 | 125,3 | | | x | | 331 | 111,4 | | | x | |
| 212 | 98,4 | | x | | | 272 | 125,3 | | | x | | 332 | 112,7 | | | x | |
| 213 | 100,4 | | x | | | 273 | 125,3 | | | x | | 333 | 113,7 | | | x | |
| 214 | 102,1 | | x | | | 274 | 125,2 | | | x | | 334 | 114,3 | | | x | |
| 215 | 103,6 | | x | | | 275 | 125,0 | | | x | | 335 | 114,6 | | | x | |
| 216 | 104,9 | | x | | | 276 | 124,8 | | | x | | 336 | 115,0 | | | x | |
| 217 | 106,2 | | x | | | 277 | 124,6 | | | x | | 337 | 115,4 | | | x | |
| 218 | 107,5 | | x | | | 278 | 124,4 | | | x | | 338 | 115,8 | | | x | |
| 219 | 108,5 | | x | | | 279 | 124,3 | | | x | | 339 | 116,2 | | | x | |
| 220 | 109,3 | | x | | | 280 | 123,9 | | | x | | 340 | 116,5 | | | x | |
| 221 | 109,9 | | x | | | 281 | 123,3 | | | | x | 341 | 116,6 | | | x | |
| 222 | 110,5 | | x | | | 282 | 122,1 | | | | x | 342 | 116,7 | | | x | |
| 223 | 110,9 | | x | | | 283 | 120,3 | | | | x | 343 | 116,8 | | | x | |
| 224 | 111,2 | | x | | | 284 | 118,0 | | | | x | 344 | 117,0 | | | x | |
| 225 | 111,4 | | x | | | 285 | 115,5 | | | | x | 345 | 117,5 | | | x | |
| 226 | 111,7 | | x | | | 286 | 113,2 | | | | x | 346 | 118,3 | | | x | |
| 227 | 111,9 | | x | | | 287 | 111,2 | | | | x | 347 | 119,2 | | | x | |
| 228 | 112,3 | | x | | | 288 | 110,1 | | | | x | 348 | 120,1 | | | x | |
| 229 | 113,0 | | x | | | 289 | 109,7 | | | x | | 349 | 120,8 | | | x | |
| 230 | 114,1 | | x | | | 290 | 109,8 | | | x | | 350 | 121,1 | | | | x |
| 231 | 115,7 | | x | | | 291 | 110,1 | | | x | | 351 | 120,7 | | | | x |
| 232 | 117,5 | | x | | | 292 | 110,4 | | | x | | 352 | 119,0 | | | | x |
| 233 | 119,3 | | x | | | 293 | 110,7 | | | x | | 353 | 116,3 | | | | x |
| 234 | 121,0 | | x | | | 294 | 110,9 | | | x | | 354 | 113,1 | | | | x |
| 235 | 122,2 | | | x | | 295 | 110,9 | | | x | | 355 | 110,3 | | | | x |
| 236 | 122,9 | | | x | | 296 | 110,8 | | | x | | 356 | 109,0 | | | | x |
| 237 | 123,0 | | | x | | 297 | 110,7 | | | x | | 357 | 109,4 | | | | x |
| 238 | 122,9 | | | x | | 298 | 110,4 | | | x | | 358 | 110,4 | | | | x |
| 239 | 122,8 | | | x | | 299 | 110,1 | | | x | | 359 | 111,3 | | | | x |
| 240 | 122,6 | | | x | | 300 | 109,9 | | | x | | 360 | 111,5 | | | | x |

Table B.5.14.-22: WMTC, cycle part 3 for vehicle class 3-2, 181 to 360 s

1.4.1.7.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 361 | 110,1 | | | | x | 421 | 116,2 | | | x | | 481 | 118,5 | | | x | |
| 362 | 107,4 | | | | x | 422 | 116,4 | | | x | | 482 | 118,8 | | | x | |
| 363 | 104,4 | | | | x | 423 | 116,6 | | | x | | 483 | 118,9 | | | x | |
| 364 | 101,8 | | | | x | 424 | 116,8 | | | x | | 484 | 119,1 | | | x | |
| 365 | 100,0 | | | | x | 425 | 117,1 | | | x | | 485 | 119,1 | | | x | |
| 366 | 99,1 | | | | x | 426 | 117,4 | | | x | | 486 | 119,2 | | | x | |
| 367 | 98,7 | | | | x | 427 | 117,9 | | | x | | 487 | 119,2 | | | x | |
| 368 | 98,2 | | | x | | 428 | 118,4 | | | x | | 488 | 119,2 | | | x | |
| 369 | 99,0 | | | x | | 429 | 118,9 | | | x | | 489 | 119,3 | | | x | |
| 370 | 100,5 | | | x | | 430 | 119,2 | | | x | | 490 | 119,3 | | | x | |
| 371 | 102,3 | | | x | | 431 | 119,5 | | | x | | 491 | 119,4 | | | x | |
| 372 | 103,9 | | | x | | 432 | 119,7 | | | x | | 492 | 119,5 | | | x | |
| 373 | 105,0 | | | x | | 433 | 119,9 | | | x | | 493 | 119,5 | | | x | |
| 374 | 105,8 | | | x | | 434 | 120,1 | | | x | | 494 | 119,3 | | | x | |
| 375 | 106,5 | | | x | | 435 | 120,3 | | | x | | 495 | 119,1 | | | x | |
| 376 | 107,1 | | | x | | 436 | 120,5 | | | x | | 496 | 118,7 | | | x | |
| 377 | 107,7 | | | x | | 437 | 120,8 | | | x | | 497 | 118,2 | | | x | |
| 378 | 108,4 | | | x | | 438 | 121,1 | | | x | | 498 | 117,9 | | | x | |
| 379 | 109,0 | | | x | | 439 | 121,5 | | | x | | 499 | 117,6 | | | x | |
| 380 | 109,6 | | | x | | 440 | 122,0 | | | x | | 500 | 117,5 | | | x | |
| 381 | 110,3 | | | x | | 441 | 122,3 | | | x | | 501 | 117,5 | | | x | |
| 382 | 110,9 | | | x | | 442 | 122,6 | | | x | | 502 | 117,4 | | | x | |
| 383 | 111,5 | | | x | | 443 | 122,9 | | | x | | 503 | 117,3 | | | x | |
| 384 | 112,0 | | | x | | 444 | 123,1 | | | x | | 504 | 117,0 | | | x | |
| 385 | 112,3 | | | x | | 445 | 123,2 | | | x | | 505 | 116,7 | | | x | |
| 386 | 112,6 | | | x | | 446 | 123,4 | | | x | | 506 | 116,4 | | | x | |
| 387 | 112,9 | | | x | | 447 | 123,5 | | | x | | 507 | 116,1 | | | x | |
| 388 | 113,1 | | | x | | 448 | 123,7 | | | x | | 508 | 115,9 | | | x | |
| 389 | 113,3 | | | x | | 449 | 123,9 | | | x | | 509 | 115,7 | | | x | |
| 390 | 113,3 | | | x | | 450 | 124,2 | | | x | | 510 | 115,5 | | | x | |
| 391 | 113,2 | | | x | | 451 | 124,5 | | | x | | 511 | 115,3 | | | x | |
| 392 | 113,2 | | | x | | 452 | 124,8 | | | x | | 512 | 115,2 | | | x | |
| 393 | 113,3 | | | x | | 453 | 125,0 | | | x | | 513 | 115,0 | | | x | |
| 394 | 113,5 | | | x | | 454 | 125,2 | | | x | | 514 | 114,9 | | | x | |
| 395 | 113,9 | | | x | | 455 | 125,3 | | | x | | 515 | 114,9 | | | x | |
| 396 | 114,3 | | | x | | 456 | 125,1 | | | x | | 516 | 115,0 | | | x | |
| 397 | 114,6 | | | x | | 457 | 124,4 | | | x | | 517 | 115,2 | | | x | |
| 398 | 114,9 | | | x | | 458 | 123,3 | | | x | | 518 | 115,3 | | | x | |
| 399 | 115,1 | | | x | | 459 | 122,1 | | | x | | 519 | 115,4 | | | x | |
| 400 | 115,3 | | | x | | 460 | 120,8 | | | x | | 520 | 115,4 | | | x | |
| 401 | 115,4 | | | x | | 461 | 119,5 | | | x | | 521 | 115,2 | | | x | |
| 402 | 115,5 | | | x | | 462 | 118,4 | | | x | | 522 | 114,8 | | | x | |
| 403 | 115,6 | | | x | | 463 | 117,8 | | | x | | 523 | 114,4 | | | x | |
| 404 | 115,8 | | | x | | 464 | 117,6 | | | x | | 524 | 113,9 | | | x | |
| 405 | 115,9 | | | x | | 465 | 117,5 | | | x | | 525 | 113,6 | | | x | |
| 406 | 116,0 | | | x | | 466 | 117,5 | | | x | | 526 | 113,5 | | | x | |
| 407 | 116,0 | | | x | | 467 | 117,4 | | | x | | 527 | 113,5 | | | x | |
| 408 | 116,0 | | | x | | 468 | 117,3 | | | x | | 528 | 113,6 | | | x | |
| 409 | 116,0 | | | x | | 469 | 117,1 | | | x | | 529 | 113,7 | | | x | |
| 410 | 115,9 | | | x | | 470 | 116,9 | | | x | | 530 | 113,8 | | | x | |
| 411 | 115,9 | | | x | | 471 | 116,6 | | | x | | 531 | 113,9 | | | x | |
| 412 | 115,9 | | | x | | 472 | 116,5 | | | x | | 532 | 114,0 | | | x | |
| 413 | 115,8 | | | x | | 473 | 116,4 | | | x | | 533 | 114,0 | | | x | |
| 414 | 115,8 | | | x | | 474 | 116,4 | | | x | | 534 | 114,1 | | | x | |
| 415 | 115,8 | | | x | | 475 | 116,5 | | | x | | 535 | 114,2 | | | x | |
| 416 | 115,8 | | | x | | 476 | 116,7 | | | x | | 536 | 114,4 | | | x | |
| 417 | 115,8 | | | x | | 477 | 117,0 | | | x | | 537 | 114,5 | | | x | |
| 418 | 115,8 | | | x | | 478 | 117,3 | | | x | | 538 | 114,6 | | | x | |
| 419 | 115,9 | | | x | | 479 | 117,7 | | | x | | 539 | 114,7 | | | x | |
| 420 | 116,0 | | | x | | 480 | 118,1 | | | x | | 540 | 114,8 | | | x | |

Table B.5.14.-23: WMTC, cycle part 3 for vehicle class 3-2, 361 to 540 s

1.4.1.8
.

| time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|
| | | stop | acc | cruise | dec |
| 541 | 115,0 | | | x | |
| 542 | 115,3 | | | x | |
| 543 | 116,0 | | | x | |
| 544 | 116,7 | | | x | |
| 545 | 117,5 | | | x | |
| 546 | 118,2 | | | x | |
| 547 | 118,6 | | | x | |
| 548 | 118,7 | | | x | |
| 549 | 118,8 | | | x | |
| 550 | 118,8 | | | x | |
| 551 | 118,9 | | | x | |
| 552 | 119,1 | | | x | |
| 553 | 119,4 | | | x | |
| 554 | 119,7 | | | x | |
| 555 | 119,9 | | | x | |
| 556 | 120,0 | | | x | |
| 557 | 119,7 | | | | x |
| 558 | 118,4 | | | | x |
| 559 | 115,9 | | | | x |
| 560 | 113,2 | | | | x |
| 561 | 110,5 | | | | x |
| 562 | 107,2 | | | | x |
| 563 | 104,0 | | | | x |
| 564 | 100,4 | | | | x |
| 565 | 96,8 | | | | x |
| 566 | 92,8 | | | | x |
| 567 | 88,9 | | | | x |
| 568 | 84,9 | | | | x |
| 569 | 80,6 | | | | x |
| 570 | 76,3 | | | | x |
| 571 | 72,3 | | | | x |
| 572 | 68,7 | | | | x |
| 573 | 65,5 | | | | x |
| 574 | 63,0 | | | | x |
| 575 | 61,2 | | | | x |
| 576 | 60,5 | | | | x |
| 577 | 60,0 | | | | x |
| 578 | 59,7 | | | | x |
| 579 | 59,4 | | | | x |
| 580 | 59,4 | | | | x |
| 581 | 58,0 | | | | x |
| 582 | 55,0 | | | | x |
| 583 | 51,0 | | | | x |
| 584 | 46,0 | | | | x |
| 585 | 38,8 | | | | x |
| 586 | 31,6 | | | | x |
| 587 | 24,4 | | | | x |
| 588 | 17,2 | | | | x |
| 589 | 10,0 | | | | x |
| 590 | 5,0 | | | | x |
| 591 | 2,0 | | | | x |
| 592 | 0,0 | x | | | |
| 593 | 0,0 | x | | | |
| 594 | 0,0 | x | | | |
| 595 | 0,0 | x | | | |
| 596 | 0,0 | x | | | |
| 597 | 0,0 | x | | | |
| 598 | 0,0 | x | | | |
| 599 | 0,0 | x | | | |
| 600 | 0,0 | x | | | |

Table B.5.14.-24: WMTC, cycle part 3 for vehicle class 3-2, 541 to 600 s

## 2. World Harmonised Motorcycle Test Cycle (WMTC) for two-wheeled vehicles with an engine displacement < 50 $cm^3$ and with a maximum design vehicle speed of 25 km/h, 45 km/h respectively.

2.1. The WMTC to be used on the chassis dynamometer is depicted in the following graph for vehicles equipped with an engine displacement < 50 $cm^3$ or with a maximum net power or maximum continuous rated power ≤ 4 kW and with a maximum design vehicle speed (25 km/h, 45 km/h, respectively), which consists of one cold phase 1 of the WMTC and one warm phase 1 of the WMTC.

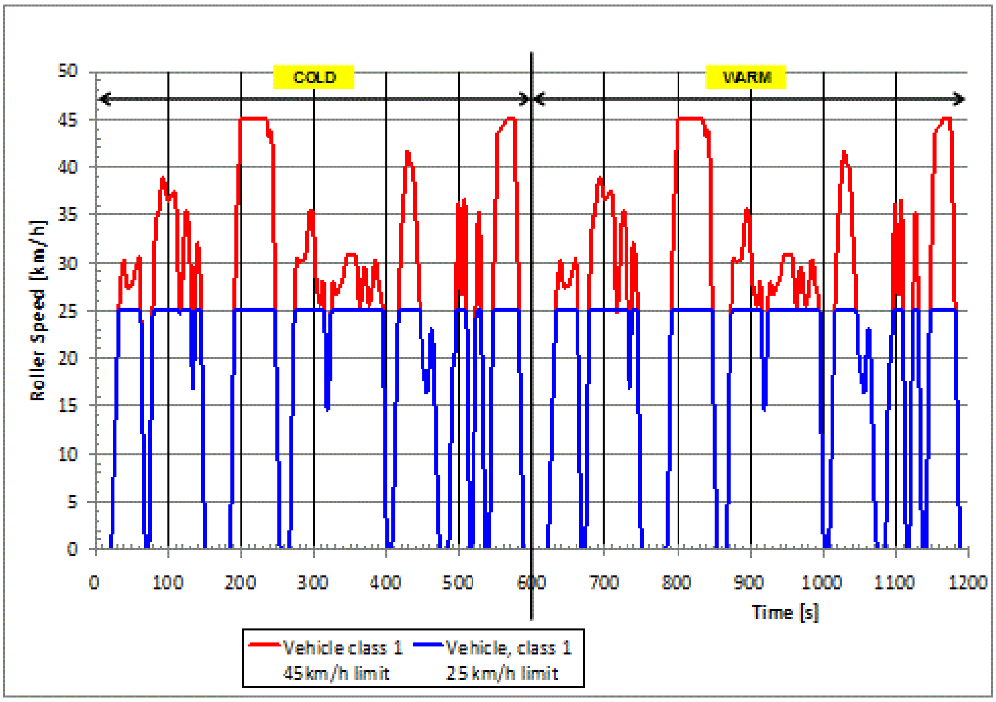


Figure B.5.14.-5: WMTC for vehicles with a maximum design vehicle speed of 45km/h and low engine displacement or maximum net or continuous rated power. The truncated desired vehicle speed trace limited to 25 km/h is applicable for vehicles with a limited maximum design vehicle speed of 25 km/h. In case of vehicle with maximum design speed of 50km/h, the vehicle shall be driven on WMTC upto maximum speed of 50km/h.

2.2 The cold and warm vehicle speed phases are identical.

2.3. **Description of the WMTC for vehicles with a maximum design vehicle speed (25 km/h, 45 km/h, respectively) and a low engine displacement (< 50 cm³) or maximum net or continuous rated power (≤ 4 kW)**

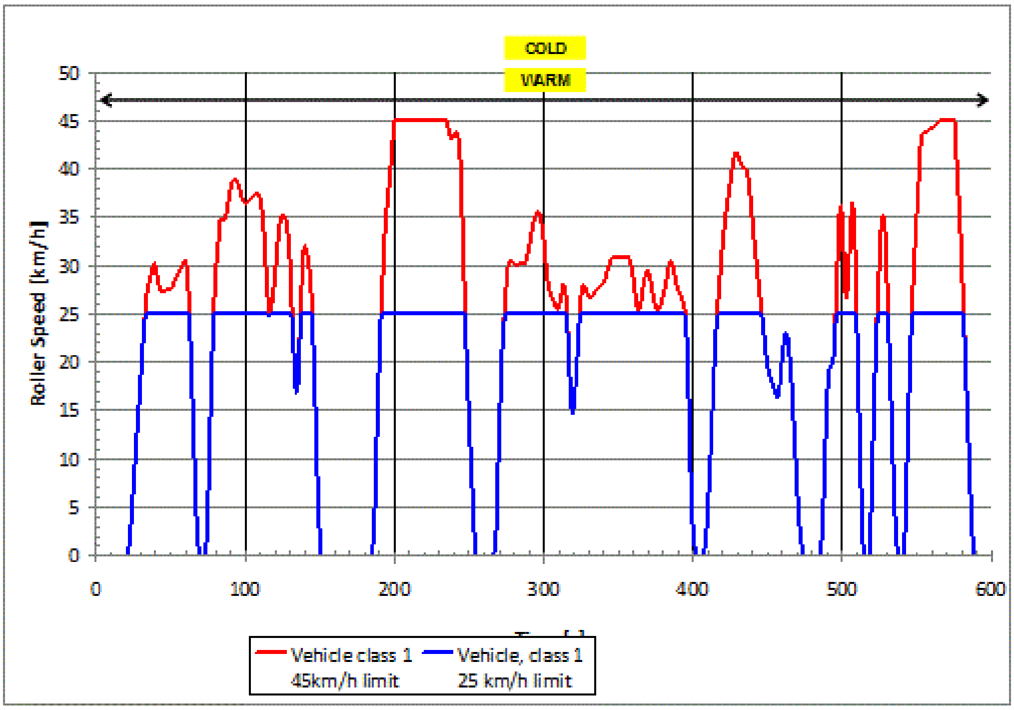


Figure B.5.14.-6: WMTC for vehicles with a maximum design vehicle speed of 45km/h and low engine displacement or maximum net or continuous rated power. The truncated desired vehicle speed trace limited to 25 km/h is applicable for vehicles with a limited maximum design vehicle speed of 25 km/h. In case of vehicle with maximum design speed of 50km/h, the vehicle shall be driven on WMTC upto maximum speed of 50km/h.

2.3.1. The desired vehicle speed trace WMTC shown in Figure Ap 6-10 is applicable for vehicles with a maximum design vehicle speed (if applicable at 25 km/h, at 45 km/h or 50 km/h) and a low engine displacement (< 50 cm³) or a low maximum net or continuous rated power (≤ 4 kW) and consists of the desired vehicle speed trace WMTC stage 1, part 1 for class 1 vehicles, driven once cold followed by the same desired vehicle speed trace driven with a warm propulsion unit. The WMTC for vehicles with a low maximum design vehicle speed and low engine displacement or maximum net or continuous rated power lasts 1200 seconds and consists of two equivalent parts to be carried out without interruption.

2.3.2. The characteristic driving conditions (idling, acceleration, steady vehicle speed, deceleration, etc.) of the WMTC for vehicles with a maximum design vehicle speed (if applicable at 25 km/h, at 45 km/h, or at 50 km/h) and low engine displacement (< 50 cm³) or maximum net or continuous rated power (≤ 4 kW) are set out in the following points and tables.

2.3.2.1.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 0 | 0 | x | | | | 61 | 25 | | | | | 121 | 25 | | | x | |
| 1 | 0 | x | | | | 62 | 25 | | | | | 122 | 25 | | | x | |
| 2 | 0 | x | | | | 63 | 23 | | | | x | 123 | 25 | | | x | |
| 3 | 0 | x | | | | 64 | 18,6 | | | | x | 124 | 25 | | | x | |
| 4 | 0 | x | | | | 65 | 14,1 | | | | x | 125 | 25 | | | | |
| 5 | 0 | x | | | | 66 | 9,3 | | | | x | 126 | 25 | | | | |
| 6 | 0 | x | | | | 67 | 4,8 | | | | x | 127 | 25 | | | | |
| 7 | 0 | x | | | | 68 | 1,9 | | | | x | 128 | 25 | | | | |
| 8 | 0 | x | | | | 69 | 0 | x | | | | 129 | 25 | | | | |
| 9 | 0 | x | | | | 70 | 0 | x | | | | 130 | 25 | | | | |
| 10 | 0 | x | | | | 71 | 0 | x | | | | 131 | 25 | | | | |
| 11 | 0 | x | | | | 72 | 0 | x | | | | 132 | 22,1 | | | | x |
| 12 | 0 | x | | | | 73 | 0 | x | | | | 133 | 18,6 | | | | x |
| 13 | 0 | x | | | | 74 | 1,7 | | x | | | 134 | 16,8 | | x | | |
| 14 | 0 | x | | | | 75 | 5,8 | | x | | | 135 | 17,7 | | x | | |
| 15 | 0 | x | | | | 76 | 11,8 | | x | | | 136 | 21,1 | | x | | |
| 16 | 0 | x | | | | 77 | 17,3 | | x | | | 137 | 25 | | | | |
| 17 | 0 | x | | | | 78 | 22 | | x | | | 138 | 25 | | | | |
| 18 | 0 | x | | | | 79 | 25 | | | | | 139 | 25 | | | | |
| 19 | 0 | x | | | | 80 | 25 | | | | | 140 | 25 | | | | |
| 20 | 0 | x | | | | 81 | 25 | | | | | 141 | 25 | | | | |
| 21 | 0 | x | | | | 82 | 25 | | | | | 142 | 25 | | | | |
| 22 | 1 | | x | | | 83 | 25 | | | | | 143 | 25 | | | | |
| 23 | 2,6 | | x | | | 84 | 25 | | | | | 144 | 25 | | | | |
| 24 | 4,8 | | x | | | 85 | 25 | | | | | 145 | 25 | | | | |
| 25 | 7,2 | | x | | | 86 | 25 | | | | | 146 | 20,3 | | | | x |
| 26 | 9,6 | | x | | | 87 | 25 | | | | | 147 | 15 | | | | x |
| 27 | 12 | | x | | | 88 | 25 | | | | | 148 | 9,7 | | | | x |
| 28 | 14,3 | | x | | | 89 | 25 | | | | | 149 | 5 | | | | x |
| 29 | 16,6 | | x | | | 90 | 25 | | | | | 150 | 1,6 | | | | x |
| 30 | 18,9 | | x | | | 91 | 25 | | | x | | 151 | 0 | x | | | |
| 31 | 21,2 | | x | | | 92 | 25 | | | x | | 152 | 0 | x | | | |
| 32 | 23,5 | | x | | | 93 | 25 | | | x | | 153 | 0 | x | | | |
| 33 | 25 | | | | | 94 | 25 | | | x | | 154 | 0 | x | | | |
| 34 | 25 | | | | | 95 | 25 | | | x | | 155 | 0 | x | | | |
| 35 | 25 | | | | | 96 | 25 | | | x | | 156 | 0 | x | | | |
| 36 | 25 | | | | | 97 | 25 | | | x | | 157 | 0 | x | | | |
| 37 | 25 | | | | | 98 | 25 | | | x | | 158 | 0 | x | | | |
| 38 | 25 | | | | | 99 | 25 | | | x | | 159 | 0 | x | | | |
| 39 | 25 | | | x | | 100 | 25 | | | x | | 160 | 0 | x | | | |
| 40 | 25 | | | x | | 101 | 25 | | | x | | 161 | 0 | x | | | |
| 41 | 25 | | | x | | 102 | 25 | | | x | | 162 | 0 | x | | | |
| 42 | 25 | | | x | | 103 | 25 | | | x | | 163 | 0 | x | | | |
| 43 | 25 | | | x | | 104 | 25 | | | x | | 164 | 0 | x | | | |
| 44 | 25 | | | x | | 105 | 25 | | | x | | 165 | 0 | x | | | |
| 45 | 25 | | | x | | 106 | 25 | | | x | | 166 | 0 | x | | | |
| 46 | 25 | | | x | | 107 | 25 | | | x | | 167 | 0 | x | | | |
| 47 | 25 | | | x | | 108 | 25 | | | x | | 168 | 0 | x | | | |
| 48 | 25 | | | x | | 109 | 25 | | | x | | 169 | 0 | x | | | |
| 49 | 25 | | | x | | 110 | 25 | | | | | 170 | 0 | x | | | |
| 50 | 25 | | | x | | 111 | 25 | | | | | 171 | 0 | x | | | |
| 51 | 25 | | | x | | 112 | 25 | | | | | 172 | 0 | x | | | |
| 52 | 25 | | | x | | 113 | 25 | | | | | 173 | 0 | x | | | |
| 53 | 25 | | | x | | 114 | 25 | | | | | 174 | 0 | x | | | |
| 54 | 25 | | | x | | 115 | 25 | | | | | 175 | 0 | x | | | |
| 55 | 25 | | | x | | 116 | 24,7 | | | x | | 176 | 0 | x | | | |
| 56 | 25 | | | x | | 117 | 25 | | | x | | 177 | 0 | x | | | |
| 57 | 25 | | | x | | 118 | 25 | | | x | | 178 | 0 | x | | | |
| 58 | 25 | | | x | | 119 | 25 | | | x | | 179 | 0 | x | | | |
| 59 | 25 | | | x | | 120 | 25 | | | x | | 180 | 0 | x | | | |
| 60 | 25 | | | | x | | | | | | | | | | | | |

Table B.5.14.-25: WMTC, part 1, class 1, applicable for vehicles with a maximum design vehicle speed (25 km/h) and a low engine displacement (< 50 $cm^3$) or maximum net or continuous rated power (≤ 4 kW), cold or warm, 0 to 180 s

2.3.2.2.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 181 | 0 | x | | | | 241 | 25 | | | x | | 301 | 25 | | | x | |
| 182 | 0 | x | | | | 242 | 25 | | | | | 302 | 25 | | | x | |
| 183 | 0 | x | | | | 243 | 25 | | | | | 303 | 25 | | | x | |
| 184 | 0 | x | | | | 244 | 25 | | | | | 304 | 25 | | | x | |
| 185 | 0,4 | | x | | | 245 | 25 | | | | | 305 | 25 | | | x | |
| 186 | 1,8 | | x | | | 246 | 25 | | | | | 306 | 25 | | | x | |
| 187 | 5,4 | | x | | | 247 | 25 | | | | | 307 | 25 | | | x | |
| 188 | 11,1 | | x | | | 248 | 21,8 | | | | x | 308 | 25 | | | x | |
| 189 | 16,7 | | x | | | 249 | 17,2 | | | | x | 309 | 25 | | | x | |
| 190 | 21,3 | | x | | | 250 | 13,7 | | | | x | 310 | 25 | | | x | |
| 191 | 24,8 | | x | | | 251 | 10,3 | | | | x | 311 | 25 | | | x | |
| 192 | 25 | | | | | 252 | 7 | | | | x | 312 | 25 | | | x | |
| 193 | 25 | | | | | 253 | 3,5 | | | | x | 313 | 25 | | | x | |
| 194 | 25 | | | | | 254 | 0 | x | | | | 314 | 25 | | | | |
| 195 | 25 | | | | | 255 | 0 | x | | | | 315 | 25 | | | | |
| 196 | 25 | | | | | 256 | 0 | x | | | | 316 | 22,7 | | | | x |
| 197 | 25 | | | | | 257 | 0 | x | | | | 317 | 19 | | | | x |
| 198 | 25 | | | | | 258 | 0 | x | | | | 318 | 16 | | | | x |
| 199 | 25 | | | | | 259 | 0 | x | | | | 319 | 14,6 | | x | | |
| 200 | 25 | | | | | 260 | 0 | x | | | | 320 | 15,2 | | x | | |
| 201 | 25 | | | | | 261 | 0 | x | | | | 321 | 16,9 | | x | | |
| 202 | 25 | | | | | 262 | 0 | x | | | | 322 | 19,3 | | x | | |
| 203 | 25 | | | x | | 263 | 0 | x | | | | 323 | 22 | | x | | |
| 204 | 25 | | | x | | 264 | 0 | x | | | | 324 | 24,6 | | x | | |
| 205 | 25 | | | x | | 265 | 0 | x | | | | 325 | 25 | | | | |
| 206 | 25 | | | x | | 266 | 0 | x | | | | 326 | 25 | | | | |
| 207 | 25 | | | x | | 267 | 0,5 | | x | | | 327 | 25 | | | x | |
| 208 | 25 | | | x | | 268 | 2,9 | | x | | | 328 | 25 | | | x | |
| 209 | 25 | | | x | | 269 | 8,2 | | x | | | 329 | 25 | | | x | |
| 210 | 25 | | | x | | 270 | 13,2 | | x | | | 330 | 25 | | | x | |
| 211 | 25 | | | x | | 271 | 17,8 | | x | | | 331 | 25 | | | x | |
| 212 | 25 | | | x | | 272 | 21,4 | | x | | | 332 | 25 | | | x | |
| 213 | 25 | | | x | | 273 | 24,1 | | x | | | 333 | 25 | | | x | |
| 214 | 25 | | | x | | 274 | 25 | | | | | 334 | 25 | | | x | |
| 215 | 25 | | | x | | 275 | 25 | | | | | 335 | 25 | | | x | |
| 216 | 25 | | | x | | 276 | 25 | | | | | 336 | 25 | | | x | |
| 217 | 25 | | | x | | 277 | 25 | | | x | | 337 | 25 | | | x | |
| 218 | 25 | | | x | | 278 | 25 | | | x | | 338 | 25 | | | x | |
| 219 | 25 | | | x | | 279 | 25 | | | x | | 339 | 25 | | | x | |
| 220 | 25 | | | x | | 280 | 25 | | | x | | 340 | 25 | | | x | |
| 221 | 25 | | | x | | 281 | 25 | | | x | | 341 | 25 | | | x | |
| 222 | 25 | | | x | | 282 | 25 | | | x | | 342 | 25 | | | x | |
| 223 | 25 | | | x | | 283 | 25 | | | x | | 343 | 25 | | | x | |
| 224 | 25 | | | x | | 284 | 25 | | | x | | 344 | 25 | | | x | |
| 225 | 25 | | | x | | 285 | 25 | | | x | | 345 | 25 | | | x | |
| 226 | 25 | | | x | | 286 | 25 | | | x | | 346 | 25 | | | x | |
| 227 | 25 | | | x | | 287 | 25 | | | x | | 347 | 25 | | | x | |
| 228 | 25 | | | x | | 288 | 25 | | | x | | 348 | 25 | | | x | |
| 229 | 25 | | | x | | 289 | 25 | | | x | | 349 | 25 | | | x | |
| 230 | 25 | | | x | | 290 | 25 | | | x | | 350 | 25 | | | x | |
| 231 | 25 | | | x | | 291 | 25 | | | x | | 351 | 25 | | | x | |
| 232 | 25 | | | x | | 292 | 25 | | | x | | 352 | 25 | | | x | |
| 233 | 25 | | | x | | 293 | 25 | | | x | | 353 | 25 | | | x | |
| 234 | 25 | | | x | | 294 | 25 | | | x | | 354 | 25 | | | x | |
| 235 | 25 | | | x | | 295 | 25 | | | x | | 355 | 25 | | | x | |
| 236 | 25 | | | x | | 296 | 25 | | | x | | 356 | 25 | | | x | |
| 237 | 25 | | | x | | 297 | 25 | | | x | | 357 | 25 | | | x | |
| 238 | 25 | | | x | | 298 | 25 | | | x | | 358 | 25 | | | x | |
| 239 | 25 | | | x | | 299 | 25 | | | x | | 359 | 25 | | | x | |
| 240 | 25 | | | x | | 300 | 25 | | | x | | 360 | 25 | | | x | |

Table B.5.14.-26: WMTC, part 1, class 1, applicable for vehicles with a maximum design vehicle speed (25 km/h) and a low engine displacement (< 50 cm3) or maximum net or continuous rated power (≤ 4 kW), cold or warm, 181 to 360 s

2.3.2.3.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 361 | 25 | | | x | | 421 | 25 | | x | | | 481 | 0 | x | | | |
| 362 | 25 | | | x | | 422 | 25 | | x | | | 482 | 0 | x | | | |
| 363 | 25 | | | x | | 423 | 25 | | x | | | 483 | 0 | x | | | |
| 364 | 25 | | | x | | 424 | 25 | | x | | | 484 | 0 | x | | | |
| 365 | 25 | | | x | | 425 | 25 | | x | | | 485 | 0 | x | | | |
| 366 | 25 | | | x | | 426 | 25 | | x | | | 486 | 1,4 | | x | | |
| 367 | 25 | | | x | | 427 | 25 | | x | | | 487 | 4,5 | | x | | |
| 368 | 25 | | | x | | 428 | 25 | | x | | | 488 | 8,8 | | x | | |
| 369 | 25 | | | x | | 429 | 25 | | | x | | 489 | 13,4 | | x | | |
| 370 | 25 | | | x | | 430 | 25 | | | x | | 490 | 17,3 | | x | | |
| 371 | 25 | | | x | | 431 | 25 | | | x | | 491 | 19,2 | | x | | |
| 372 | 25 | | | x | | 432 | 25 | | | x | | 492 | 19,7 | | x | | |
| 373 | 25 | | | x | | 433 | 25 | | | x | | 493 | 19,8 | | x | | |
| 374 | 25 | | | x | | 434 | 25 | | | x | | 494 | 20,7 | | x | | |
| 375 | 25 | | | x | | 435 | 25 | | | x | | 495 | 23,7 | | x | | |
| 376 | 25 | | | x | | 436 | 25 | | | | | 496 | 25 | | | | |
| 377 | 25 | | | x | | 437 | 25 | | | | | 497 | 25 | | | | |
| 378 | 25 | | | x | | 438 | 25 | | | | | 498 | 25 | | | | |
| 379 | 25 | | | x | | 439 | 25 | | | | | 499 | 25 | | | | |
| 380 | 25 | | | x | | 440 | 25 | | | | | 500 | 25 | | | | |
| 381 | 25 | | | x | | 441 | 25 | | | | | 501 | 25 | | | | |
| 382 | 25 | | | x | | 442 | 25 | | | | | 502 | 25 | | | | |
| 383 | 25 | | | x | | 443 | 25 | | | | | 503 | 25 | | | | |
| 384 | 25 | | | x | | 444 | 25 | | | | | 504 | 25 | | | | |
| 385 | 25 | | | x | | 445 | 25 | | | | | 505 | 25 | | | | |
| 386 | 25 | | | x | | 446 | 25 | | | | | 506 | 25 | | | | |
| 387 | 25 | | | x | | 447 | 23,4 | | | | x | 507 | 25 | | | | |
| 388 | 25 | | | x | | 448 | 21,8 | | | | x | 508 | 25 | | | | |
| 389 | 25 | | | x | | 449 | 20,3 | | | | x | 509 | 25 | | | | |
| 390 | 25 | | | x | | 450 | 19,3 | | | | x | 510 | 23,1 | | | | x |
| 391 | 25 | | | x | | 451 | 18,7 | | | | x | 511 | 16,7 | | | | x |
| 392 | 25 | | | | | 452 | 18,3 | | | | x | 512 | 10,7 | | | | x |
| 393 | 25 | | | | | 453 | 17,8 | | | | x | 513 | 4,7 | | | | x |
| 394 | 25 | | | | | 454 | 17,4 | | | | x | 514 | 1,2 | | | | x |
| 395 | 24,9 | | | | x | 455 | 16,8 | | | | x | 515 | 0 | x | | | |
| 396 | 21,4 | | | | x | 456 | 16,3 | | | x | | 516 | 0 | x | | | |
| 397 | 15,9 | | | | x | 457 | 16,5 | | | x | | 517 | 0 | x | | | |
| 398 | 9,9 | | | | x | 458 | 17,6 | | | x | | 518 | 0 | x | | | |
| 399 | 4,9 | | | | x | 459 | 19,2 | | | x | | 519 | 3 | | x | | |
| 400 | 2,1 | | | | x | 460 | 20,8 | | | x | | 520 | 8,2 | | x | | |
| 401 | 0,9 | | | | x | 461 | 22,2 | | | x | | 521 | 14,3 | | x | | |
| 402 | 0 | x | | | | 462 | 23 | | | x | | 522 | 19,3 | | x | | |
| 403 | 0 | x | | | | 463 | 23 | | | | x | 523 | 23,5 | | x | | |
| 404 | 0 | x | | | | 464 | 22 | | | | x | 524 | 25 | | | | |
| 405 | 0 | x | | | | 465 | 20,1 | | | | x | 525 | 25 | | | | |
| 406 | 0 | x | | | | 466 | 17,7 | | | | x | 526 | 25 | | | | |
| 407 | 0 | x | | | | 467 | 15 | | | | x | 527 | 25 | | | | |
| 408 | 1,2 | | x | | | 468 | 12,1 | | | | x | 528 | 25 | | | | |
| 409 | 3,2 | | x | | | 469 | 9,1 | | | | x | 529 | 25 | | | | |
| 410 | 5,9 | | x | | | 470 | 6,2 | | | | x | 530 | 25 | | | | |
| 411 | 8,8 | | x | | | 471 | 3,6 | | | | x | 531 | 23,2 | | | | x |
| 412 | 12 | | x | | | 472 | 1,8 | | | | x | 532 | 18,5 | | | | x |
| 413 | 15,4 | | x | | | 473 | 0,8 | | | | x | 533 | 13,8 | | | | x |
| 414 | 18,9 | | x | | | 474 | 0 | x | | | | 534 | 9,1 | | | | x |
| 415 | 22,1 | | x | | | 475 | 0 | x | | | | 535 | 4,5 | | | | x |
| 416 | 24,7 | | x | | | 476 | 0 | x | | | | 536 | 2,3 | | | | x |
| 417 | 25 | | | | | 477 | 0 | x | | | | 537 | 0 | x | | | |
| 418 | 25 | | | | | 478 | 0 | x | | | | 538 | 0 | x | | | |
| 419 | 25 | | | | | 479 | 0 | x | | | | 539 | 0 | x | | | |
| 420 | 25 | | | | | 480 | 0 | x | | | | 540 | 0 | | | | |

Table B.5.14.-27: WMTC, part 1, class 1, applicable for vehicles with a maximum design vehicle speed (25 km/h) and a low engine displacement (< 50 $cm^3$) or maximum net or continuous rated power (≤ 4 kW), cold or warm, 361 to 540 s

2.3.2.4.

| time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|
| | | stop | acc | cruise | dec |
| 541 | 0 | x | | | |
| 542 | 2,8 | | x | | |
| 543 | 8,1 | | x | | |
| 544 | 14,3 | | x | | |
| 545 | 19,2 | | x | | |
| 546 | 23,5 | | x | | |
| 547 | 25 | | | | |
| 548 | 25 | | | | |
| 549 | 25 | | | | |
| 550 | 25 | | | | |
| 551 | 25 | | | | |
| 552 | 25 | | | | |
| 553 | 25 | | | x | |
| 554 | 25 | | | x | |
| 555 | 25 | | | x | |
| 556 | 25 | | | x | |
| 557 | 25 | | | x | |
| 558 | 25 | | | x | |
| 559 | 25 | | | x | |
| 560 | 25 | | | x | |
| 561 | 25 | | | x | |
| 562 | 25 | | | x | |
| 563 | 25 | | | x | |
| 564 | 25 | | | x | |
| 565 | 25 | | | x | |
| 566 | 25 | | | x | |
| 567 | 25 | | | x | |
| 568 | 25 | | | x | |
| 569 | 25 | | | x | |
| 570 | 25 | | | x | |
| 571 | 25 | | | x | |
| 572 | 25 | | | x | |
| 573 | 25 | | | | |
| 574 | 25 | | | | |
| 575 | 25 | | | | |
| 576 | 25 | | | | |
| 577 | 25 | | | | |
| 578 | 25 | | | | |
| 579 | 25 | | | | |
| 580 | 25 | | | | |
| 581 | 25 | | | | |
| 582 | 21,8 | | | | x |
| 583 | 17,7 | | | | x |
| 584 | 13,5 | | | | x |
| 585 | 9,4 | | | | x |
| 586 | 5,6 | | | | x |
| 587 | 2,1 | | | | x |
| 588 | 0 | x | | | |
| 589 | 0 | x | | | |
| 590 | 0 | x | | | |
| 591 | 0 | x | | | |
| 592 | 0 | x | | | |
| 593 | 0 | x | | | |
| 594 | 0 | x | | | |
| 595 | 0 | x | | | |
| 596 | 0 | x | | | |
| 597 | 0 | x | | | |
| 598 | 0 | x | | | |
| 599 | 0 | x | | | |
| 600 | 0 | x | | | |

Table B.5.14.-28: WMTC, part 1, class 1, applicable for vehicles with a maximum design vehicle speed (25 km/h) and a low engine displacement (< 50 $cm^3$) or maximum net or continuous rated power (≤ 4 kW), cold or warm, 541 to 600 s

2.3.2.5.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 0 | 0 | x | | | | 61 | 29,6 | | | | x | 121 | 31,2 | | | x | |
| 1 | 0 | x | | | | 62 | 26,9 | | | | x | 122 | 33 | | | x | |
| 2 | 0 | x | | | | 63 | 23 | | | | x | 123 | 34,4 | | | x | |
| 3 | 0 | x | | | | 64 | 18,6 | | | | x | 124 | 35,2 | | | x | |
| 4 | 0 | x | | | | 65 | 14,1 | | | | x | 125 | 35,4 | | | | x |
| 5 | 0 | x | | | | 66 | 9,3 | | | | x | 126 | 35,2 | | | | x |
| 6 | 0 | x | | | | 67 | 4,8 | | | | x | 127 | 34,7 | | | | x |
| 7 | 0 | x | | | | 68 | 1,9 | | | | x | 128 | 33,9 | | | | x |
| 8 | 0 | x | | | | 69 | 0 | x | | | | 129 | 32,4 | | | | x |
| 9 | 0 | x | | | | 70 | 0 | x | | | | 130 | 29,8 | | | | x |
| 10 | 0 | x | | | | 71 | 0 | x | | | | 131 | 26,1 | | | | x |
| 11 | 0 | x | | | | 72 | 0 | x | | | | 132 | 22,1 | | | | x |
| 12 | 0 | x | | | | 73 | 0 | x | | | | 133 | 18,6 | | | | x |
| 13 | 0 | x | | | | 74 | 1,7 | | x | | | 134 | 16,8 | | x | | |
| 14 | 0 | x | | | | 75 | 5,8 | | x | | | 135 | 17,7 | | x | | |
| 15 | 0 | x | | | | 76 | 11,8 | | x | | | 136 | 21,1 | | x | | |
| 16 | 0 | x | | | | 77 | 17,3 | | x | | | 137 | 25,4 | | x | | |
| 17 | 0 | x | | | | 78 | 22 | | x | | | 138 | 29,2 | | x | | |
| 18 | 0 | x | | | | 79 | 26,2 | | x | | | 139 | 31,6 | | x | | |
| 19 | 0 | x | | | | 80 | 29,4 | | x | | | 140 | 32,1 | | | | x |
| 20 | 0 | x | | | | 81 | 31,1 | | x | | | 141 | 31,6 | | | | x |
| 21 | 0 | x | | | | 82 | 32,9 | | x | | | 142 | 30,7 | | | | x |
| 22 | 1 | | x | | | 83 | 34,7 | | x | | | 143 | 29,7 | | | | x |
| 23 | 2,6 | | x | | | 84 | 34,8 | | x | | | 144 | 28,1 | | | | x |
| 24 | 4,8 | | x | | | 85 | 34,8 | | x | | | 145 | 25 | | | | x |
| 25 | 7,2 | | x | | | 86 | 34,9 | | x | | | 146 | 20,3 | | | | x |
| 26 | 9,6 | | x | | | 87 | 35,4 | | x | | | 147 | 15 | | | | x |
| 27 | 12 | | x | | | 88 | 36,2 | | x | | | 148 | 9,7 | | | | x |
| 28 | 14,3 | | x | | | 89 | 37,1 | | x | | | 149 | 5 | | | | x |
| 29 | 16,6 | | x | | | 90 | 38 | | x | | | 150 | 1,6 | | | | x |
| 30 | 18,9 | | x | | | 91 | 38,7 | | | x | | 151 | 0 | x | | | |
| 31 | 21,2 | | x | | | 92 | 38,9 | | | x | | 152 | 0 | x | | | |
| 32 | 23,5 | | x | | | 93 | 38,9 | | | x | | 153 | 0 | x | | | |
| 33 | 25,6 | | x | | | 94 | 38,8 | | | x | | 154 | 0 | x | | | |
| 34 | 27,1 | | x | | | 95 | 38,5 | | | x | | 155 | 0 | x | | | |
| 35 | 28 | | x | | | 96 | 38,1 | | | x | | 156 | 0 | x | | | |
| 36 | 28,7 | | x | | | 97 | 37,5 | | | x | | 157 | 0 | x | | | |
| 37 | 29,2 | | x | | | 98 | 37 | | | x | | 158 | 0 | x | | | |
| 38 | 29,8 | | x | | | 99 | 36,7 | | | x | | 159 | 0 | x | | | |
| 39 | 30,3 | | | x | | 100 | 36,5 | | | x | | 160 | 0 | x | | | |
| 40 | 29,6 | | | x | | 101 | 36,5 | | | x | | 161 | 0 | x | | | |
| 41 | 28,7 | | | x | | 102 | 36,6 | | | x | | 162 | 0 | x | | | |
| 42 | 27,9 | | | x | | 103 | 36,8 | | | x | | 163 | 0 | x | | | |
| 43 | 27,4 | | | x | | 104 | 37 | | | x | | 164 | 0 | x | | | |
| 44 | 27,3 | | | x | | 105 | 37,1 | | | x | | 165 | 0 | x | | | |
| 45 | 27,3 | | | x | | 106 | 37,3 | | | x | | 166 | 0 | x | | | |
| 46 | 27,4 | | | x | | 107 | 37,4 | | | x | | 167 | 0 | x | | | |
| 47 | 27,5 | | | x | | 108 | 37,5 | | | x | | 168 | 0 | x | | | |
| 48 | 27,6 | | | x | | 109 | 37,4 | | | x | | 169 | 0 | x | | | |
| 49 | 27,6 | | | x | | 110 | 36,9 | | | | x | 170 | 0 | x | | | |
| 50 | 27,6 | | | x | | 111 | 36 | | | | x | 171 | 0 | x | | | |
| 51 | 27,8 | | | x | | 112 | 34,8 | | | | x | 172 | 0 | x | | | |
| 52 | 28,1 | | | x | | 113 | 31,9 | | | | x | 173 | 0 | x | | | |
| 53 | 28,5 | | | x | | 114 | 29 | | | | x | 174 | 0 | x | | | |
| 54 | 28,9 | | | x | | 115 | 26,9 | | | | x | 175 | 0 | x | | | |
| 55 | 29,2 | | | x | | 116 | 24,7 | | | x | | 176 | 0 | x | | | |
| 56 | 29,4 | | | x | | 117 | 25,4 | | | x | | 177 | 0 | x | | | |
| 57 | 29,7 | | | x | | 118 | 26,4 | | | x | | 178 | 0 | x | | | |
| 58 | 30 | | | x | | 119 | 27,7 | | | x | | 179 | 0 | x | | | |
| 59 | 30,5 | | | x | | 120 | 29,4 | | | x | | 180 | 0 | x | | | |
| 60 | 30,6 | | | | x | | | | | | | | | | | | |

Table B.5.14.-29: WMTC, part 1, class 1, applicable for vehicles with a maximum design vehicle speed (where applicable truncated at 45 km/h, respectively at 50 km/h) and a low engine displacement (< 50 $cm^3$) or maximum net or continuous rated power (≤ 4 kW), cold or warm, 0 to 180 s

2.3.2.6.

| time in s | roller speed in km/h | phase indicators: stop | acc | cruise | dec |
|---|---|---|---|---|---|
| 181 | 0 | x | | | |
| 182 | 0 | x | | | |
| 183 | 0 | x | | | |
| 184 | 0 | x | | | |
| 185 | 0,4 | | x | | |
| 186 | 1,8 | | x | | |
| 187 | 5,4 | | x | | |
| 188 | 11,1 | | x | | |
| 189 | 16,7 | | x | | |
| 190 | 21,3 | | x | | |
| 191 | 24,8 | | x | | |
| 192 | 28,4 | | x | | |
| 193 | 31,8 | | x | | |
| 194 | 34,6 | | x | | |
| 195 | 36,3 | | x | | |
| 196 | 37,8 | | x | | |
| 197 | 39,6 | | x | | |
| 198 | 41,3 | | x | | |
| 199 | 43,3 | | x | | |
| 200 | 45 | | | | |
| 201 | 45 | | | | |
| 202 | 45 | | | | |
| 203 | 45 | | | x | |
| 204 | 45 | | | x | |
| 205 | 45 | | | x | |
| 206 | 45 | | | x | |
| 207 | 45 | | | x | |
| 208 | 45 | | | x | |
| 209 | 45 | | | x | |
| 210 | 45 | | | x | |
| 211 | 45 | | | x | |
| 212 | 45 | | | x | |
| 213 | 45 | | | x | |
| 214 | 45 | | | x | |
| 215 | 45 | | | x | |
| 216 | 45 | | | x | |
| 217 | 45 | | | x | |
| 218 | 45 | | | x | |
| 219 | 45 | | | x | |
| 220 | 45 | | | x | |
| 221 | 45 | | | x | |
| 222 | 45 | | | x | |
| 223 | 45 | | | x | |
| 224 | 45 | | | x | |
| 225 | 45 | | | x | |
| 226 | 45 | | | x | |
| 227 | 45 | | | x | |
| 228 | 45 | | | x | |
| 229 | 45 | | | x | |
| 230 | 45 | | | x | |
| 231 | 45 | | | x | |
| 232 | 45 | | | x | |
| 233 | 45 | | | x | |
| 234 | 45 | | | x | |
| 235 | 45 | | | x | |
| 236 | 44,4 | | | x | |
| 237 | 43,5 | | | x | |
| 238 | 43,2 | | | x | |
| 239 | 43,3 | | | x | |
| 240 | 43,7 | | | x | |

| time in s | roller speed in km/h | phase indicators: stop | acc | cruise | dec |
|---|---|---|---|---|---|
| 241 | 43,9 | | | x | |
| 242 | 43,8 | | | | x |
| 243 | 43 | | | | x |
| 244 | 40,9 | | | | x |
| 245 | 36,9 | | | | x |
| 246 | 32,1 | | | | x |
| 247 | 26,6 | | | | x |
| 248 | 21,8 | | | | x |
| 249 | 17,2 | | | | x |
| 250 | 13,7 | | | | x |
| 251 | 10,3 | | | | x |
| 252 | 7 | | | | x |
| 253 | 3,5 | | | | x |
| 254 | 0 | x | | | |
| 255 | 0 | x | | | |
| 256 | 0 | x | | | |
| 257 | 0 | x | | | |
| 258 | 0 | x | | | |
| 259 | 0 | x | | | |
| 260 | 0 | x | | | |
| 261 | 0 | x | | | |
| 262 | 0 | x | | | |
| 263 | 0 | x | | | |
| 264 | 0 | x | | | |
| 265 | 0 | x | | | |
| 266 | 0 | x | | | |
| 267 | 0,5 | | x | | |
| 268 | 2,9 | | x | | |
| 269 | 8,2 | | x | | |
| 270 | 13,2 | | x | | |
| 271 | 17,8 | | x | | |
| 272 | 21,4 | | x | | |
| 273 | 24,1 | | x | | |
| 274 | 26,4 | | x | | |
| 275 | 28,4 | | x | | |
| 276 | 29,9 | | x | | |
| 277 | 30,5 | | | x | |
| 278 | 30,5 | | | x | |
| 279 | 30,3 | | | x | |
| 280 | 30,2 | | | x | |
| 281 | 30,1 | | | x | |
| 282 | 30,1 | | | x | |
| 283 | 30,1 | | | x | |
| 284 | 30,2 | | | x | |
| 285 | 30,2 | | | x | |
| 286 | 30,2 | | | x | |
| 287 | 30,2 | | | x | |
| 288 | 30,5 | | | x | |
| 289 | 31 | | | x | |
| 290 | 31,9 | | | x | |
| 291 | 32,8 | | | x | |
| 292 | 33,7 | | | x | |
| 293 | 34,5 | | | x | |
| 294 | 35,1 | | | x | |
| 295 | 35,5 | | | x | |
| 296 | 35,6 | | | x | |
| 297 | 35,4 | | | x | |
| 298 | 35 | | | x | |
| 299 | 34 | | | x | |
| 300 | 32,4 | | | x | |

| time in s | roller speed in km/h | phase indicators: stop | acc | cruise | dec |
|---|---|---|---|---|---|
| 301 | 30,6 | | | x | |
| 302 | 29 | | | x | |
| 303 | 27,8 | | | x | |
| 304 | 27,2 | | | x | |
| 305 | 26,9 | | | x | |
| 306 | 26,5 | | | x | |
| 307 | 26,1 | | | x | |
| 308 | 25,7 | | | x | |
| 309 | 25,5 | | | x | |
| 310 | 25,7 | | | x | |
| 311 | 26,4 | | | x | |
| 312 | 27,3 | | | x | |
| 313 | 28,1 | | | x | |
| 314 | 27,9 | | | | x |
| 315 | 26 | | | | x |
| 316 | 22,7 | | | | x |
| 317 | 19 | | | | x |
| 318 | 16 | | | | x |
| 319 | 14,6 | | x | | |
| 320 | 15,2 | | x | | |
| 321 | 16,9 | | x | | |
| 322 | 19,3 | | x | | |
| 323 | 22 | | x | | |
| 324 | 24,6 | | x | | |
| 325 | 26,8 | | x | | |
| 326 | 27,9 | | x | | |
| 327 | 28 | | | x | |
| 328 | 27,7 | | | x | |
| 329 | 27,1 | | | x | |
| 330 | 26,8 | | | x | |
| 331 | 26,6 | | | x | |
| 332 | 26,8 | | | x | |
| 333 | 27 | | | x | |
| 334 | 27,2 | | | x | |
| 335 | 27,4 | | | x | |
| 336 | 27,5 | | | x | |
| 337 | 27,7 | | | x | |
| 338 | 27,9 | | | x | |
| 339 | 28,1 | | | x | |
| 340 | 28,3 | | | x | |
| 341 | 28,6 | | | x | |
| 342 | 29,1 | | | x | |
| 343 | 29,6 | | | x | |
| 344 | 30,1 | | | x | |
| 345 | 30,6 | | | x | |
| 346 | 30,8 | | | x | |
| 347 | 30,8 | | | x | |
| 348 | 30,8 | | | x | |
| 349 | 30,8 | | | x | |
| 350 | 30,8 | | | x | |
| 351 | 30,8 | | | x | |
| 352 | 30,8 | | | x | |
| 353 | 30,8 | | | x | |
| 354 | 30,9 | | | x | |
| 355 | 30,9 | | | x | |
| 356 | 30,9 | | | x | |
| 357 | 30,8 | | | x | |
| 358 | 30,4 | | | x | |
| 359 | 29,6 | | | x | |
| 360 | 28,4 | | | x | |

Table B.5.14.-30: WMTC, part 1, class 1, applicable for vehicles with a maximum design vehicle speed (where applicable truncated at 45 km/h, respectively at 50 km/h) and a low engine displacement (< 50 $cm^3$) or maximum net or continuous rated power (≤ 4 kW), cold or warm, 181 to 360 s

2.3.2.7.

| time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | | time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | stop | acc | cruise | dec | | | stop | acc | cruise | dec | | | stop | acc | cruise | dec |
| 361 | 27,1 | | | x | | 421 | 34 | | x | | | 481 | 0 | x | | | |
| 362 | 26 | | | x | | 422 | 35,4 | | x | | | 482 | 0 | x | | | |
| 363 | 25,4 | | | x | | 423 | 36,5 | | x | | | 483 | 0 | x | | | |
| 364 | 25,5 | | | x | | 424 | 37,5 | | x | | | 484 | 0 | x | | | |
| 365 | 26,3 | | | x | | 425 | 38,6 | | x | | | 485 | 0 | x | | | |
| 366 | 27,3 | | | x | | 426 | 39,6 | | x | | | 486 | 1,4 | | x | | |
| 367 | 28,3 | | | x | | 427 | 40,7 | | x | | | 487 | 4,5 | | x | | |
| 368 | 29,2 | | | x | | 428 | 41,4 | | x | | | 488 | 8,8 | | x | | |
| 369 | 29,5 | | | x | | 429 | 41,7 | | | x | | 489 | 13,4 | | x | | |
| 370 | 29,4 | | | x | | 430 | 41,4 | | | x | | 490 | 17,3 | | x | | |
| 371 | 28,9 | | | x | | 431 | 40,9 | | | x | | 491 | 19,2 | | x | | |
| 372 | 28,1 | | | x | | 432 | 40,5 | | | x | | 492 | 19,7 | | x | | |
| 373 | 27,1 | | | x | | 433 | 40,2 | | | x | | 493 | 19,8 | | x | | |
| 374 | 26,3 | | | x | | 434 | 40,1 | | | x | | 494 | 20,7 | | x | | |
| 375 | 25,7 | | | x | | 435 | 40,1 | | | x | | 495 | 23,7 | | x | | |
| 376 | 25,5 | | | x | | 436 | 39,8 | | | | x | 496 | 27,9 | | x | | |
| 377 | 25,6 | | | x | | 437 | 38,9 | | | | x | 497 | 31,9 | | x | | |
| 378 | 25,9 | | | x | | 438 | 37,4 | | | | x | 498 | 35,4 | | x | | |
| 379 | 26,3 | | | x | | 439 | 35,8 | | | | x | 499 | 36,2 | | | | x |
| 380 | 26,9 | | | x | | 440 | 34,1 | | | | x | 500 | 34,2 | | | | x |
| 381 | 27,6 | | | x | | 441 | 32,5 | | | | x | 501 | 30,2 | | | | x |
| 382 | 28,4 | | | x | | 442 | 30,9 | | | | x | 502 | 27,1 | | | | x |
| 383 | 29,3 | | | x | | 443 | 29,4 | | | | x | 503 | 26,6 | | x | | |
| 384 | 30,1 | | | x | | 444 | 27,9 | | | | x | 504 | 28,6 | | x | | |
| 385 | 30,4 | | | x | | 445 | 26,5 | | | | x | 505 | 32,6 | | x | | |
| 386 | 30,2 | | | x | | 446 | 25 | | | | x | 506 | 35,5 | | x | | |
| 387 | 29,5 | | | x | | 447 | 23,4 | | | | x | 507 | 36,6 | | | | x |
| 388 | 28,6 | | | x | | 448 | 21,8 | | | | x | 508 | 34,6 | | | | x |
| 389 | 27,9 | | | x | | 449 | 20,3 | | | | x | 509 | 30 | | | | x |
| 390 | 27,5 | | | x | | 450 | 19,3 | | | | x | 510 | 23,1 | | | | x |
| 391 | 27,2 | | | x | | 451 | 18,7 | | | | x | 511 | 16,7 | | | | x |
| 392 | 26,9 | | | | x | 452 | 18,3 | | | | x | 512 | 10,7 | | | | x |
| 393 | 26,4 | | | | x | 453 | 17,8 | | | | x | 513 | 4,7 | | | | x |
| 394 | 25,7 | | | | x | 454 | 17,4 | | | | x | 514 | 1,2 | | | | x |
| 395 | 24,9 | | | | x | 455 | 16,8 | | | | x | 515 | 0 | x | | | |
| 396 | 21,4 | | | | x | 456 | 16,3 | | | x | | 516 | 0 | x | | | |
| 397 | 15,9 | | | | x | 457 | 16,5 | | | x | | 517 | 0 | x | | | |
| 398 | 9,9 | | | | x | 458 | 17,6 | | | x | | 518 | 0 | x | | | |
| 399 | 4,9 | | | | x | 459 | 19,2 | | | x | | 519 | 3 | | x | | |
| 400 | 2,1 | | | | x | 460 | 20,8 | | | x | | 520 | 8,2 | | x | | |
| 401 | 0,9 | | | | x | 461 | 22,2 | | | x | | 521 | 14,3 | | x | | |
| 402 | 0 | x | | | | 462 | 23 | | | x | | 522 | 19,3 | | x | | |
| 403 | 0 | x | | | | 463 | 23 | | | | x | 523 | 23,5 | | x | | |
| 404 | 0 | x | | | | 464 | 22 | | | | x | 524 | 27,3 | | x | | |
| 405 | 0 | x | | | | 465 | 20,1 | | | | x | 525 | 30,8 | | x | | |
| 406 | 0 | x | | | | 466 | 17,7 | | | | x | 526 | 33,7 | | x | | |
| 407 | 0 | x | | | | 467 | 15 | | | | x | 527 | 35,2 | | x | | |
| 408 | 1,2 | | x | | | 468 | 12,1 | | | | x | 528 | 35,2 | | | | x |
| 409 | 3,2 | | x | | | 469 | 9,1 | | | | x | 529 | 32,5 | | | | x |
| 410 | 5,9 | | x | | | 470 | 6,2 | | | | x | 530 | 27,9 | | | | x |
| 411 | 8,8 | | x | | | 471 | 3,6 | | | | x | 531 | 23,2 | | | | x |
| 412 | 12 | | x | | | 472 | 1,8 | | | | x | 532 | 18,5 | | | | x |
| 413 | 15,4 | | x | | | 473 | 0,8 | | | | x | 533 | 13,8 | | | | x |
| 414 | 18,9 | | x | | | 474 | 0 | x | | | | 534 | 9,1 | | | | x |
| 415 | 22,1 | | x | | | 475 | 0 | x | | | | 535 | 4,5 | | | | x |
| 416 | 24,7 | | x | | | 476 | 0 | x | | | | 536 | 2,3 | | | | x |
| 417 | 26,8 | | x | | | 477 | 0 | x | | | | 537 | 0 | x | | | |
| 418 | 28,7 | | x | | | 478 | 0 | x | | | | 538 | 0 | x | | | |
| 419 | 30,6 | | x | | | 479 | 0 | x | | | | 539 | 0 | x | | | |
| 420 | 32,4 | | x | | | 480 | 0 | x | | | | 540 | 0 | x | | | |

Table B.5.14.-31: WMTC, part 1, class 1, applicable for vehicles with a maximum design vehicle speed (where applicable truncated at 45 km/h, respectively at 50 km/h) and a low engine displacement (< 50 $cm^3$) or maximum net or continuous rated power (≤ 4 kW), cold or warm, 361 to 540 s

2.3.2.8.

| time in s | roller speed in km/h | phase indicators | | | |
|---|---|---|---|---|---|
| | | stop | acc | cruise | dec |
| 541 | 0 | x | | | |
| 542 | 2,8 | | x | | |
| 543 | 8,1 | | x | | |
| 544 | 14,3 | | x | | |
| 545 | 19,2 | | x | | |
| 546 | 23,5 | | x | | |
| 547 | 27,2 | | x | | |
| 548 | 30,5 | | x | | |
| 549 | 33,1 | | x | | |
| 550 | 35,7 | | x | | |
| 551 | 38,3 | | x | | |
| 552 | 41 | | x | | |
| 553 | 43,6 | | | x | |
| 554 | 43,7 | | | x | |
| 555 | 43,8 | | | x | |
| 556 | 43,9 | | | x | |
| 557 | 44 | | | x | |
| 558 | 44,1 | | | x | |
| 559 | 44,2 | | | x | |
| 560 | 44,3 | | | x | |
| 561 | 44,4 | | | x | |
| 562 | 44,5 | | | x | |
| 563 | 44,6 | | | x | |
| 564 | 44,9 | | | x | |
| 565 | 45 | | | x | |
| 566 | 45 | | | x | |
| 567 | 45 | | | x | |
| 568 | 45 | | | x | |
| 569 | 45 | | | x | |
| 570 | 45 | | | x | |
| 571 | 45 | | | x | |
| 572 | 45 | | | x | |
| 573 | 45 | | | | |
| 574 | 45 | | | | |
| 575 | 45 | | | | |
| 576 | 42,3 | | | | x |
| 577 | 39,5 | | | | x |
| 578 | 36,6 | | | | x |
| 579 | 33,7 | | | | x |
| 580 | 30,1 | | | | x |
| 581 | 26 | | | | x |
| 582 | 21,8 | | | | x |
| 583 | 17,7 | | | | x |
| 584 | 13,5 | | | | x |
| 585 | 9,4 | | | | x |
| 586 | 5,6 | | | | x |
| 587 | 2,1 | | | | x |
| 588 | 0 | x | | | |
| 589 | 0 | x | | | |
| 590 | 0 | x | | | |
| 591 | 0 | x | | | |
| 592 | 0 | x | | | |
| 593 | 0 | x | | | |
| 594 | 0 | x | | | |
| 595 | 0 | x | | | |
| 596 | 0 | x | | | |
| 597 | 0 | x | | | |
| 598 | 0 | x | | | |
| 599 | 0 | x | | | |
| 600 | 0 | x | | | |

Table B.5.14.-32: WMTC, part 1, class 1, applicable for vehicles with a maximum design vehicle speed (where applicable truncated at 45 km/h, respectively at 50 km/h) and a low engine displacement (< 50 $cm^3$) or maximum net or continuous rated power (≤ 4 kW), cold or warm, 541 to 600 s

## B.5.15. Annex: explanatory note on the gearshift procedure

### 1. Introduction

This explanatory note explains matters specified or described in this Regulation, including its Annexes or Appendices, and matters related thereto with regard to the gearshift procedure.

### 2. Approach

2.1. The development of the gearshift procedure was based on an analysis of the gearshift points in the in-use data. In order to establish generalised correlations between technical specifications of the vehicles and desired vehicle speeds to shift gears, the engine speeds were normalised to the utilisable band between rated engine speed and idling engine speed.

2.2. In a second step, the end speeds (vehicle speed as well as normalised engine speed) for upshifts and downshifts were determined and recorded in a separate table. The averages of these speeds for each gear and vehicle were calculated and correlated with the vehicles' technical specifications.

2.3. The results of these analyses and calculations can be summarised as follows:

(a) the gearshift behaviour is engine-speed-related rather than vehicle-speed-related;

(b) the best correlation between gearshift desired vehicle speeds and technical data was found for normalised engine speeds and the power-to-mass ratio (maximum continuous rated power/(reference mass));

(c) the residual variations cannot be explained by other technical data or by different drive train ratios. They are most probably due to differences in traffic conditions and individual driver behaviour;

(d) the best approximation between gearshift desired vehicle speeds and power-to-mass ratio was found for exponential functions;

(e) the gearshift mathematical function for the first gear is significantly lower than for all other gears;

(f) the gearshift desired vehicle speeds for all other gears can be approximated by one common mathematical function;

(g) no differences were found between five-gear and six-gear transmissions;

(h) gearshift behaviour in Japan is significantly different from the equal-type gearshift behaviour in the European Union (EU) and in the United States of America (USA).

2.4. In order to find a balanced compromise between the three regions, a new approximation function for normalised upshift engine speeds versus power-to-mass ratio was calculated as a weighted average of the EU/USA curve (with 2/3 weighting) and the Japanese curve (with 1/3 weighting), resulting in the following equations for normalised upshift engine speeds:

Equation B.5.15.-1: Normalised upshift engine speed in 1$^{st}$ gear (gear 1)

$$n\_max\_acc(1) = (0.5753 \times e^{(-1.9 \times \frac{P_n}{m_k + 75})} - 0.1) \times (s - n_{idle}) + n_{idle}$$

Equation B.5.15.-2: Normalised upshift engine speed in gears > 1

$$n\_max\_acc(i) = (0.5753 \times e^{(-1.9 \times \frac{P_n}{m_k + 75})}) \times (s - n_{idle}) + n_{idle}$$

## 3. Calculation example

3.1 Figure B.5.15.-1 shows an example of gearshift use for a small vehicle:

(a) the lines in bold show the gear use for acceleration phases;

(b) the dotted lines show the downshift points for deceleration phases;

(c) in the cruising phases, the whole engine speed range between downshift engine speed and upshift engine speed may be used.

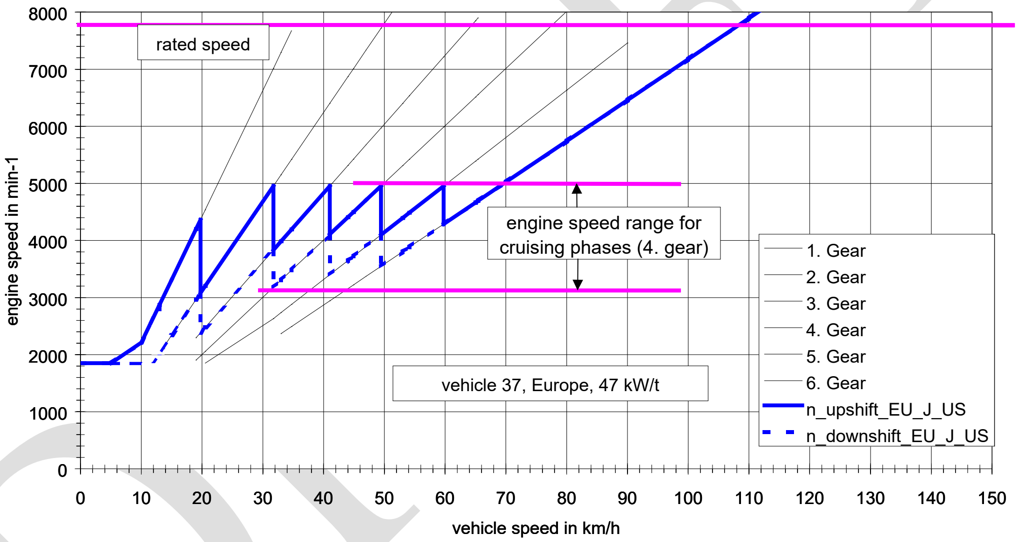


Figure B.5.15.-1: Example of a gearshift sketch for a small vehicle

3.2 Where vehicle speed increases gradually during cruise phases, upshift engine speeds ($v1\rightarrow2$, $v2\rightarrow3$and $vi\rightarrow i+1$) in km/h may be calculated using the following equations:

Equation B.5.15.-3:

$$v_{1\rightarrow2} = \left[0.03 \times (s - n_{idle}) + n_{idle}\right] \times \frac{1}{ndv_2}$$

Equation B.5.15.-4:

$$v_{1\rightarrow2} = \left[ (0.5753 \times e^{(-1.9 \times \frac{P_n}{mref})} - 0.1) \times (s - n_{idle}) + n_{idle} \right] \times \frac{1}{ndv_1}$$

Equation B.5.15.-5:

$$v_{i\rightarrow i+1} = \left[ (0.5753 \times e^{(-1.9 \times \frac{P_n}{mref})}) \times (s - n_{idle}) + n_{idle} \right] \times \frac{1}{ndv_{i-1}}, \quad i = 3 \text{ to } ng$$

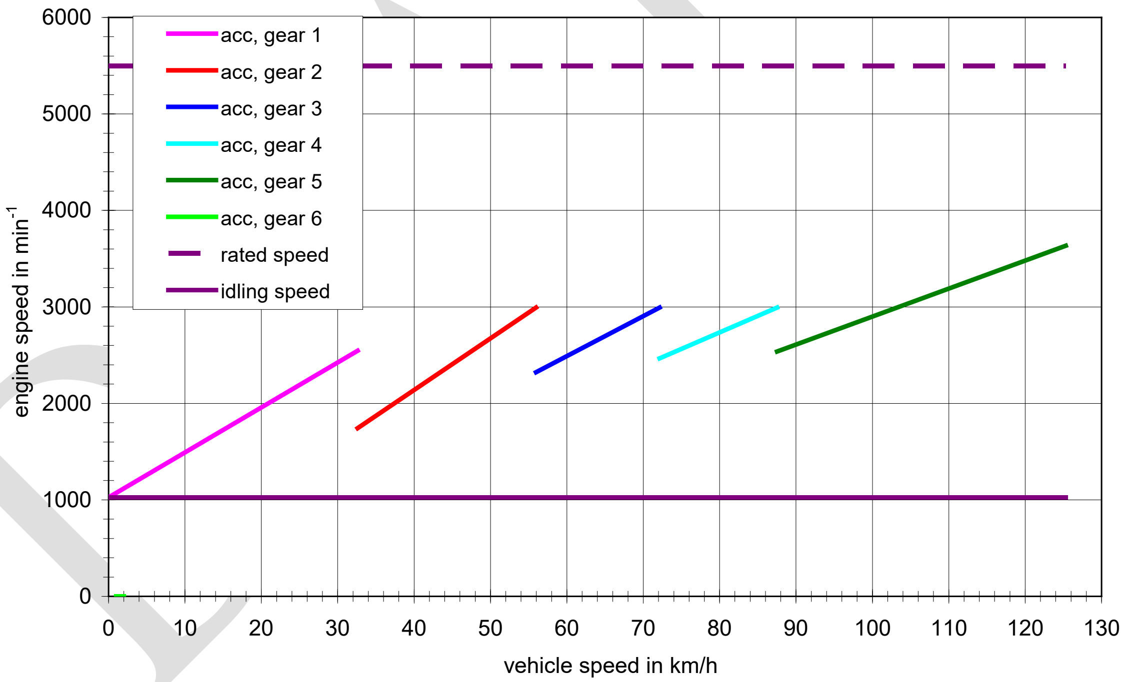


Figure B.5.15.-2: gear use during acceleration phases

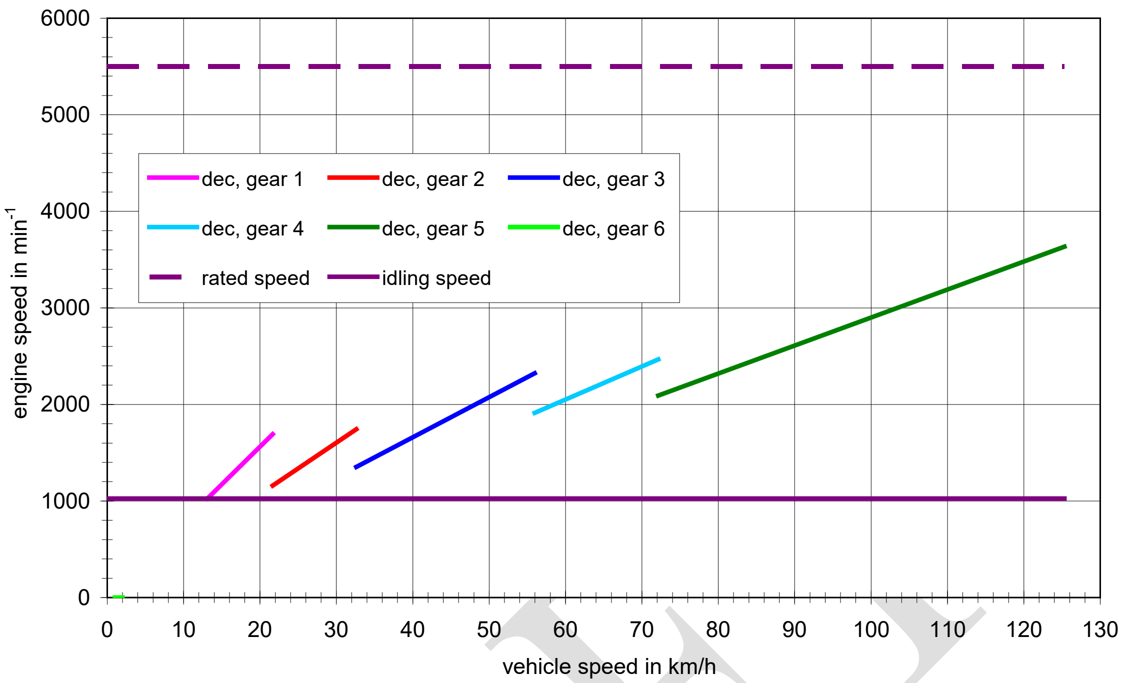


Figure B.5.15.-3: Example of a gearshift sketch — Gear use during deceleration and cruise phases

In order to allow the technical service more flexibility and to ensure driveability, the gearshift regression functions should be considered as lower limits. Higher engine speeds are permitted in any cycle phase.

## 4. Phase indicators

4.1 In order to avoid different interpretations in the application of the gearshift equations and thus to improve the comparability of the test, fixed-phase indicators are assigned to the vehicle speed pattern of the cycles. The specification of the phase indicators is based on the definition from the Japan Automobile Research Institute (JARI) of the four driving modes as shown in the following table:

| 4 modes | Definition |
|---|---|
| Idle mode | vehicle speed < 5 km/h and<br>-0.5 km/h/s (-0.139 m/s$^2$) < acceleration < 0.5 km/h/s (0.139 m/s$^2$) |
| Acceleration mode | acceleration > 0.5 km/h/s (0.139 m/s$^2$) |
| Deceleration mode | acceleration < - 0.5 km/h/s (- 0.139 m/s$^2$) |
| Cruise mode | vehicle speed ≥ 5 km/h and<br>-0.5 km/h/s (-0.139 m/s$^2$) < acceleration < 0.5 km/h/s (0.139 m/s$^2$) |

Table B.5.15.-1: Definition of driving modes

4.2 The indicators were then modified in order to avoid frequent changes during relatively homogeneous cycle parts and thus improve driveability. Figure Ap9-2 shows an example from cycle part 1.

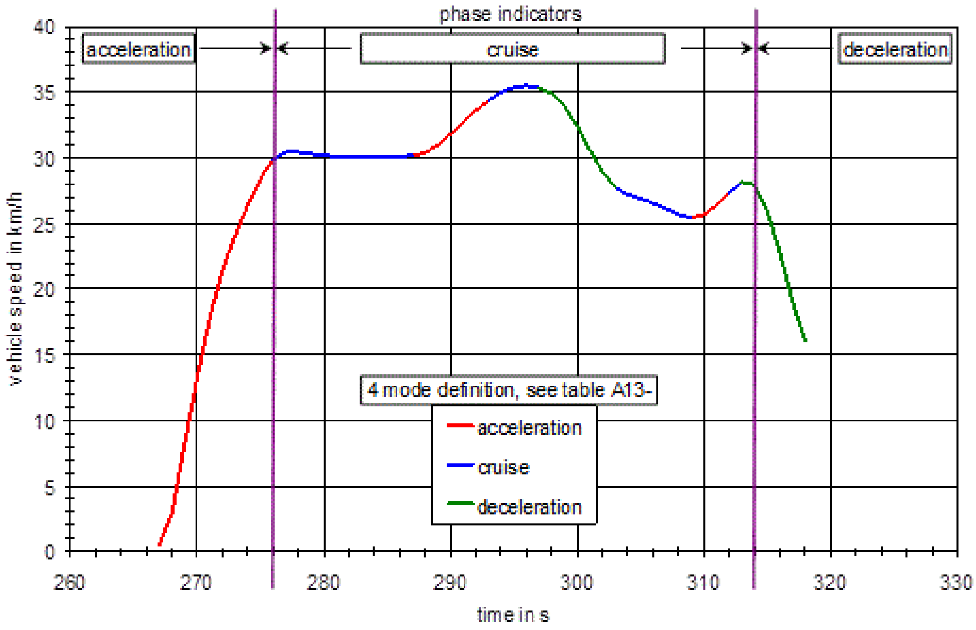


Figure B.5.15.4: Example for modified phase indicators

## 5. Calculation example

5.1. An example of input data necessary for the calculation of shift engine speeds is shown in Table B.5.15.-2. The upshift engine speeds for acceleration phases for first gear and higher gears are calculated using Equations B.5.15.-1 and B.5.15.-2. The denormalisation of engine speeds can be performed using the equation $n = n\_norm \times (s - n_{idle}) + n_{idle}$.

5.2. The downshift engine speeds for deceleration phases can be calculated using Equations B.5.15.-3 and B.5.15.-4. The ndv values in Table B.5.15.-2 can be used as gear ratios. These values can also be used to calculate the corresponding vehicle speeds (vehicle shift speed in gear i = engine shift speed in gear i / ndvi). The results are shown in Tables B.5.15.-3 and B.5.15.-4.

5.3. Additional analyses and calculations were conducted to investigate whether these gearshift algorithms could be simplified and, in particular, whether engine shift speeds could be replaced by vehicle shift speeds. The analysis showed that vehicle speeds could not be brought in line with the gearshift behaviour of the in-use data.

5.3.1.

| **Item** | **Input data** |
|---|---|

| | |
|---|---|
| Engine capacity in $cm^3$ | 600 |
| $P_n$ in kW | 72 |
| $m_k$ in kg | 199 |
| s in $min^{-1}$ | 11800 |
| $n_{idle}$ in $min^{-1}$ | 1150 |
| $ndv_1$ */ | 133.66 |
| $ndv_2$ | 94.91 |
| $ndv_3$ | 76.16 |
| $ndv_4$ | 65.69 |
| $ndv_5$ | 58.85 |
| $ndv_6$ | 54.04 |
| pmr **/ in kW/t | 262.8 |
| */ndv means the ratio between engine speed in $min^{-1}$ and vehicle speed in km/h<br>**/pmr means the power-to-mass ratio calculated by Pn / (mk) · 1000; Pn in kW, mk in kg | |

Table B.5.15.-2: Input data for the calculation of engine and vehicle shift speeds

5.3.2.

| | EU/USA/JAPAN DRIVING BEHAVIOUR | |
|---|---|---|
| | EU/USA/Japan driving behaviour | n_acc_max (1) n_acc_max (i) |
| n_norm */ in percent | 24.9 | 34.9 |
| n in min-1 | 3804 | 4869 |
| | | |

Table B.5.15.-3: Shift engine speeds for acceleration phases for first gear and for higher gears (see Table B.5.15.-1)

5.3.3.

| **Gearshift** | **EU/USA/Japan driving behaviour** |
|---|---|

| | | v in km/h | n_norm (i) in percent | n in $min^{-1}$ |
|---|---|---|---|---|
| **Upshift** | 1→2 | 28.5 | 24.9 | 3804 |
| | 2→3 | 51.3 | 34.9 | 4869 |
| | 3→4 | 63.9 | 34.9 | 4869 |
| | 4→5 | 74.1 | 34.9 | 4869 |
| | 5→6 | 82.7 | 34.9 | 4869 |
| **Downshift** | 2→cl */ | 15.5 | 3.0 | 1470 |
| | 3→2 | 28.5 | 9.6 | 2167 |
| | 4→3 | 51.3 | 20.8 | 3370 |
| | 5→4 | 63.9 | 24.5 | 3762 |
| | 6→5 | 74.1 | 26.8 | 4005 |
| */'cl' means 'Clutch-Off' timing. | | | | |

Table B.5.14.-4: Engine and desired vehicle shift speeds based on Table B.5.15.-2