



Brussels, **XXX**
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ANNEXES 1 to 5

ANNEXES

to the

Commission Implementing Regulation

implementing Regulation (EU) 2019/1242 of the European Parliament and of the Council by determining the procedures for the in-service verification of the CO₂ emissions of heavy-duty vehicles

ANNEX I

Minimum number of families selected

1. For vehicle manufacturers:

Table 1: number of families, for which the corresponding in-service verification tests on the individual vehicles and tyres shall be performed

Total number of vehicles under Article 9 of Regulation (EU) 2017/2400	Number of VTP families (VTP test)	Number of air drag families (air drag test)	Number of ISV tyre families (tyre RRC test)
5 000 to 20 000	1	1	1
20 001 to 40 000	1	1	2
More than 40 000	2	2	3

2. For trailer manufacturers:

Table 2: number of ISV tyre families, for which the corresponding in-service verification tests on the individual tyres shall be performed

Total number of trailers under Article 8 of Regulation (EU) 2022/1362	Number of ISV tyre families (tyre RRC test)
Up to 10 000	1
More than 10 000	2

ANNEX II

Statistical evaluation of the tests

1. Starting point

The starting point for the statistical evaluation of the test results are the following values, calculated for the minimum number of individual test vehicles or tyres:

- (1) For VTP tests, the value 'C_{VTP ratio}' calculated in accordance with Article 7, for N=1;
- (2) For air drag tests, the value 'C_{dA ratio}' calculated in accordance with Article 10(2), for N=1;
- (3) For tyre rolling resistance coefficient tests, the value 'RRC_{ratio}' calculated in accordance with Article 13, for N=3;
- (4) For mass tests, the value 'mass_{ratio}' calculated in accordance with Article 16, for N=3.

The granting approval authority shall determine if it is necessary to test additional vehicles or tyres by applying the criteria set out in point 3 of this Annex.

2. Statistical parameters

For the total number of vehicles or tyres tested (N), the average (X_{tests}) and the standard deviation (s) of the test results shall be determined by applying the following formulas:

$$X_{tests} = \frac{(x_1 + x_2 + \dots + x_N)}{N}$$

and

$$s = \sqrt{\frac{(x_1 - X_{tests})^2 + (x_2 - X_{tests})^2 + \dots + (x_N - X_{tests})^2}{N-1}} \text{ if } N > 2,$$

where:

x_i is the ratio calculated for the individual test vehicle or tyre i:

- C_{VTP, ratio} for VTP test results in accordance with Article 7;
- C_{dA ratio} for air drag test results in accordance with Article 10(2);
- RRC_{ratio} for tyre rolling resistance coefficient test results in accordance with Article 13;
- mass_{ratio} for mass test results in accordance with Article 16.

3. Evaluation

After each additional vehicle or tyre tested, the value X_{tests} shall be assessed as set out below in order to reach one of the following conclusions for the vehicle or tyre family concerned:

- (1) Pass the family if: $X_{tests} \leq \text{bound}_P$
- (2) Fail the family if: $X_{tests} > \text{bound}_F$

(3) Test an additional vehicle or tyre if: $bound_P < X_{tests} \leq bound_F$

where:

$bound_P$ and $bound_F$ are set out in Table 1 of this Annex for VTP test results and for air drag test results;

$bound_P$ and $bound_F$ are set out in Table 2 of this Annex for tyre rolling resistance coefficient test results and for mass test results;

s is the standard deviation determined in accordance with point 2 of this Annex;

A is 1,03 for VTP test results;

A is $\frac{1,03*N_x+1,07*N_y}{N_x+N_y}$ for air drag test results,

where

N_x is the number of vehicles tested with a date of first registration from 1 January 2025;

N_y is the number of vehicles tested with a date of first registration before 1 January 2025;

A is 1,03 for tyre rolling resistance coefficient test results;

A is 1,02 for mass test results.

Table 1: **Values for bound P and bound F** for VTP test results and for air drag test results

<i>Number of vehicles tested</i>	<i>bound P</i>	<i>bound F</i>
1	$A - 0,04$	$A + 0,07$
2	$A - 0,03$	$A + 0,05$
3	$A - 0,8027 * s$	$A + 0,7325 * s$
4	$A - 0,3973 * s$	$A + 0,2233 * s$
5	A	A

Table 2: **Values for bound P and bound F** for tyre rolling resistance coefficient test results and for mass test results

<i>Number of vehicles tested</i>	<i>bound P</i>	<i>bound F</i>
3	$A - 2,2655 * s$	$A + \max\{1,1062, (0.02 / s)\} * s$
4	$A - 1,5093 * s$	$A + 0,5970 * s$
5	$A - 1,1230 * s$	$A + 0,3737 * s$
6	$A - 0,8196 * s$	$A + 0,2430 * s$
7	$A - 0,5944 * s$	$A + 0,1548 * s$
8	$A - 0,3866 * s$	$A + 0,0902 * s$
9	$A - 0,1873 * s$	$A + 0,0402 * s$
10	A	A

4. Calculation of the size of the deviation

For the calculation of the size of the deviation, the average_{ratio} is defined as X_{tests} for the total number of vehicles tested, after the vehicle or tyre family has failed according to point 3(2) of this Annex:

$$\text{average}_{\text{ratio}} = X_{tests}$$

ANNEX III

Checklist for vehicles selected for in-service verification tests

1. Definitions

For the purposes of this Annex, the following definitions shall apply:

- (1) 'Exclusion criteria' means that if the condition described is met (reply to the question is 'yes'), the vehicle cannot be selected for in-service verification tests.
- (2) 'Confidential' means that this information shall be kept as appropriate by the granting approval authority, but not be included in the test report submitted to the Commission.

(2) Vehicle Characteristics

2.1. The following information shall be recorded and included in the test report:

2.1.1.	Vehicle identification number (VIN):	CONFIDENTIAL
2.1.2.	Mileage [km]:	
2.1.3.	Date of first registration:	
2.1.4.	Cryptographic hash of the manufacturer's records file	CONFIDENTIAL

2.2. The following exclusion criteria shall be checked:

		Yes / No
2.2.1.	Mileage: <i>Is the mileage lower than 25 000 km or higher than 160 000 / 300 000 / 700 000 km according to Article 4(2) of Regulation (EC) No 595/2009?</i>	
2.2.2.	Date of first registration: <i>Is that date more than 5/6/7 years, as referred to in Article 4(2) of Regulation (EC) No 595/2009, prior to the date of vehicle selection?</i>	

(3) Vehicle Owner/User Interview

(The owner shall have no knowledge of the implications of the replies)

3.1. The following information shall be recorded:

3.1.1.	Name of the owner:	CONFIDENTIAL
3.1.2.	Contact (address / telephone):	CONFIDENTIAL

3.2. The following exclusion criteria shall be checked:

	<i>Unauthorised use of the vehicle</i>	Yes / No
3.2.1.	Has the vehicle carried heavy loads over the specifications of the manufacturer?	
3.2.2.	Was the vehicle used for racing or motor sports?	
3.2.3.	Was the vehicle driven in a non-EU Member State for more than 10% of	

	driving time?	
3.2.4.	Has the vehicle been used with a wrong fuel type (e.g. gasoline instead of diesel) or with non-commercially available EU-quality fuel (black market, or blended fuel)?	
3.2.5.	Has a fuel additive, not approved by the manufacturer, been used?	
	<i>Unauthorised repairs</i>	
3.2.6.	Has the vehicle not been maintained in accordance with the manufacturer's instructions?	
3.2.7.	Have there been unauthorised major engine or vehicle repairs?	
3.2.8.	Was the vehicle involved in a serious accident?	
	<i>Unauthorised changes</i>	
3.2.9.	Has there been a power increase/tuning?	
3.2.10.	Was any part of the emissions after-treatment system permanently removed?	
3.2.11.	Were there any unauthorised emission related devices installed (urea killer, emulator, etc.)?	

(4) Vehicle Examination

4.1. The following information shall be included in the test report:

4.1.1.	Powertrain Control Module software and calibration part numbers and checksums	
4.1.2.	OBD diagnosis	Read Diagnostic Trouble Codes & print error log ¹
4.1.3.	OBD Service Mode 09 Query	Read Service Mode 09 and record the information.
4.1.4.	OBD mode 07	Read Service Mode 07 and record the information.
4.1.5.	Pictures of the tested vehicle including of the underbody	

Remark: All checks requiring OBD connections are to be performed before and after the emission test

4.2. The following exclusion criteria shall be checked:

		Yes / No
4.2.1.	Are there any warning lights on the instrument panel activated indicating a vehicle or exhaust after-treatment system malfunctioning that cannot be resolved by normal maintenance? (Malfunction Indication Light, Engine Service Light, etc?)	
4.2.2.	Are there any modifications with relevance to CO ₂ emissions and fuel consumption as determined by Regulation (EU) 2017/2400 (e.g. mounting of an additional power take off, change in auxiliary components or in axle	

¹ All systems shall be part of OBD Diagnosis and 'Error logs/Information detected and diagnosed' shall be part of the test report.

	configuration) that cannot be restored? Are any standard aerodynamics components missing (front deflectors, diffusers, splitters, etc.)?	
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4.3. If the following conditions are not met, the vehicle may still be selected on the condition that appropriate action is taken before performing in-service verification tests:

	Check to do	Issue identified and action to be taken
4.3.1.	Fuel tank level	<i>If fuel reserve light ON, refuel before test.</i>
4.3.2.	Diesel exhaust fuel (AdBlue)	<i>If SCR light is on after engine-on, the AdBlue shall be filled in, or the repair executed before the vehicle is used for testing.</i>
4.3.3.	Air filter and oil filter <i>Check for contamination and damage</i>	<i>If damaged or heavily contaminated or less than 800 km before the next recommended change; change the filters.</i>
4.3.4.	Check fluid levels and grade <i>Check the max. and min. levels (engine oil, cooling liquid)</i>	<i>If below minimum, top up. If different grade, replace.</i>
4.3.5.	Ignition cable (positive ignition) <i>Check spark plugs, cables, etc.</i>	<i>In case of damage, replace them.</i>
4.3.6.	Service <i>Check if less than 800 km away from next scheduled service</i>	<i>If yes, then perform the service.</i>
4.3.7.	For air drag tests ONLY: <i>Check if wheel alignment and adjustable vehicle height/ground clearance are out of range.</i>	<i>If yes, adjust wheel alignment and vehicle height/ground clearance to be in range.</i>
4.3.8.	For air drag test ONLY: <i>Check if a standard body is installed in accordance with Annex VIII to regulation (EU) 2017/2400</i>	<i>If not, install standard body</i>

ANNEX IV

In-service verification test data to report

(1) In-service verification test data to report for a VTP test

The data to report is the data of the test reports referred to in Article 20(1), second subparagraph, of Commission Regulation (EU) 2017/2400.

In addition, the following data shall be reported:

No	Parameters	Unit	Source	Remarks
1	Granting approval authority responsible for the in-service verification tests	-	-	
2	Vehicle number	-	-	Vehicle sequence (1, 2, 3, ...10) in the statistical evaluation
3	Total number of vehicles tested	-	-	Total number of vehicles included in the statistical evaluation described in Annex I
4	Pass/fail decision	-	-	Pass or Fail for the test

(2) In-service verification test data to report for an air drag test

The data to report is the data specified in Appendix 2 of Annex VIII to Regulation (EU) 2017/2400.

In addition, the following data shall be reported:

No	Parameters	Unit	Source	Remarks
1	Granting approval authority responsible for the in-service verification tests	-	-	
2	Vehicle number	-	-	Vehicle sequence (1, 2, 3, ...10) in the statistical evaluation
3	Total number of vehicles tested	-	-	Total number of vehicles included in the statistical evaluation described in Annex I
4	Vehicle identification number (VIN)	-	-	The VIN of the vehicle selected
5	Odometer reading at start of the ISV tests	km		
6	Test track on which tests have been conducted	-		
7	Total vehicle mass during	kg		Actual vehicle mass during the

	measurement			measurement
8	Maximum vehicle height during measurement	m		
9	Average ambient temperature during first low speed test	°C		
10	Average vehicle speed during high speed tests	km/h		
11	Product of drag coefficient (Cd) by cross sectional area (Acr) for zero crosswind conditions CdAcr(0)	m ²		
12	Product of drag coefficient (Cd) by cross sectional area (Acr) for average crosswind conditions during constant speed test CdAcr(β)	m ²		
13	Average yaw angle during constant speed test β	°		
14	Version number of air drag pre-processing tool	-		
15	Air drag test result (CdA _{ratio})	-		As defined in Article 10 (IR)
16	Cryptographic hash of the manufacturer's records file			
17	Declared CdA	m ²		Declared value for air drag family
18	Pass/fail decision	-		Pass or fail for the test

In addition, for a CFD method air drag test, the data and calculations specified in point 2 of Appendix 10 of Annex VIII to Regulation (EU) 2017/2400 shall be reported.

(3) In-service verification test data to report for a tyre RRC test

The data to report is the data specified in Appendix 2 of Annex X of Regulation (EU) 2017/2400.

In addition, the following data shall be reported:

No	Parameters	Unit	Source	Remarks
1	Granting approval authority responsible for the in-service verification tests	-	-	
2	Name and location of lab performing the ISV test			
3	Tyre number	-	-	Tyres sequence (1, 2, 3, ...10) in

				the statistical evaluation
4	Total number of tyres tested	-	-	Total number of tyres included in the statistical evaluation described in Annex I
5	Tyre certification number			In accordance with Appendix 4 of Annex X of Commission Regulation (EU) 2017/2400
6	Hash of the tyre certificate			
7	Name and location of certification lab			
8	Tyre rolling resistance coefficient test result (RRC_{ratio})			As defined in Article 13 of this Regulation
9	Pass/fail decision	-		Pass or fail for the test

(4) In-service verification test data to report for a mass test

The following data shall be reported:

No	Parameters	Unit	Source	Remarks
1	Granting approval authority responsible for the in-service verification tests	-	-	
2	Vehicle number	-	-	Vehicle sequence (1, 2, 3, ...10) in the statistical evaluation
3	Total number of vehicles tested	-	-	Total number of vehicles included in the statistical evaluation described in Annex I
4	Name and address of the vehicle manufacturer			
5	Vehicle identification number (VIN)			
6	Odometer reading at start of the ISV tests	Km		
7	Vehicle model			
8	Vehicle category			
9	Axle configuration			
10	Maximum gross vehicle weight / Total Permissible Maximum Laden Mass			

	(TPMLM)			
11	Vehicle group			
12	Cryptographic hash of the manufacturer's records file			
13	Measured Corrected actual mass of the vehicle	Kg		In accordance with Article 15
14	Declared Corrected actual mass of the vehicle	kg	1.1.8 of CIF	In accordance with Article 16
15	The mass test result (mass _{ratio})			As defined in Article 14
16	Pass/fail decision			Pass or fail for the test

ANNEX V

Reporting format for the in-service verification annual overview

A. General information

(1)	Granting type-approval authority	
(2)	Date of annual overview	
(3)	Reporting period of the year concerned	
(4)	Total number of vehicles per manufacturer for the average of the three reporting periods preceding the in-service verification	
(5)	Minimum number of VTP / air drag / ISV tyre families selected	
(6)	Total number of VTP / air drag / CFD / ISV tyre families selected in the year concerned	

B. List of the VTP / air drag / CFD / ISV tyre families selected for the in-service verification

- Identification number of the family selected (ISV ID);
- Vehicle manufacturer concerned (OEM);
- VTP / air drag / CFD / ISV tyre family identifiers for each of the families selected;
- Reason(s) underlying the selection of the families for the in-service verification:
 - ‘risk assessment’ if based on Article 3;
 - ‘other’ if any other reason, please specify in a footnote.

ISV ID	OEM	VTP / air drag / CFD / ISV tyre family identifiers	Reason
1			
2			
3			
...			

C. Summary of in-service verification test results

- Type of test: verification testing procedure (VTP), air drag (AD), CFD method air drag (CFD), tyre rolling resistance coefficient (RRC), mass (mass) or artificial strategies (AS) tests

- Minimum number of tests per type of test (Min.), calculated according to Article 4(1) based on point A(4) of this Annex
- Total number of tests per type of test (Total)
- Total number of conclusions per type of test:
 - no lack of correspondence (Pass);
 - lack of correspondence (Fail);
 - no conclusion established yet (Pending).

Type of test	Min.	Total	Pass	Fail	Pending
VTP test					
Air drag test					
CFD method air drag test					
Tyre RRC test					
Mass test	1				
Artificial strategies test	1				

D. Detailed in-service verification test results for the year concerned

- Identification number of the family selected (ISV ID);
- Manufacturer concerned (OEM);
- Type of test performed (Type of test): verification testing procedure (VTP), air drag (AD), CFD method air drag (CFD), tyre rolling resistance coefficient (RRC), mass (mass) or artificial strategies (AS) tests;
- Start date of the test (Start date) according to Article 5(2) of Regulation (EU) 2024/1127;
- Name of the organisation(s) performing the test (granting approval authority or Technical Service) (GAA/TS);
- Number of vehicles tested (No of vehicles);
- Test result of each individual test vehicle (average, ratio);
- Conclusion of the test (Conclusion/Deviation), that is ‘Pass’, ‘Fail’ or ‘Pending’, incl. size of the deviation in case of ‘Fail’;
- Test report reference number (Test ref.);
- Conclusion reference number (Conclusion ref.).

ISV ID	OEM	Type of test	Start date	GAA/ TS	No of vehicles	average _{ratio}	Conclusion /Deviation	Test ref.	Conclusion ref.
1									
2									
3									
...									

E. Detailed in-service verification test results, for which conclusions were reported as 'Pending' in the previous annual overview

- Reporting period of the year concerned (Year)
- Other fields: see description under point D.

Year	ISV ID	OEM	Type of test	Start date	GAA/ TS	No of vehicles	average _{ratio}	Conclusion/ Deviation	Test ref.	Conclusion ref.
...	...									