
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. (See end of Document for details) [View outstanding changes](#)

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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[^{F1}ANNEX Xa

CONFORMITY OF SIMULATION TOOL OPERATION AND OF CO₂ EMISSIONS AND FUEL CONSUMPTION RELATED PROPERTIES OF COMPONENTS, SEPARATE TECHNICAL UNITS AND SYSTEMS: VERIFICATION TESTING PROCEDURE

Textual Amendments

F1 Inserted 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).

6. Test procedure

6.1. Vehicle preparation

The vehicle shall be taken from the series production and selected as set out in point 3.

6.1.1. Validation of input data

The manufacturer's records file for the vehicle selected shall be used as basis for validating the input data. The vehicle identification number of the vehicle selected shall be the same as the vehicle identification number in the customer information file.

Upon request by the approval authority that granted the licence to operate the simulation tool, the vehicle manufacturer shall provide, within 15 working days, the manufacturer's records file, the input information and input data necessary to run the simulation tool as well as the certificate of CO₂ emissions and fuel consumption related properties for all relevant components, separate technical units or systems.

6.1.1.1. Verification of components, separate technical units or systems and input data and information

The following checks shall be performed for the components, separate technical units and systems mounted on the vehicle:

- (a) Simulation tool data integrity: the integrity of the cryptographic hash of the manufacturer's records file in accordance with Article 9(3) re-calculated during the verification testing procedure with the hashing tool shall be verified by comparison with the cryptographic hash in the certificate of conformity;
- (b) Vehicle data: the vehicle identification number, axle configuration, selected auxiliaries and power take off technology shall match the selected vehicle;
- (c) Component, separate technical unit or system data: the certification number and the model type imprinted on the certificate of CO₂ emissions and fuel consumption related properties shall match the component, separate technical unit or system installed in the selected vehicle;
- (d) The hash of the simulation tool input data and the input information shall match the hash imprinted on the certificate of CO₂ emissions and fuel consumption related properties for the following components, separate technical units or systems:
 - (i) engines;

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- (ii) transmissions;
- (iii) torque converters;
- (iv) other torque transferring components;
- (v) additional driveline components;
- (vi) axles;
- (vii) body or trailer air drag;
- (viii) tyres.

6.1.1.2. Verification of the vehicle mass

If requested by the approval authority that granted the licence to operate the simulation tool, a verification of the corrected actual mass of the vehicle shall be included into the verification of input data.

For the verification of the mass, the mass in running order of the vehicle shall be verified in accordance with point 2 of Appendix 2 to Annex I to Regulation (EC) No 1230/2012.

6.1.1.3. Actions to be taken

In case of discrepancies in the certification number or the cryptographic hash of one or more files regarding the components, separate technical units or systems listed in subpoints (d)(i) to (vii) of point 6.1.1.1 the correct input data file fulfilling the checks in accordance with points 6.1.1.1 and 6.1.1.2 shall replace the incorrect data for all further actions. If no complete input data set with correct certificates of CO₂ emissions and fuel consumption related properties is available for the components, separate technical units or systems listed in subpoints (d)(i) to (vii) of point 6.1.1.1 the verification test shall end and the vehicle fails the verification testing procedure.

6.1.2. Run in phase

After the validation of input data in accordance with point 6.1.1, a run in phase up to maximum 15 000 km odometer reading may take place, with no need to use the reference fuel, if the odometer reading of the vehicle selected is below 15 000 km. In case of damage of any of the components, separate technical units or systems listed in point 6.1.1.1, the component, separate technical units or systems may be replaced by an equivalent component, separate technical units or systems with the same certification number. The replacement shall be documented in the test report.

All relevant components, separate technical units or systems shall be checked before the measurements to exclude unusual conditions, such as incorrect oil fill levels, plugged air filters or on-board diagnostic warnings.

6.1.3. Set up of measurement equipment

All measurement systems shall be calibrated in accordance with the provisions of the equipment maker. If no provisions exist, the recommendations from the equipment maker shall be followed for calibration.

After the run in phase, the vehicle shall be equipped with the measurement systems set out in point 5.

6.1.4. Set up of the test vehicle for the fuel consumption measurement

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Tractors of the vehicle groups defined in Table 1 of Annex I shall be tested with any type of semitrailer, providing the loading defined below can be applied.

Rigid lorries of the vehicle groups defined in Table 1 of Annex I shall be tested with trailer, if a trailer connection is mounted. Any body type or other device to carry the loading set out below can be applied.

The bodies of the vehicles may differ from the standard bodies set out in Table 1 of Annex I for the certification of CO₂ emissions and fuel consumption related properties of component, separate technical units or systems.

The vehicle payload shall be at minimum to a mass leading to a total test weight of 90 % of the maximum gross combined weight or gross vehicle weight for rigid lorries without trailer.

The tyre inflation pressure shall be in line with the recommendation of the manufacturer. The tyres of the semitrailer may differ from the standard tyres set out in Table 2 of Part B of Annex II to Regulation (EC) No 661/2009 for the CO₂ certification of tyres.

All settings influencing the auxiliary energy demand shall be set to minimum reasonable energy consumption where applicable. The air conditioning shall be switched off and venting of the cabin shall be set lower than medium mass flow. Additional energy consumers not necessary to run the vehicle shall be switched off. External devices to provide energy on board, such as external batteries, are allowed only for running the extra measurement equipment for the verification testing procedure listed in Table 2 but shall not provide energy to serial vehicle equipment.

A particle filter regeneration may be initiated and shall be achieved before the verification test. If an initiated particle filter regeneration cannot be achieved before the verification test, the test is invalid and shall be repeated.

6.1.5. Verification test

6.1.5.1. Route selection

The route selected for the verification test shall fulfil the requirements set out in Table 3. The routes may include both public and private tracks.

6.1.5.2. Vehicle pre conditioning

No specific pre-conditioning of the vehicle is required.

6.1.5.3. Vehicle warm up

Before the fuel consumption measurement starts, the vehicle shall be driven for warm up as set out in Table 3. The warm up phase shall not be considered in the evaluation of the verification test.

6.1.5.4. Zeroing of the torque measurement equipment

Zeroing of the torque measurement equipment shall follow the instruction of the equipment maker. It shall be ensured for zeroing, that the torque on the driven axle is zero. For zeroing, the vehicle shall be stopped directly after the warm up phase and zeroing shall be performed directly after the vehicle stop to minimise cool down effects. Zeroing shall be finished within less than 20 minutes.

6.1.5.5. Fuel consumption measurement

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The fuel consumption measurement shall start directly after the zeroing of the wheel-torque measurement equipment at vehicle stand still and engine idling. The vehicle shall be driven during the measurement in a driving style avoiding unnecessary braking of the vehicle, gas pedal pumping and aggressive cornering. The setting for the electronic control systems which is activated automatically at vehicle start shall be used, and gear shifts shall be performed by the automated system if applicable. If only manual settings for the electronic control systems are available, the settings leading to higher fuel consumption per kilometre shall be selected. The duration of the fuel consumption measurement shall be within the tolerances set out in Table 3. The fuel consumption measurement shall end also at vehicle stand still in idling condition directly before the measurement of the drift of the torque measurement equipment.

6.1.5.6. Measurement of the drift of the torque measurement equipment

Directly after the fuel consumption measurement, the drift of the torque measurement equipment shall be recorded by measuring the torque at the same vehicle conditions as during the zeroing process. If the fuel consumption measurement does not end at zero vehicle speed, the vehicle shall be stopped for the drift measurement in moderate deceleration.

6.1.5.7. Boundary conditions for the verification test

The boundary conditions to be met for a valid verification test are set in Table 3.

If the vehicle passes the verification test in accordance with point 7, the test shall be set valid even if the following conditions are not met:

- undercut of minimum values for parameter No 1, 2, 6, 9 in Table 3,
- exceedance of maximum values for parameter No 3, 4, 5, 7, 8, 10, 12 in Table 3.

TABLE 3

Parameters for a valid verification test

No	Parameter	Min.	Max.	Applicable for
1	Warm up [minutes]	60		
2	Average velocity at warm up [km/h]	70 ^a	100	
3	Fuel consumption measurement duration [minutes]	80	120	
4	Distance based share urban driving	2 %	8 %	vehicle groups 4, 5, 9, 10
5	Distance based share rural driving	7 %	13 %	

^a Or maximum vehicle speed if lower than 70 km/h

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6	Distance based share motorway driving	74 %	—	vehicle groups 4, 5, 9, 10
7	Time share of idling at stand still		5 %	
8	Average ambient temperature	5 °C	30 °C	
9	Road condition dry	100 %		
10	Road condition snow or ice		0 %	
11	Seal level of the route [m]	0	800	
12	Duration of continuous idling at stand still [minutes]		3	

a Or maximum vehicle speed if lower than 70 km/h

In case of extraordinary traffic conditions, the verification test shall be repeated.

6.1.6. Data reporting

The data recorded during the verification testing procedure shall be reported to the approval authority that granted the licence to operate the simulation tool as follows:

- (a) The data recorded shall be reported in a constant 2 Hz signals as set out in Table 1. The data recorded at higher frequencies than 2 Hz shall be converted into 2 Hz by averaging the time intervals around the 2 Hz nodes. In case of e.g. 10 Hz sampling, the first 2 Hz node is defined by the average from second 0,1 to 0,5, the second node is defined by the average from second 0,6 to 1,0. The time stamp for each node shall be the last time stamp per node, i.e. 0,5, 1,0, 1,5 etc.
- (b) The wheel power shall be calculated from the measured wheel torque and rotational wheel speed. All values shall first be converted into 2 Hz signals in accordance with point (a). Then the wheel power for each driven wheel shall be calculated from the 2 Hz torque and speed signals as set out in the following equation:

$$P_{\text{wheel-}i(t)} = \frac{2 \times \pi \times n_{\text{wheel-}i(t)} \times M_{\text{wheel-}i(t)}}{60000}$$

where:

- i = Index standing for left and right wheel of the driven axle
- $P_{\text{wheel-}i(t)}$ = power at the left and right driven wheel time node (t) [kW]
- $n_{\text{wheel-}i(t)}$ = rotational speed of driven the left and right driven wheel at time node (t) [rpm]

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$M_{d_wheel-i(t)}$ = measured torque at the left and right driven wheel at time node (t) [Nm]

The wheel power input data for the verification test simulation with the simulation tool shall be the sum of the power of all driven wheels of the vehicle as set out in the following equation:

$$P_{wheel(t)} = \sum_{i=1}^{wd} P_{wheel-i(t)}$$

where:

$P_{wheel(t)}$ = total power at a driven wheel at time node (t) [kW]
 wd = number of driven wheels

TABLE 4

Data reporting format for measured data for the simulation tool in the verification test

Quantity	Unit	Header input data	Comment
time node	[s]	<t>	
vehicle speed	[km/h]	<v>	
engine speed	[rpm]	<n_eng>	
engine cooling fan speed	[rpm]	<n_fan>	
torque left wheel	[Nm]	<tq_left>	
torque right wheel	[Nm]	<tq_right>	
wheel speed left	[rpm]	<n_wh_left>	
wheel speed right	[rpm]	<n_wh_right>	
gear	[-]	<gear>	optional signal for MT and AMT
fuel flow	[g/h]	<fc>	for standard NCV (point 7.2)]

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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)