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Commission Regulation (EU) 2017/2400 of 12 December 2017 implementing Regulation (EC) No 595/2009 of the European Parliament and of the Council as regards the determination of the CO₂ emissions and fuel consumption of heavy-duty vehicles and amending Directive 2007/46/EC of the European Parliament and of the Council and Commission Regulation (EU) No 582/2011 (Text with EEA relevance)

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ANNEX V

VERIFYING ENGINE DATA

4. Testing procedure

All measurement data shall be determined in accordance with Annex 4 to UN/ECE Regulation 49 Rev.06, unless stated otherwise in this Annex.

4.1 Overview of testruns to be performed

Table 3 gives an overview of all testruns to be performed for the purpose of certification of one specific engine CO₂-family defined in accordance with Appendix 3.

The fuel consumption mapping cycle in accordance with paragraph 4.3.5 and the recording of the engine motoring curve in accordance with paragraph 4.3.2 shall be omitted for all other engines except the CO₂-parent engine of the engine CO₂-family.

In the case that upon request of the manufacturer the provisions defined in Article 15(5) of this Regulation are applied, the fuel consumption mapping cycle in accordance with paragraph 4.3.5 and the recording of the engine motoring curve in accordance with paragraph 4.3.2 shall be performed additionally for that specific engine.

TABLE 3

Overview of testruns to be performed

Testrun	Reference to paragraph	Required to be run for CO ₂ -parent engine	Required to be run for other engines within CO ₂ -family
Engine full load curve	4.3.1	yes	yes
Engine motoring curve	4.3.2	yes	no
WHTC test	4.3.3	yes	yes
WHSC test	4.3.4	yes	yes
Fuel consumption mapping cycle	4.3.5	yes	no

4.2 Allowed changes to the engine system

Changing of the target value for the engine idle speed controller to a lower value in the electronic control unit of the engine shall be allowed for all testruns in which idle operation occurs, in order to prevent interference between the engine idle speed controller and the test bed speed controller.

4.3 Testruns

4.3.1 Engine full load curve

The engine full load curve shall be recorded in accordance with paragraphs 7.4.1. to 7.4.5. of Annex 4 to UN/ECE Regulation 49 Rev.06.

4.3.2 Engine motoring curve

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The recording of the engine motoring curve in accordance with this paragraph shall be omitted for all other engines except the CO₂-parent engine of the engine CO₂-family defined in accordance with Appendix 3. In accordance with paragraph 6.1.3 the engine motoring curve recorded for the CO₂-parent engine of the engine CO₂-family shall also be applicable to all engines within the same engine CO₂-family.

In the case that upon request of the manufacturer the provisions defined in Article 15(5) of this Regulation are applied, the recording of the engine motoring curve shall be performed additionally for that specific engine.

The engine motoring curve shall be recorded in accordance with option (b) in paragraph 7.4.7. of Annex 4 to UN/ECE Regulation 49 Rev.06. This test shall determine the negative torque required to motor the engine between maximum and minimum mapping speed with minimum operator demand.

The test shall be continued directly after the full load curve mapping according to paragraph 4.3.1. At the request of the manufacturer, the motoring curve may be recorded separately. In this case the engine oil temperature at the end of the full load curve testrun performed in accordance with paragraph 4.3.1 shall be recorded and the manufacturer shall prove to the satisfaction of the an approval authority, that the engine oil temperature at the starting point of the motoring curve meets the aforementioned temperature within ± 2 K.

At the start of the testrun for the engine motoring curve the engine shall be operated with minimum operator demand at maximum mapping speed defined in paragraph 7.4.3. of Annex 4 to UN/ECE Regulation 49 Rev.06. As soon as the motoring torque value has stabilized within ± 5 % of its mean value for at least 10 seconds, the data recording shall start and the engine speed shall be decreased at an average rate of $8 \pm 1 \text{ min}^{-1}/\text{s}$ from maximum to minimum mapping speed, which are defined in paragraph 7.4.3. of Annex 4 to UN/ECE Regulation 49 Rev.06.

4.3.3 WHTC test

The WHTC test shall be performed in accordance with Annex 4 to UN/ECE Regulation 49 Rev.06. The weighted emission test results shall meet the applicable limits defined in Regulation (EC) No 595/2009.

The engine full load curve recorded in accordance with paragraph 4.3.1 shall be used for the denormalization of the reference cycle and all calculations of reference values performed in accordance with paragraphs 7.4.6, 7.4.7 and 7.4.8 of Annex 4 to UN/ECE Regulation 49 Rev.06.

4.3.3.1 Measurement signals and data recording

In addition to the provisions defined in Annex 4 to UN/ECE Regulation 49 Rev.06 the actual fuel mass flow consumed by the engine in accordance with paragraph 3.4 shall be recorded.

4.3.4 WHSC test

The WHSC test shall be performed in accordance with Annex 4 to UN/ECE Regulation 49 Rev.06. The emission test results shall meet the applicable limits defined in Regulation (EC) No 595/2009.

The engine full load curve recorded in accordance with paragraph 4.3.1 shall be used for the denormalization of the reference cycle and all calculations of reference values performed in accordance with paragraphs 7.4.6, 7.4.7 and 7.4.8 of Annex 4 to UN/ECE Regulation 49 Rev.06.

4.3.4.1 Measurement signals and data recording

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In addition to the provisions defined in Annex 4 to UN/ECE Regulation 49 Rev.06 the actual fuel mass flow consumed by the engine in accordance with paragraph 3.4 shall be recorded.

4.3.5 Fuel consumption mapping cycle (FCMC)

The fuel consumption mapping cycle (FCMC) in accordance with this paragraph shall be omitted for all other engines except the CO₂-parent engine of the engine CO₂-family. The fuel map data recorded for the CO₂-parent engine of the engine CO₂-family shall also be applicable to all engines within the same engine CO₂-family.

In the case that upon request of the manufacturer the provisions defined in Article 15(5) of this Regulation are applied, the fuel consumption mapping cycle shall be performed additionally for that specific engine.

The engine fuel map shall be measured in a series of steady state engine operation points, as defined according to paragraph 4.3.5.2. The metrics of this map are the fuel consumption in g/h depending on engine speed in min⁻¹ and engine torque in Nm.

4.3.5.1 Handling of interruptions during the FCMC

If an after-treatment regeneration event occurs during the FCMC for engines equipped with exhaust after-treatment systems that are regenerated on a periodic basis defined in accordance with paragraph 6.6 of Annex 4 to UN/ECE Regulation 49 Rev.06, all measurements at that engine speed mode shall be void. The regeneration event shall be completed and afterwards the procedure shall be continued as described in paragraph 4.3.5.1.1.

If an unexpected interruption, malfunction or error occurs during the FCMC, all measurements at that engine speed mode shall be void and one of the following options how to continue shall be chosen by the manufacturer:

- (1) the procedure shall be continued as described in paragraph 4.3.5.1.1
- (2) the whole FCMC shall be repeated in accordance with paragraphs 4.3.5.4 and 4.3.5.5

4.3.5.1.1 Provisions for continuing the FCMC

The engine shall be started and warmed up in accordance with paragraph 7.4.1. of Annex 4 to UN/ECE Regulation 49 Rev.06. After warm-up, the engine shall be preconditioned by operating the engine for 20 minutes at mode 9, as defined in Table 1 of paragraph 7.2.2. of Annex 4 to UN/ECE Regulation 49 Rev.06.

The engine full load curve recorded in accordance with paragraph 4.3.1 shall be used for the denormalization of the reference values of mode 9 performed in accordance with paragraphs 7.4.6, 7.4.7 and 7.4.8 of Annex 4 to UN/ECE Regulation 49 Rev.06.

Directly after completion of preconditioning, the target values for engine speed and torque shall be changed linearly within 20 to 46 seconds to the highest target torque setpoint at the next higher target engine speed setpoint than the particular target engine speed setpoint where the interruption of the FCMC occurred. If the target setpoint is reached within less than 46 seconds, the remaining time up to 46 seconds shall be used for stabilization.

For stabilization the engine operation shall continue from that point in accordance with the test sequence specified in paragraph 4.3.5.5 without recording of measurement values.

When the highest target torque setpoint at the particular target engine speed setpoint where the interruption occurred is reached, the recording of measurement values shall be continued from that point on in accordance with the test sequence specified in paragraph 4.3.5.5.

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4.3.5.2 Grid of target setpoints

The grid of target setpoints is fixed in a normalized way and consists of 10 target engine speed setpoints and 11 target torque setpoints. Conversion of the normalized setpoint definition to the actual target values of engine speed and torque setpoints for the individual engine under test shall be based on the engine full load curve of the CO₂-parent engine of the engine CO₂-family defined in accordance with Appendix 3 to this Annex and recorded in accordance with paragraph 4.3.1.

4.3.5.2.1 Definition of target engine speed setpoints

The 10 target engine speed setpoints are defined by 4 base target engine speed setpoints and 6 additional target engine speed setpoints.

The engine speeds n_{idle} , n_{lo} , n_{pref} , n_{95h} and n_{hi} shall be determined from the engine full load curve of the CO₂-parent engine of the engine CO₂-family defined in accordance with Appendix 3 to this Annex and recorded in accordance with paragraph 4.3.1 by applying the definitions of characteristic engine speeds in accordance with paragraph 7.4.6. of Annex 4 to UN/ECE Regulation 49 Rev.06.

The engine speed n_{57} shall be determined by the following equation:

$$n_{57} = 0,565 \times (0,45 \times n_{lo} + 0,45 \times n_{pref} + 0,1 \times n_{hi} - n_{idle}) \times 2,0327 + n_{idle}$$

The 4 base target engine speed setpoints are defined as follows:

- (1) Base engine speed 1: n_{idle}
- (2) Base engine speed 2: $n_A = n_{57} - 0,05 \times (n_{95h} - n_{idle})$
- (3) Base engine speed 3: $n_B = n_{57} + 0,08 \times (n_{95h} - n_{idle})$
- (4) Base engine speed 4: n_{95h}

The potential distances between the speed setpoints shall be determined by the following equations:

- (1) $dn_{idleA_44} = (n_A - n_{idle}) / 4$
- (2) $dn_{B95h_44} = (n_{95h} - n_B) / 4$
- (3) $dn_{idleA_35} = (n_A - n_{idle}) / 3$
- (4) $dn_{B95h_35} = (n_{95h} - n_B) / 5$
- (5) $dn_{idleA_53} = (n_A - n_{idle}) / 5$
- (6) $dn_{B95h_53} = (n_{95h} - n_B) / 3$

The absolute values of potential deviations between the two sections shall be determined by the following equations:

- (1) $dn_{44} = ABS(dn_{idleA_44} - dn_{B95h_44})$
- (2) $dn_{35} = ABS(dn_{idleA_35} - dn_{B95h_35})$
- (3) $dn_{53} = ABS(dn_{idleA_53} - dn_{B95h_53})$

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[^{F1}The 6 additional target engine speed setpoints shall be determined in accordance with the following provisions:

Textual Amendments

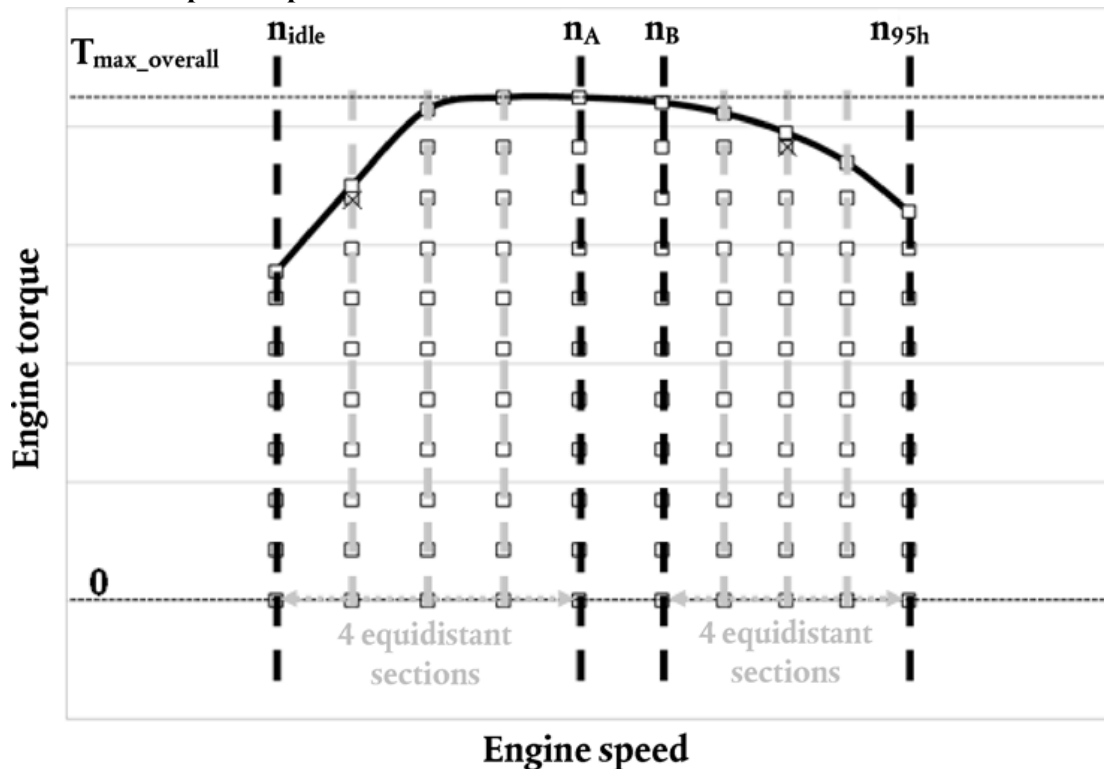
F1 Substituted by Commission Regulation (EU) 2019/318 of 19 February 2019 amending Regulation (EU) 2017/2400 and Directive 2007/46/EC of the European Parliament and of the Council as regards the determination of the CO₂ emissions and fuel consumption of heavy-duty vehicles (Text with EEA relevance).

- (1) If dn_{44} is smaller than or equal to $(dn_{35} + 5)$ and also smaller than or equal to $(dn_{53} + 5)$, the 6 additional target engine speeds shall be determined by dividing each of the two ranges, one from n_{idle} to n_A and the other from n_B to n_{95h} , into 4 equidistant sections.
- (2) If $(dn_{35} + 5)$ is smaller than dn_{44} and also dn_{35} is smaller than dn_{53} , the 6 additional target engine speeds shall be determined by dividing the range from n_{idle} to n_A into 3 equidistant sections and the range from n_B to n_{95h} , into 5 equidistant sections.
- (3) If $(dn_{53} + 5)$ is smaller than dn_{44} and also dn_{53} is smaller than dn_{35} , the 6 additional target engine speeds shall be determined by dividing the range from n_{idle} to n_A into 5 equidistant sections and the range from n_B to n_{95h} , into 3 equidistant sections.]

Figure 1 exemplarily illustrates the definition of the target engine speed setpoints according to subpoint (1) above.

Figure 1

Definition of speed setpoints



4.3.5.2.2 Definition of target torque setpoints

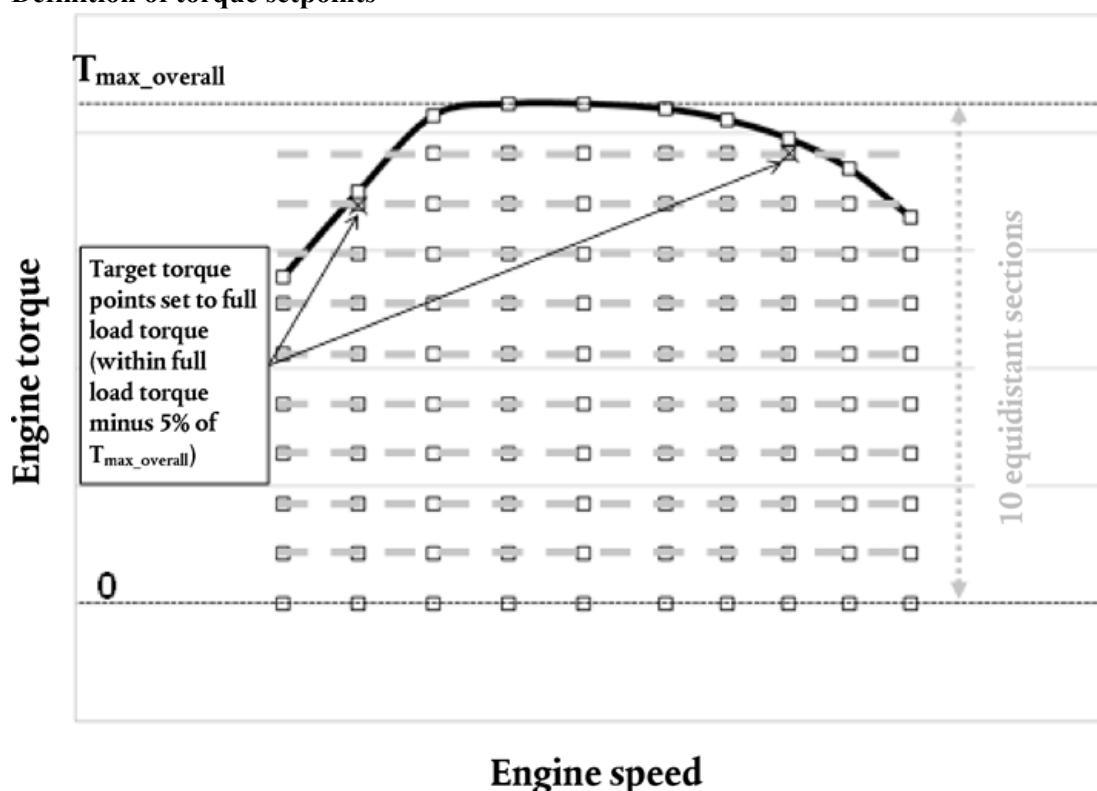
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The 11 target torque setpoints are defined by 2 base target torque setpoints and 9 additional target torque setpoints. The 2 base target torque setpoints are defined by zero engine torque and the maximum engine full load of the CO₂-parent engine determined in accordance with paragraph 4.3.1. (overall maximum torque $T_{\max_overall}$). The 9 additional target torque setpoints are determined by dividing the range from zero torque to overall maximum torque, $T_{\max_overall}$, into 10 equidistant sections.

[^{F1}All target torque setpoints at a particular target engine speed setpoint that exceed the limit value defined by the full load torque value at this particular target engine speed setpoint minus 5 percent of $T_{\max_overall}$, shall be replaced by one single target torque setpoint at full load torque at this particular target engine speed setpoint. Each of these replacement setpoints shall be measured only once during the FCMC test sequence defined in accordance with paragraph 4.3.5.5. Figure 2 exemplarily illustrates the definition of the target torque setpoints.]

Figure 2

Definition of torque setpoints



4.3.5.3 Measurement signals and data recording

The following measurement data shall be recorded:

- (1) engine speed
- (2) engine torque corrected in accordance with paragraph 3.1.2
- (3) fuel mass flow consumed by the whole engine system in accordance with paragraph 3.4

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- (4) Gaseous pollutants according to the definitions in UN/ECE Regulation 49 Rev.06. Particulate pollutants and ammonia emissions are not required to be monitored during the FCMC testrun.

The measurement of gaseous pollutants shall be carried out in accordance with paragraphs 7.5.1, 7.5.2, 7.5.3, 7.5.5, 7.7.4, 7.8.1, 7.8.2, 7.8.4 and 7.8.5 of Annex 4 to UN/ECE Regulation 49 Rev.06.

For the purpose of paragraph 7.8.4 of Annex 4 to UN/ECE Regulation 49 Rev.06, the term 'test cycle' in the paragraph referred to shall be the complete sequence from preconditioning in accordance with paragraph 4.3.5.4 to ending of the test sequence in accordance with paragraph 4.3.5.5.

4.3.5.4 Preconditioning of the engine system

The dilution system, if applicable, and the engine shall be started and warmed up in accordance with paragraph 7.4.1. of Annex 4 to UN/ECE Regulation 49 Rev.06.

After warm-up is completed, the engine and sampling system shall be preconditioned by operating the engine for 20 minutes at mode 9, as defined in Table 1 of paragraph 7.2.2. of Annex 4 to UN/ECE Regulation 49 Rev.06, while simultaneously operating the dilution system.

The engine full load curve of the CO₂-parent engine of the engine CO₂-family and recorded in accordance with paragraph 4.3.1 shall be used for the denormalization of the reference values of mode 9 performed in accordance with paragraphs 7.4.6, 7.4.7 and 7.4.8 of Annex 4 to UN/ECE Regulation 49 Rev.06.

Directly after completion of preconditioning, the target values for engine speed and torque shall be changed linearly within 20 to 46 seconds to match the first target setpoint of the test sequence according to paragraph 4.3.5.5. If the first target setpoint is reached within less than 46 seconds, the remaining time up to 46 seconds shall be used for stabilization.

4.3.5.5 Test sequence

The test sequence consists of steady state target setpoints with defined engine speed and torque at each target setpoint in accordance with paragraph 4.3.5.2 and defined ramps to move from one target setpoint to the next.

The highest target torque setpoint at each target engine speed shall be operated with maximum operator demand.

The first target setpoint is defined at the highest target engine speed setpoint and highest target torque setpoint.

The following steps shall be performed to cover all target setpoints:

- (1) The engine shall be operated for 95 ± 3 seconds at each target setpoint. The first 55 ± 1 seconds at each target setpoint are considered as a stabilization period. During the following period of 30 ± 1 seconds the engine speed mean value shall be controlled as follows:
 - (a) The engine speed mean value shall be held at the target engine speed setpoint within ± 1 percent of the highest target engine speed.
 - (b) Except for the points at full load, the engine torque mean value shall be held at the target torque setpoint within a tolerance of ± 20 Nm or ± 2 percent of the overall maximum torque, $T_{\max_overall}$, whichever is greater.

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The recorded values in accordance with paragraph 4.3.5.3 shall be stored as averaged value over the period of 30 ± 1 seconds. The remaining period of 10 ± 1 seconds may be used for data post-processing and storage if necessary. During this period the engine target setpoint shall be kept.

- (2) After the measurement at one target setpoint is completed, the target value for engine speed shall be kept constant within $\pm 20 \text{ min}^{-1}$ of the target engine speed setpoint and the target value for torque shall be decreased linearly within 20 ± 1 seconds to match the next lower target torque setpoint. Then the measurement shall be performed according to subpoint (1).
- (3) After the zero torque setpoint has been measured in subpoint (1), the target engine speed shall be decreased linearly to the next lower target engine speed setpoint while at the same time the target torque shall be increased linearly to the highest target torque setpoint at the next lower target engine speed setpoint within 20 to 46 seconds. If the next target setpoint is reached within less than 46 seconds, the remaining time up to 46 seconds shall be used for stabilization. Then the measurement shall be performed by starting the the stabilization procedure according to subpoint (1) and afterwards the target torque setpoints at constant target engine speed shall be adjusted according to subpoint (2).

Figure 3 illustrates the three different steps to be performed at each measurement setpoint for the test according to subpoint (1) above.

Figure 3

Steps to be performed at each measurement setpoint

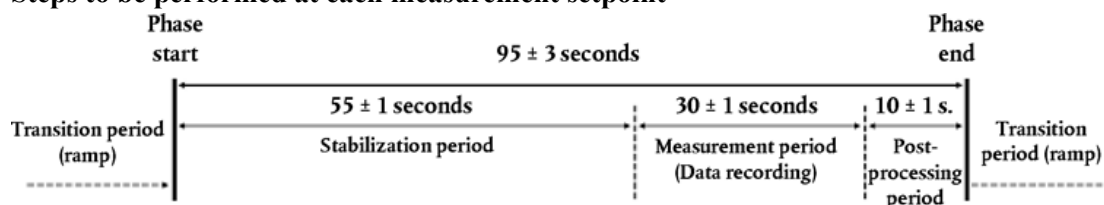
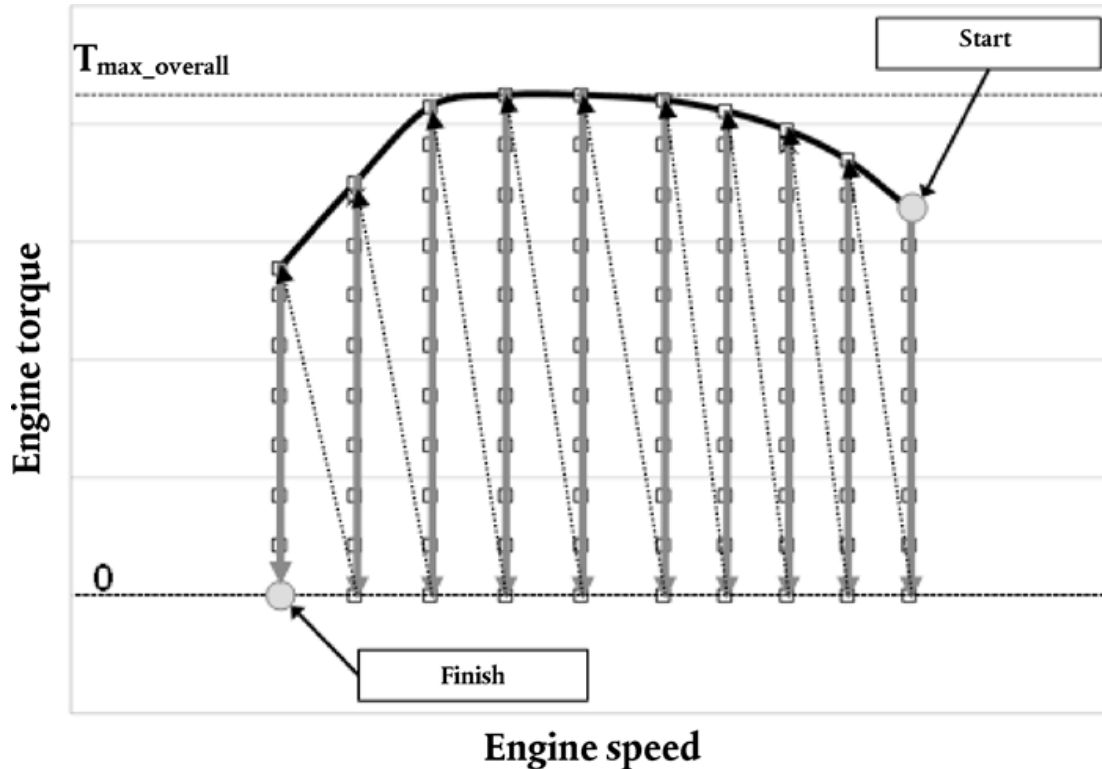


Figure 4 exemplarily illustrates the sequence of steady state measurement setpoints to be followed for the test.

Figure 4

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Sequence of steady state measurement setpoints



4.3.5.6 Data evaluation for emission monitoring

Gaseous pollutants in accordance with paragraph 4.3.5.3 shall be monitored during the FCMC. The definitions of characteristic engine speeds in accordance with paragraph 7.4.6. of Annex 4 to UN/ECE R.49.06 shall apply.

4.3.5.6.1 Definition of control area

The control area for emission monitoring during the FCMC shall be determined in accordance with paragraphs 4.3.5.6.1.1 and 4.3.5.6.1.2.

4.3.5.6.1.1 Engine speed range for the control area

- (1) The engine speed range for the control area shall be defined based on the engine full load curve of the CO₂-parent engine of the engine CO₂-family defined in accordance with Appendix 3 to this Annex and recorded in accordance with paragraph 4.3.1.
- (2) The control area shall include all engine speeds greater than or equal to the 30th percentile cumulative speed distribution, determined from all engine speeds including idle speed sorted in ascending order, over the hotstart WHTC test cycle performed in accordance with paragraph 4.3.3 (n_{30}) for the engine full load curve referred to the subpoint (1).
- (3) The control area shall include all engine speeds lower than or equal to n_{hi} determined from the engine full load curve referred to in the subpoint (1)

4.3.5.6.1.2 Engine torque and power range for the control area

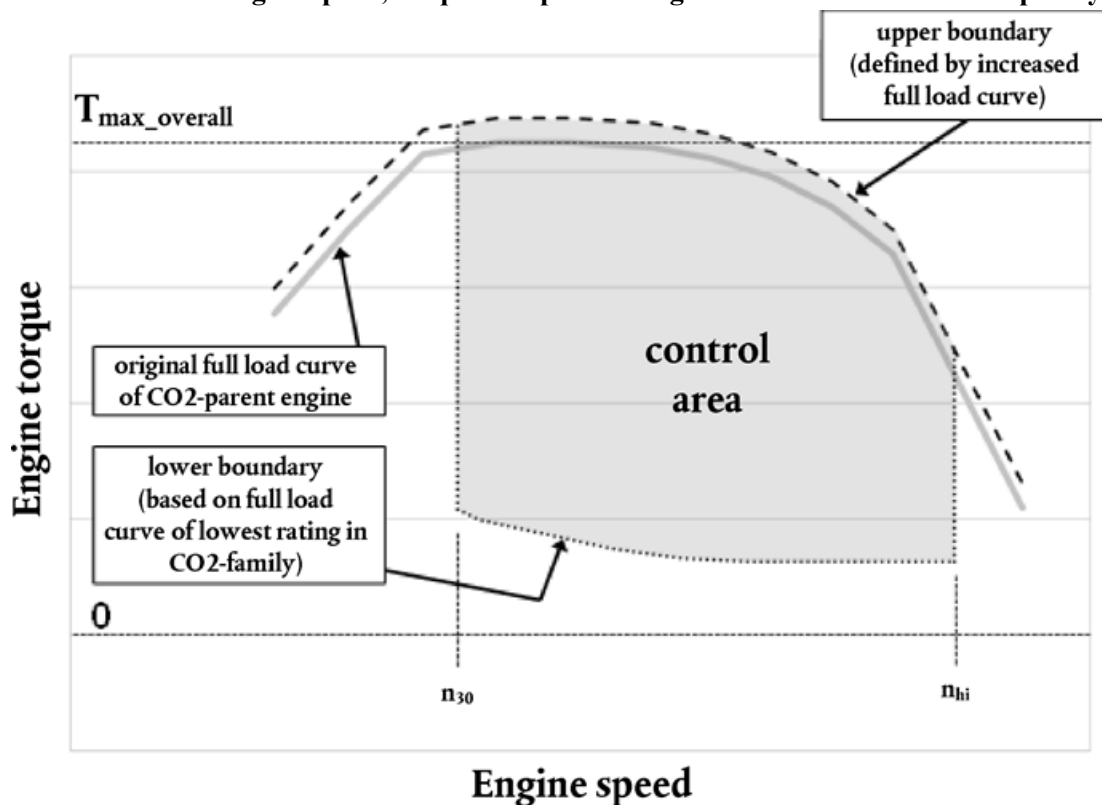
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- (1) The lower boundary of the engine torque range for the control area shall be defined based on the engine full load curve of the engine with the lowest rating of all engines within the engine CO₂-family and recorded in accordance with paragraph 4.3.1.
- (2) The control area shall include all engine load points with a torque value greater than or equal to 30 percent of the maximum torque value determined from the engine full load curve referred to in subpoint (1).
- (3) Notwithstanding the provisions of subpoint (2), speed and torque points below 30 percent of the maximum power value, determined from the engine full load curve referred to in subpoint (1), shall be excluded from the control area.
- (4) Notwithstanding the provisions of subpoints (2) and (3), the upper boundary of the control area shall be based on the engine full load curve of the CO₂-parent engine of the engine CO₂-family defined in accordance with Appendix 3 to this Annex and recorded in accordance with paragraph 4.3.1. The torque value for each engine speed determined from the engine full load curve of the CO₂-parent engine shall be increased by 5 percent of the overall maximum torque, $T_{\max_overall}$, defined in accordance with paragraph 4.3.5.2.2. The modified increased engine full load curve of the CO₂-parent engine shall be used as upper boundary of the control area.

Figure 5 exemplarily illustrates the definition of the engine speed, torque and power range for the control area.

Figure 5

Definition of the engine speed, torque and power range for the control area exemplarily



4.3.5.6.2 Definition of the grid cells

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The control area defined in accordance with paragraph 4.3.5.6.1 shall be divided into a number of grid cells for emission monitoring during the FCMC.

The grid shall comprise of 9 cells for engines with a rated speed less than $3\,000\text{ min}^{-1}$ and 12 cells for engines with a rated speed greater than or equal to $3\,000\text{ min}^{-1}$. The grids shall be defined in accordance with the following provisions:

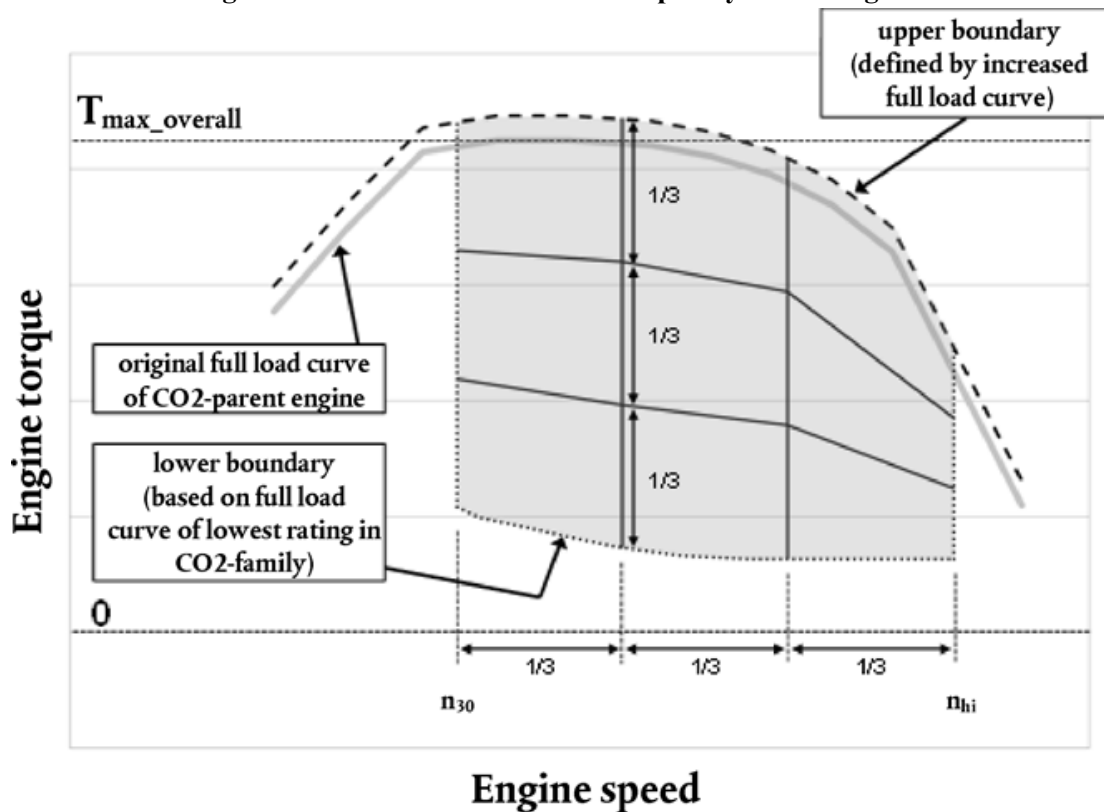
- (1) The outer boundaries of the grids are aligned to the control area defined according to paragraph 4.3.5.6.1.
- (2) 2 vertical lines spaced at equal distance between engine speeds n_{30} and $1,1$ times n_{95h} for 9 cell grids, or 3 vertical lines spaced at equal distance between engine speeds n_{30} and $1,1$ times n_{95h} for 12 cell grids.
- (3) 2 lines spaced at equal distance of engine torque (i.e. $1/3$) at each vertical line of engine speed defined by subpoints (1) and (2)

All engine speed values in min^{-1} and all torque values in Newtonmeters defining the boundaries of the grid cells shall be rounded to 2 places to the right of the decimal point in accordance with ASTM E 29-06.

Figure 6 exemplarily illustrates the definition of the grid cells for the control area in the case of 9 cell grid.

Figure 6

Definition of the grid cells for the control area exemplarily for 9 cell grid



4.3.5.6.3 Calculation of specific mass emissions

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The specific mass emissions of the gaseous pollutants shall be determined as average value for each grid cell defined in accordance with paragraph 4.3.5.6.2. The average value for each grid cell shall be determined as arithmetical mean value of the specific mass emissions over all engine speed and torque points measured during the FCMC located within the same grid cell.

The specific mass emissions of the single engine speed and torque measured during the FCMC shall be determined as averaged value over the 30 ± 1 seconds measurement period defined in accordance with subpoint (1) of paragraph 4.3.5.5.

If an engine speed and torque point is located directly on a line that separates different grid cells from each other, this engine speed and load point shall be taken into account for the average values of all adjacent grid cells.

The calculation of the total mass emissions of each gaseous pollutant for each engine speed and torque point measured during the FCMC, $m_{\text{FCMC},i}$ in grams, over the 30 ± 1 seconds measurement period in accordance with subpoint (1) of paragraph 4.3.5.5 shall be carried out in accordance with paragraph 8 of Annex 4 to UN/ECE Regulation 49 Rev.06.

The actual engine work for each engine speed and torque point measured during the FCMC, $W_{\text{FCMC},i}$ in kWh, over the 30 ± 1 seconds measurement period in accordance with subpoint (1) of paragraph 4.3.5.5 shall be determined from the engine speed and torque values recorded in accordance with paragraph 4.3.5.3.

The specific mass emissions of gaseous pollutants $e_{\text{FCMC},i}$ in g/kWh for each engine speed and torque point measured during the FCMC shall be determined by the following equation:

$$e_{\text{FCMC},i} = m_{\text{FCMC},i} / W_{\text{FCMC},i}$$

4.3.5.7 Validity of data

4.3.5.7.1 Requirements for validation statistics of the FCMC

A linear regression analysis of the actual values of engine speed (n_{act}), engine torque (M_{act}) and engine power (P_{act}) on the respective reference values (n_{ref} , M_{ref} , P_{ref}) shall be performed for the FCMC. The actual values for n_{act} , M_{act} and P_{act} shall be determined from the values recorded in accordance with paragraph 4.3.5.3.

The ramps to move from one target setpoint to the next shall be excluded from this regression analysis.

To minimize the biasing effect of the time lag between the actual and reference cycle values, the entire engine speed and torque actual signal sequence may be advanced or delayed in time with respect to the reference speed and torque sequence. If the actual signals are shifted, both speed and torque shall be shifted by the same amount in the same direction.

The method of least squares shall be used for the regression analysis in accordance with paragraphs A.3.1 and A.3.2 of Appendix 3 to Annex 4 to UN/ECE Regulation 49 Rev.06, with the best-fit equation having the form as defined in paragraph 7.8.7 of Annex 4 to UN/ECE Regulation 49 Rev.06. It is recommended that this analysis be performed at 1 Hz.

For the purposes of this regression analysis only, omissions of points are permitted where noted in Table 4 (Permitted point omissions from regression analysis) of Annex 4 to UN/ECE Regulation 49 Rev.06 before doing the regression calculation. Additionally, all engine torque and power values at points with maximum operator demand shall be omitted for the purposes of this regression analysis only. However, points omitted for the purposes of regression analysis shall not be omitted for any other calculations in accordance with this Annex. Point omission may be applied to the whole or to any part of the cycle.

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For the data to be considered valid, the criteria of Table 3 (Regression line tolerances for the WHSC) of Annex 4 to UN/ECE Regulation 49 Rev.06 shall be met.

4.3.5.7.2 Requirements for emission monitoring

The data obtained from the FCMC tests is valid if the specific mass emissions of the regulated gaseous pollutants determined for each grid cell in accordance with paragraph 4.3.5.6.3 meet the applicable limits for gaseous pollutants defined in paragraph 5.2.2 of Annex 10 to UN/ECE Regulation 49 Rev.06. In the case that the number of engine speed and torque points within the same grid cell is less than 3, this paragraph shall not apply for that specific grid cell.

Changes to legislation:

There are outstanding changes not yet made to Commission Regulation (EU) 2017/2400. Any changes that have already been made to the legislation appear in the content and are referenced with annotations.

[View outstanding changes](#)

Changes and effects yet to be applied to the whole legislation item and associated provisions

- Signature words omitted by [S.I. 2022/1273 reg. 82\(18\)](#)
- Annex 5 Appendix 6 point 1.3 substituted by [S.I. 2022/1273 reg. 83\(4\)\(b\)\(i\)](#)
- Annex 5 Appendix 6 point 1.4.1 image substituted by [S.I. 2022/1273 reg. 83\(4\)\(b\)\(iii\)\(aa\)](#)
- Annex 5 Appendix 6 point 1.5.1 image substituted by [S.I. 2022/1273 reg. 83\(4\)\(b\)\(iv\)\(aa\)](#)
- Annex 5 Appendix 4 point 7.4 word substituted by [S.I. 2022/1273 reg. 83\(4\)\(a\)](#)
- Annex 5 Appendix 6 point 2.1 word substituted by [S.I. 2022/1273 reg. 83\(4\)\(b\)\(v\)](#)
- Annex 5 Appendix 6 point 1.4.1 words omitted by [S.I. 2022/1273 reg. 83\(4\)\(b\)\(iii\)\(bb\)](#)
- Annex 5 Appendix 6 point 1.5.1 words omitted by [S.I. 2022/1273 reg. 83\(4\)\(b\)\(iv\)\(bb\)](#)
- Annex 5 Appendix 6 point 1.4 words substituted by [S.I. 2022/1273 reg. 83\(4\)\(b\)\(ii\)](#)
- Annex 5 Appendix 6 point 2.1 table words substituted by [S.I. 2022/1273 reg. 83\(4\)\(b\)\(vi\)](#)
- Annex 10 Appendix 4 point 1.1 word substituted by [S.I. 2022/1273 reg. 83\(8\)\(d\)\(i\)](#)
- Annex 10 Appendix 1 words substituted by [S.I. 2022/1273 reg. 83\(8\)\(c\)](#)
- Annex 10 Appendix 4 point 1.1 table words substituted by [S.I. 2022/1273 reg. 83\(8\)\(d\)\(ii\)](#)
- Annex 7 Appendix 5 point 1.3 substituted by [S.I. 2022/1273 reg. 83\(6\)\(c\)\(i\)](#)
- Annex 7 Appendix 5 point 1.4.1 image substituted by [S.I. 2022/1273 reg. 83\(6\)\(c\)\(iii\)\(aa\)](#)
- Annex 7 Appendix 1s. 1 point 000.5 word substituted by [S.I. 2022/1273 reg. 83\(6\)\(b\)\(ii\)](#)
- Annex 7 Appendix 1 words inserted by [S.I. 2022/1273 reg. 83\(6\)\(b\)\(i\)\(aa\)](#)
- Annex 7 Appendix 1 words omitted by [S.I. 2022/1273 reg. 83\(6\)\(b\)\(i\)\(bb\)](#)
- Annex 7 Appendix 5 point 1.4.1 words omitted by [S.I. 2022/1273 reg. 83\(6\)\(c\)\(iii\)\(bb\)](#)
- Annex 7 Appendix 5 point 1.4 words substituted by [S.I. 2022/1273 reg. 83\(6\)\(c\)\(ii\)](#)
- Annex 7 Appendix 5 point 2.1 words substituted by [S.I. 2022/1273 reg. 83\(6\)\(c\)\(iv\)](#)
- Annex 7 Appendix 5 point 2.1 table words substituted by [S.I. 2022/1273 reg. 83\(6\)\(c\)\(v\)](#)
- Annex 8 Appendix 8 point 1.3 substituted by [S.I. 2022/1273 reg. 83\(7\)\(d\)\(i\)](#)
- Annex 8 Appendix 8 point 1.4.1 image substituted by [S.I. 2022/1273 reg. 83\(7\)\(d\)\(iii\)\(aa\)](#)
- Annex 8 Appendix 4 table 11 word omitted by [S.I. 2022/1273 reg. 83\(7\)\(c\)\(i\)](#)
- Annex 8 Appendix 4 table 13 word omitted by [S.I. 2022/1273 reg. 83\(7\)\(c\)\(i\)](#)
- Annex 8 Appendix 4 table 15 word omitted by [S.I. 2022/1273 reg. 83\(7\)\(c\)\(ii\)\(aa\)](#)
- Annex 8 Appendix 4 table 15 word omitted by [S.I. 2022/1273 reg. 83\(7\)\(c\)\(ii\)\(bb\)](#)
- Annex 8 Appendix 1s. 1 point 000.6 word substituted by [S.I. 2022/1273 reg. 83\(7\)\(b\)\(ii\)](#)
- Annex 8 Appendix 8 point 2.1 word substituted by [S.I. 2022/1273 reg. 83\(7\)\(d\)\(iv\)](#)
- Annex 8 Appendix 1 words inserted by [S.I. 2022/1273 reg. 83\(7\)\(b\)\(i\)\(aa\)](#)
- Annex 8 Appendix 1 words omitted by [S.I. 2022/1273 reg. 83\(7\)\(b\)\(i\)\(bb\)](#)
- Annex 8 Appendix 8 point 1.4.1 words omitted by [S.I. 2022/1273 reg. 83\(7\)\(d\)\(iii\)\(bb\)](#)
- Annex 8 Appendix 8 point 1.4 words substituted by [S.I. 2022/1273 reg. 83\(7\)\(d\)\(ii\)](#)
- Annex 8 Appendix 8 point 2.1 table words substituted by [S.I. 2022/1273 reg. 83\(7\)\(d\)\(v\)](#)

- Annex 2 Appendix 2s. 2 point 2 omitted by S.I. 2022/1273 reg. 83(2)(b)(ii)
- Annex 2 Appendix 2 words inserted by S.I. 2022/1273 reg. 83(2)(b)(i)
- Annex 6 Appendix 7 point 1.3 substituted by S.I. 2022/1273 reg. 83(5)(e)(i)
- Annex 6 Appendix 7 point 1.5 image substituted by S.I. 2022/1273 reg. 83(5)(e)(iii)(aa)
- Annex 6 Appendix 7 point 2.1 word substituted by S.I. 2022/1273 reg. 83(5)(e)(iv)
- Annex 6 Appendix 1 words omitted by S.I. 2022/1273 reg. 83(5)(c)
- Annex 6 Appendix 7 point 1.5 words omitted by S.I. 2022/1273 reg. 83(5)(e)(iii)(bb)
- Annex 6 Appendix 2 point 8 words substituted by S.I. 2022/1273 reg. 83(5)(d)
- Annex 6 Appendix 3 point 8 words substituted by S.I. 2022/1273 reg. 83(5)(d)
- Annex 6 Appendix 4 point 8 words substituted by S.I. 2022/1273 reg. 83(5)(d)
- Annex 6 Appendix 5 point 8 words substituted by S.I. 2022/1273 reg. 83(5)(d)
- Annex 6 Appendix 7 point 1.4 words substituted by S.I. 2022/1273 reg. 83(5)(e)(ii)
- Annex 6 Appendix 7 point 2.1 table words substituted by S.I. 2022/1273 reg. 83(5)(e)(v)
- Art. 3(5) omitted by S.I. 2022/1273 reg. 82(4)(a)
- Art. 3(16) words substituted by S.I. 2022/1273 reg. 82(4)(b)
- Art. 3(20) words substituted by S.I. 2022/1273 reg. 82(4)(c)
- Art. 10(1a) inserted by S.I. 2022/1273 reg. 82(8)(b)
- Annex 10a para. 3(f) words inserted by S.I. 2022/1273 reg. 83(9)(a)
- Annex 10a para. 3(f) table words substituted by S.I. 2022/1273 reg. 83(9)(b)(c)
- Art. 12(8) inserted by S.I. 2022/1273 reg. 82(10)