

Official Journal of the European Union

L 259



English edition

Legislation

Volume 59

27 September 2016

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⁽¹⁾ Text with EEA relevance

EN

Acts whose titles are printed in light type are those relating to day-to-day management of agricultural matters, and are generally valid for a limited period.

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II

(Non-legislative acts)

REGULATIONS

COMMISSION REGULATION (EU) 2016/1718

of 20 September 2016

amending Regulation (EU) No 582/2011 with respect to emissions from heavy-duty vehicles as regards the provisions on testing by means of portable emission measurement systems (PEMS) and the procedure for the testing of the durability of replacement pollution control devices

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Regulation (EC) No 595/2009 of the European Parliament and of the Council of 18 June 2009 on type-approval of motor vehicles and engines with respect to emissions from heavy-duty vehicles (Euro VI) and on access to vehicle repair and maintenance information and amending Regulation (EC) No 715/2007 and Directive 2007/46/EC and repealing Directives 80/1269/EEC, 2005/55/EC and 2005/78/EC ⁽¹⁾, and in particular Article 4(3), Article 5(4) and Article 12 thereof,

Whereas:

- (1) In-service conformity testing represents one of the building blocks of the type-approval procedure and allows for the verification of the performance of emission control systems during the useful lifetime of vehicles. In accordance with Commission Regulation (EU) No 582/2011 ⁽²⁾, the tests are performed by means of portable emission measurement systems (PEMS) which assess the emissions in the normal operations of use. The PEMS approach is equally applied to verify off-cycle emissions during the type-approval certification.
- (2) Regulation (EU) No 582/2011 states that any additional requirements with respect to the off-cycle in-use emissions testing procedure should be introduced after the assessment of the test procedure specified in that Regulation.
- (3) The Commission has therefore performed an in-depth analysis of the testing procedure. That analysis has identified a number of shortfalls which undermine the efficiency of the European type-approval legislation and need to be remedied in order to ensure the appropriate level of environmental protection.
- (4) Emission performance of vehicles in a warm-up period is currently not assessed under the type-approval demonstration test or under the in-service conformity test. In order to address the existing knowledge gap and to prepare a new testing procedure for cold start operations, a monitoring phase during which data from type-approval and in-service conformity tests will be collected should be launched.
- (5) In accordance with Regulation (EU) No 582/2011, replacement pollution control devices are to be type-approved in accordance with Euro VI emission requirements once the specific durability testing requirements are introduced in that Regulation.

⁽¹⁾ OJ L 188, 18.7.2009, p. 1.

⁽²⁾ Commission Regulation (EU) No 582/2011 of 25 May 2011 implementing and amending Regulation (EC) No 595/2009 of the European Parliament and of the Council with respect to emissions from heavy duty vehicles (Euro VI) and amending Annexes I and III to Directive 2007/46/EC of the European Parliament and of the Council (OJ L 167, 25.6.2011, p. 1).

- (6) It is therefore necessary to lay down a procedure which will properly assess the durability of those replacement parts entering the Union market and to ensure that they meet environmental requirements compatible with those set for similar systems produced as original vehicles' parts.
- (7) A test procedure based on the accelerated ageing of replacement pollution control devices due to thermal and lubricant consumption effects meets the objective of addressing durability of replacement pollution control devices in an accurate and objective manner and is not excessively burdensome for the industry.
- (8) Regulation (EU) No 582/2011 sets out requirements related to the measures that need to be introduced by vehicle manufacturers in order to prevent tampering with emission control systems. Those requirements should effectively address the most common means of tampering without imposing an excessive burden on the industry.
- (9) References to international standards in Regulation (EU) No 582/2011 should be updated.
- (10) In order to ensure a sufficient lead time for the vehicle manufacturers to modify their products in accordance with the new requirement on the power threshold, that requirement should take effect on 1 September 2018 for new types and on 1 September 2019 for all new vehicles.
- (11) It is appropriate that the new requirements for the in-service testing do not apply retroactively to engines and vehicles which have not been approved in accordance with those requirements. Therefore, the new provisions set out in Annex II shall only apply to the in-service conformity testing of new types of engines and vehicles which have been approved in accordance with the amended version of the Regulation (EU) No 582/2011.
- (12) Regulation (EU) No 582/2011 should therefore be amended accordingly.
- (13) The measures provided for in this Regulation are in accordance with the opinion of the Technical Committee — Motor vehicles,

HAS ADOPTED THIS REGULATION:

Article 1

Regulation (EU) No 582/2011 is amended as follows:

- (1) in Article 14, paragraph 3 is deleted;
- (2) in Article 15, paragraph 5 is deleted;
- (3) the following Article 17a is inserted:

'Article 17a

Transitional provisions for certain type-approvals and certificates of conformity

1. With effect from 1 September 2018, national authorities shall refuse, on grounds relating to emissions, to grant EC type-approval or national type-approval in respect of new types of vehicles or engines tested using procedures which do not comply with points 4.2.2.2 and 4.2.2.2.1 and 4.2.2.2.2 and 4.3.1.2 and 4.3.1.2.1 and 4.3.1.2.2 of Appendix 1 to Annex II.

2. With effect from 1 September 2019, national authorities shall, in the case of new vehicles which do not comply with points 4.2.2.2 and 4.2.2.2.1 and 4.2.2.2.2 and 4.3.1.2 and 4.3.1.2.1 and 4.3.1.2.2 of Appendix 1 to Annex II, consider certificates of conformity issued in respect of those vehicles to be no longer valid for the purposes of Article 26 of Directive 2007/46/EC and shall, on grounds relating to emissions, prohibit the registration, sale and entry into service of such vehicles.

With effect from 1 September 2019 and except in the case of replacement engines for in-service vehicles, national authorities shall prohibit the sale or use of new engines which do not comply with points 4.2.2.2 and 4.2.2.2.1 and 4.3.1.2 and 4.3.1.2.1 of Appendix 1 to Annex II.;

- (4) Annex I is amended in accordance with Annex I to this Regulation;
- (5) Annex II is amended in accordance with Annex II to this Regulation;
- (6) Annex VI is amended in accordance with Annex III to this Regulation;
- (7) Annex XI is amended in accordance with Annex IV to this Regulation;
- (8) Annex XIII is amended in accordance with Annex V to this Regulation;
- (9) Annex XIV is amended in accordance with Annex VI to this Regulation.

Article 2

This Regulation shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.

With the exception of point 8(c), which shall apply to all vehicles as from the entry into force of this Regulation, Annex II shall apply from 1 January 2017 to new vehicle types.

This Regulation shall be binding in its entirety and directly applicable in the Member States in accordance with the Treaties.

Done at Brussels, 20 September 2016.

For the Commission
The President
Jean-Claude JUNKER

ANNEX I

Annex I to Regulation (EU) No 582/2011 is amended as follows:

(1) point 1.1.2 is replaced by the following:

‘1.1.2. If the manufacturer permits the engine family to run on market fuels that do not comply neither with Directive 98/70/EC of the European Parliament and of the Council (*) nor with CEN standard EN 228:2012 (in the case of unleaded petrol) or CEN standard EN 590:2013 (in the case of diesel), such as running on B100 (EN 14214), the manufacturer shall, in addition to the requirements in point 1.1.1, comply with the following requirements:

- (a) declare the fuels the engine family is capable of running on in point 3.2.2.2.1 of the Information Document as set out in Part 1 of Appendix 4., either by reference to an official standard or to a production specification of a brand specific market fuel not meeting any official standard such as those mentioned in point 1.1.2. The manufacturer shall also declare that the functionality of the OBD system is not affected by the use of the declared fuel;
- (b) demonstrate that the parent engine meets the requirements specified in Annex III and in Appendix 1 of Annex VI to this Regulation on the fuels declared; the approval authority may request that the demonstration requirements be further extended to those laid down in Annex VII and Annex X;
- (c) be liable to meet the requirements of in-service conformity specified in Annex II on the fuels declared including any blend between the declared fuels and the market fuels included in Directive 98/70/EC and the relevant CEN standards.

At the request of the manufacturer, the requirements set out in this point shall be applied to fuels used for military purposes.

For the purposes of point (a) of the first subparagraph where the emission tests are performed for demonstrating compliance with the requirements of this Regulation, a fuel analysis report of the test fuel shall be attached to the test report and shall comprise at least the parameters specified in the official specification of the fuel manufacturer.

(*) Directive 98/70/EC of the European Parliament and of the Council of 13 October 1998 relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC (OJ L 350, 28.12.1998, p. 58).;

(2) point 1.1.5 is replaced by the following:

‘1.1.5. In the case of natural gas/biomethane engines, the ratio of the emission results “r” shall be determined for each pollutant as follows:

$$r = \frac{\text{emission result on reference fuel 2}}{\text{emission result on reference fuel 1}}$$

or

$$r_a = \frac{\text{emission result on reference fuel 2}}{\text{emission result on reference fuel 3}}$$

and

$$r_b = \frac{\text{emission result on reference fuel 1,}}{\text{emission result on reference fuel 3,}}$$

(3) point 3.1 is replaced by the following:

‘3.1. In the case of an engine type-approved as a separate technical unit or a vehicle type-approved with regard to emissions and access to vehicle repair and maintenance information, the engine shall bear:

- (a) the trademark or trade name of the manufacturer of the engine;
- (b) the manufacturer’s commercial description of the engine.’;

(4) the following points 3.2.1.1 to 3.2.1.6 are inserted:

‘3.2.1.1. In case of a natural gas/biomethane engine one of the following markings to be placed after the EC type-approval mark:

- (a) H in case of the engine being approved and calibrated for the H-range of gases;
- (b) L in case of the engine being approved and calibrated for the L-range of gases;
- (c) HL in case of the engine being approved and calibrated for both the H-range and L-range of gases;
- (d) H_t in case of the engine being approved and calibrated for a specific gas composition in the H-range of gases and transformable to another specific gas in the H-range of gases by fine tuning of the engine fuelling;
- (e) L_t in case of the engine being approved and calibrated for a specific gas composition in the L-range of gases and transformable to another specific gas in the L-range of gases after fine tuning of the engine fuelling;
- (f) HL_t in the case of the engine being approved and calibrated for a specific gas composition in either the H-range or the L- range of gases and transformable to another specific gas in either the H-range or the L-range of gases by fine tuning of the engine fuelling;
- (g) CNG_{fr} in all other cases where the engine is fuelled with CNG/biomethane and designed for operation on one restricted gas fuel range composition;
- (h) LNG_{fr} in the cases where the engine is fuelled with LNG and designed for operation on one restricted gas fuel range composition;
- (i) LPG_{fr} in the cases where the engine is fuelled with LPG and designed for operation on one restricted gas fuel range composition;
- (j) LNG_{20} in case of the engine being approved and calibrated for a specific LNG composition resulting in a λ -shift factor not differing by more than 3 per cent the λ -shift factor of the G_{20} gas specified in Annex IX, and the ethane content of which does not exceed 1,5 per cent;
- (k) LNG in case of the engine being approved and calibrated for any other LNG composition;

3.2.1.2. For dual-fuel engines, the approval mark shall contain a series of digits after the national symbol, the purpose of which is to distinguish for which dual-fuel engine type and with which range of gases the approval has been granted. The series of digits will be constituted of two digits identifying the dual-fuel engine type as defined in Article 2, followed by the letter or letters specified in point 3.2.1.1 corresponding to the natural gas/biomethane composition used by the engine. The two digits identifying the dual- fuel engine types as defined in Article 2 are the following:

- (a) 1A for dual-fuel engines of Type 1A;
- (b) 1B for dual-fuel engines of Type 1B;
- (c) 2A for dual-fuel engines of Type 2A;

- (d) 2B for dual-fuel engines of Type 2B;
 - (e) 3B for dual-fuel engines of Type 3B;
- 3.2.1.3. For diesel-fuelled CI engines, the approval mark shall contain the letter 'D' after the national symbol;
- 3.2.1.4. For ethanol (ED95)-fuelled CI engines the approval mark shall contain the letters 'ED' after the national symbol;
- 3.2.1.5. For ethanol (E85)-fuelled PI engines the approval mark shall contain 'E85' after the national symbol;
- 3.2.1.6. for petrol-fuelled PI engines the approval mark shall contain the letter 'P' after the national symbol.;
- (5) in point 4.2, point (b) is replaced by the following:
- '(b) as regards the compliance of the system ensuring the correct operation of NO_x control measures, the installation shall, according to Appendix 4 of Annex 11 to UN/ECE Regulation No 49, meet the manufacturer's installation requirements as specified in Part 1 of Annex 1 to that Regulation.';
- (6) in Appendix 4, the ninth, tenth and eleventh paragraphs are replaced by the following:
- 'In the case of application for EC type-approval of an engine or engine family as a separate technical unit the general part and Parts 1 and 3 shall be filled in.
- In the case of application for EC type-approval of vehicle with an approved engine with regard to emissions and access to vehicle repair and maintenance information the general part and Part 2 shall be filled in.
- In the case of application for EC type-approval of a vehicle with regard to emissions and access to vehicle repair and maintenance information the general part and Parts 1, 2 and 3 shall be filled in.';
- (7) Appendix 9 is replaced by the following:

'Appendix 9

EC Type-Approval Certification Numbering System

Section 3 of the EC type-approval number issued according to Articles 6(1), 8(1) and 10(1) shall be composed by the number of the implementing regulatory act or the latest amending regulatory act applicable to the EC type-approval. The number shall be followed by an alphabetical character reflecting the requirements of OBD and SCR systems in accordance with Table 1.

Table 1

Char-acter	NO _x OTL ⁽¹⁾	PM OTL ⁽²⁾	CO OTL ⁽⁶⁾	IUPR ⁽¹³⁾	Reagent quality	Additional OBD monitors ⁽¹²⁾	Power threshold require-ments ⁽¹⁴⁾	Implementation dates: new types	Implementation dates: all vehicles	Last date of registration
A ⁽⁹⁾ ⁽¹⁰⁾ B ⁽¹⁰⁾	Row “phase-in period” of Tables 1 or Table 2	Performance. Monitoring ⁽³⁾	N/A	Phase-in ⁽⁷⁾	Phase-in ⁽⁴⁾	N/A	20 %	31.12.2012	31.12.2013	31.8.2015 ⁽⁹⁾ 30.12.2016 ⁽¹⁰⁾
B ⁽¹¹⁾	Row “phase-in period” of Tables 1 and 2	N/A	Row “phase-in period” of Table 2	N/A	Phase-in ⁽⁴⁾	N/A	20 %	1.9.2014	1.9.2015	30.12.2016
C	Row “general requirements” of Tables 1 or Table 2	Row “general requirements” of Table 1	Row “general requirements” of Table 2	General ⁽⁸⁾	General ⁽⁵⁾	Yes	20 %	31.12.2015	31.12.2016	31.12.2018
D	Row “general requirements” of Tables 1 or Table 2	Row “general requirements” of Table 1	Row “general requirements” of Table 2	General ⁽⁸⁾	General ⁽⁵⁾	Yes	10 %	1.9.2018	1.9.2019	

Key:

- ⁽¹⁾ “NO_x OTL” monitoring requirements as set out in Table 1 of Annex X for compression ignition and dual-fuel engines and vehicles and Table 2 of Annex X for positive ignition engines and vehicles.
⁽²⁾ “PM OTL” monitoring requirements as set out in Table 1 of Annex X for compression ignition and dual-fuel engines and vehicles.
⁽³⁾ “Performance monitoring” requirements as set out in point 2.1.1 of Annex X.
⁽⁴⁾ Reagent quality “phase-in” requirements as set out in point 7.1 of Annex XIII.
⁽⁵⁾ Reagent quality “general” requirements as set out in point 7.1.1 of Annex XIII.
⁽⁶⁾ “CO OTL” monitoring requirements as set out in Table 2 of Annex X for positive ignition engines and vehicles.
⁽⁷⁾ IUPR “Phase-in” requirements as set out in Section 6 of Annex X.
⁽⁸⁾ IUPR “General” requirements as set out in Section 6 of Annex X.
⁽⁹⁾ For positive-ignition engines and vehicles equipped with such engines.
⁽¹⁰⁾ For compression-ignition and dual-fuel engines and vehicles equipped with such engines.
⁽¹¹⁾ Only applicable to positive-ignition engines and vehicles equipped with such engines.
⁽¹²⁾ Additional provisions concerning monitoring requirements as set out in paragraph 2.3.1.2 of Annex 9A to UNECE Regulation No 49.
⁽¹³⁾ IUPR specifications are set out in Annex X. Positive Ignition engines and vehicles equipped with such engines are not subjected to IUPR.
⁽¹⁴⁾ ISC requirement set out in Appendix 1 to Annex II.
N/A Not applicable.’.

ANNEX II

Annex II to Regulation (EU) No 582/2011 is amended as follows:

(1) point 2.1 is replaced by the following:

‘2.1. The conformity of in-service vehicles or engines of an engine family shall be demonstrated by testing vehicles on the road operated over their normal driving patterns, conditions and payloads. The in-service conformity test shall be representative for vehicles operated on their real driving routes, with their normal payload and with the usual professional driver of the vehicle. When the vehicle is operated by a driver other than the usual professional driver of the particular vehicle, the alternative driver shall be skilled and trained to operate vehicles of the category subject to be tested.’;

(2) point 2.3 is replaced by the following:

‘2.3. The manufacturer shall demonstrate to the approval authority that the chosen vehicle, driving patterns and conditions are representative for the engine family. The requirements as specified in point 4.5 shall be used to determine whether the driving patterns are acceptable for in-service conformity testing.’;

(3) point 4.1 is replaced by the following:

‘4.1. Vehicle payload

Normal payload is a payload between 10 and 100 % of the maximum payload.

The maximum payload is the difference between technically permissible maximum laden mass of the vehicle and the mass of the vehicle in running order as specified in accordance to Annex I to Directive 2007/46/EC.

For the purpose of in-service conformity testing, the payload may be reproduced and an artificial load may be used.

Approval authorities may request to test the vehicle with any payload between 10 and 100 % of the maximum vehicle payload. In case the mass of the PEMS equipment needed for operation exceeds 10 % of the maximum vehicle payload this mass may be considered as minimum payload.

Vehicles of category N₃ shall be tested, when applicable, with a semi-trailer.’;

(4) points 4.4.1 to 4.5.5 are replaced by the following:

‘4.4.1. The test lubricating oil shall be market oil and must comply with the specifications of the engine manufacturer.

Oil samples shall be taken.

4.4.2. Fuel

The test fuel shall be market fuel covered by Directive 98/70/EC and relevant CEN standards or reference fuel as specified in Annex IX to this Regulation. Fuel samples shall be taken.

A manufacturer may request not to sample the fuel from a gas engine.

4.4.2.1. If the manufacturer has, in accordance with Section 1 of Annex I to this Regulation, declared the capability to meet the requirements of this Regulation on market fuels declared in point 3.2.2.2.1 of the Information Document as set out in Appendix 4 to Annex I to this Regulation, at least one test shall be conducted on each of the declared market fuels.

4.4.3. For exhaust after-treatment systems that use a reagent to reduce emissions, the reagent shall be market reagent and must comply with the specifications of the engine manufacturer. A sample of the reagent shall be taken. The reagent shall not be frozen.

4.5. Trip requirements

The shares of operation shall be expressed as a percentage of the total trip duration.

The trip shall consist of urban driving followed by rural and motorway driving according to the shares specified in points 4.5.1 to 4.5.4. Where another testing order is justified for practical reasons and after the agreement of the approval authority another order may be used, however, the test shall always start with the urban driving.

For the purpose of this Section, 'approximately' shall mean the target value $\pm 5\%$.

Urban, rural and motorway parts can be determined either on the basis of:

- geographical coordinates (by means of a map), or
- first acceleration method.

In case the trip composition is determined on the basis of geographical coordinates, the vehicle should not exceed, for a cumulative period longer than 5 % of the total duration of each part of the trip, the following speed:

- 50 km/h in the urban part,
- 75 km/h in the rural part (90 km/h in the case of vehicles of categories M_1 and N_1)

In case the trip composition is determined by means of the first acceleration method, the first acceleration above 55 km/h (70 km/h in the case of vehicles of categories M_1 and N_1) shall indicate the beginning of the rural part and the first acceleration above 75 km/h (90 km/h in the case of vehicles of categories M_1 and N_1) shall indicate the beginning of the motorway part.

The criteria for differentiation between urban, rural and motorway operation shall be agreed with the approval authority prior to the beginning of the test.

Average speed in urban operation shall be between 15 and 30 km/h.

Average speed in rural operation shall be between 45 and 70 km/h (60 and 90 km/h in the case of vehicles of categories M_1 and N_1).

Average speed in motorway operation shall be above 70 km/h (90 km/h in the case of vehicles of categories M_1 and N_1).

- 4.5.1. For M_1 and N_1 vehicles the trip shall consist of approximately 34 % urban, 33 % rural and 33 % motorway operation.
- 4.5.2. For N_2 , M_2 and M_3 vehicles the trip shall consist of approximately 45 % urban, 25 % rural and 30 % motorway operation. M_2 and M_3 vehicles of Class I, II or Class A as defined in UN/ECE Regulation 107 shall be tested in approximately 70 % urban and 30 % rural operation.
- 4.5.3. For N_3 vehicles the trip shall consist of approximately 20 % urban, 25 % rural and 55 % motorway operation.
- 4.5.4. For the purpose of the assessment of the trip composition, the duration of the share shall be calculated from the moment when the coolant temperature has reached 343 K (70 °C) for the first time or after the coolant temperature is stabilised within ± 2 K over a period of 5 minutes whichever comes first but no later than 15 minutes after engine start. In accordance with paragraph 4.5 the period elapsed to reach the coolant temperature of 343 K (70 °C) shall be operated under urban driving conditions.

Artificial warming-up of the emission control systems prior to the test is prohibited.

4.5.5. The following distribution of the characteristic trip values from the WHDC database may serve as additional guidance for the evaluation of the trip:

- (a) accelerating: 26,9 % of the time;
- (b) decelerating: 22,6 % of the time;
- (c) cruising: 38,1 % of the time;
- (d) stop (vehicle speed = 0): 12,4 % of the time.;

(5) point 4.6.5 is replaced by the following:

‘4.6.5. The test duration shall be long enough to complete between four and seven times the work performed during the WHTC or produce between four and seven times the CO₂ reference mass in kg/cycle from the WHTC as applicable.;

(6) point 4.6.10 is replaced by the following:

‘4.6.10. If the particle exhaust after-treatment system undergoes a non-continuous regeneration event during the trip or an OBD class A or B malfunction occurs during the test, the manufacturer can request the trip to be voided.;

(7) point 5.1.2.2 is replaced by the following:

‘5.1.2.2. The conformity of the ECU torque signal is considered to be sufficient if the calculated torque remains within the full load torque tolerance specified in point 5.2.5 of Annex I.;

(8) Appendix 1 is amended as follows:

(a) point 1 is replaced by the following:

‘1. INTRODUCTION

This Appendix describes the procedure to determine gaseous emissions from on-vehicle on-road measurements using portable emissions measurement systems (hereinafter ‘PEMS’). The pollutant emissions to be measured from the exhaust of the engine include the following components: carbon monoxide, total hydrocarbons and nitrogen oxides for compression ignition engines and carbon monoxide, non-methane hydrocarbons, methane and nitrogen oxides for positive ignition engines. Additionally, carbon dioxide shall be measured to enable the calculation procedures described in Sections 4 and 5.

For engines fuelled with natural gas, the manufacturer, technical service or approval authority may choose to measure the total hydrocarbon (THC) emissions only instead of measuring the methane and non-methane hydrocarbon emissions. In that case, the emission limit for the total hydrocarbon emissions is the same as the one specified in Annex I to Regulation (EC) No 595/2009 for methane emissions. For the purposes of the calculation of the conformity factors pursuant to points 4.2.3 and 4.3.2, the applicable limit shall in that case be the methane emission limit only.

For engines fuelled with gases other than natural gas, the manufacturer, technical service or approval authority may choose to measure the total hydrocarbon (THC) emissions instead of measuring the non-methane hydrocarbon emissions. In that case, the emission limit for the total hydrocarbon emissions is the same as the one specified in Annex I to Regulation (EC) No 595/2009 for non-methane hydrocarbon emissions. For the purposes of the calculation of the conformity factors pursuant to points 4.2.3 and 4.3.2, the applicable limit shall in that case be the non-methane emission limit.;

(b) in point 2.2., the sentence ‘The parameters summarised in Table 1 shall be measured and recorded:’ is replaced by the following:

‘The parameters as specified in Table 1 shall be measured and recorded at a constant frequency of 1,0 Hz or higher. The original raw data shall be kept by the manufacturer and shall be made available, upon request, to the approval authority and the Commission.;

- (c) the following point 2.2.1 is inserted:

‘2.2.1. Data reporting format

Emission values as well as any other relevant parameters shall be reported and exchanged as csv-formatted data file. Parameter values shall be separated by a comma, ASCII-Code #h2C. The decimal marker of numerical values shall be a point, ASCII-Code #h2E. Lines shall be terminated by carriage return, ASCII-Code #h0D. No thousands separators shall be used.’;

- (d) points 2.6.1 and 2.6.2 are replaced by the following:

‘2.6.1. Test start

Emissions sampling, measurement of the exhaust parameters and recording of the engine and ambient data shall commence prior to starting the engine. The coolant temperature shall not exceed 303 K (30 °C) at the beginning of the test. In case ambient temperature exceeds 303 K (30 °C) at the beginning of the test, the coolant temperature shall not exceed the ambient temperature by more than 2 °C. The data evaluation shall start after the coolant temperature has reached 343 K (70 °C) for the first time or after the coolant temperature is stabilised within ± 2 K over a period of 5 minutes whichever comes first but no later than 15 minutes after engine start.

2.6.2. Test run

Emission sampling, measurement of the exhaust parameters and recording of the engine and ambient data shall continue throughout the normal in-use operation of the engine. The engine may be stopped and started, but emissions sampling shall continue throughout the entire test.

Periodic zero-checks of the PEMS gas analysers may be conducted every 2 hours and the results may be used to perform a zero drift correction. The data recorded during the checks shall be flagged and shall not be used for the emission calculations.

In case of interrupted GPS signal the GPS data may be calculated based on the ECU vehicle speed and a map, for a consecutive period of less than 60 s. If the cumulative loss of GPS signal exceeds 3 % of the total trip duration, the trip should be declared void.’;

- (e) point 3.2.1 is replaced by the following:

‘3.2.1. Analysers and EFM data

The consistency of the data (exhaust mass flow measured by the EFM and gas concentrations) shall be verified using a correlation between the measured fuel flow from the ECU and the fuel flow calculated using the formula in paragraph 8.4.1.7 of Annex 4 to UN/ECE Regulation No 49. A linear regression shall be performed for the measured and calculated fuel rate values. The method of least squares shall be used with the best fit equation having the form:

$$y = mx + b$$

where:

- y is the calculated fuel flow [g/s]
- m is the slope of the regression line
- x is the measured fuel flow [g/s]
- b is the y intercept of the regression line

The slope (m) and the coefficient of determination (r^2) shall be calculated for each regression line. It is recommended to perform this analysis in the range from 15 % of the maximum value to the maximum value and at a frequency greater or equal to 1 Hz. For a test to be considered valid, the following two criteria shall be evaluated:

Table 2

Tolerances

Slope of the regression line, m	0,9 to 1,1 — Recommended
Coefficient of determination r^2	min. 0,90 — Mandatory;

(f) point 4.1 is replaced by the following:

‘4.1. Averaging window principle

The emissions shall be integrated using a moving averaging window method, based on the reference CO₂ mass or the reference work. The principle of the calculation is as follows: The mass emissions are not calculated for the complete data set, but for sub-sets of the complete data set, the length of these sub-sets being determined so as to match the engine CO₂ mass or work measured over the reference laboratory transient cycle. The moving average calculations are conducted with a time increment Δt equal to the data sampling period. These sub-sets used to average the emissions data are referred to as “averaging windows” in the following points.

Any invalidated data shall not be considered for the calculation of the work or CO₂ mass and the emissions of the averaging window.

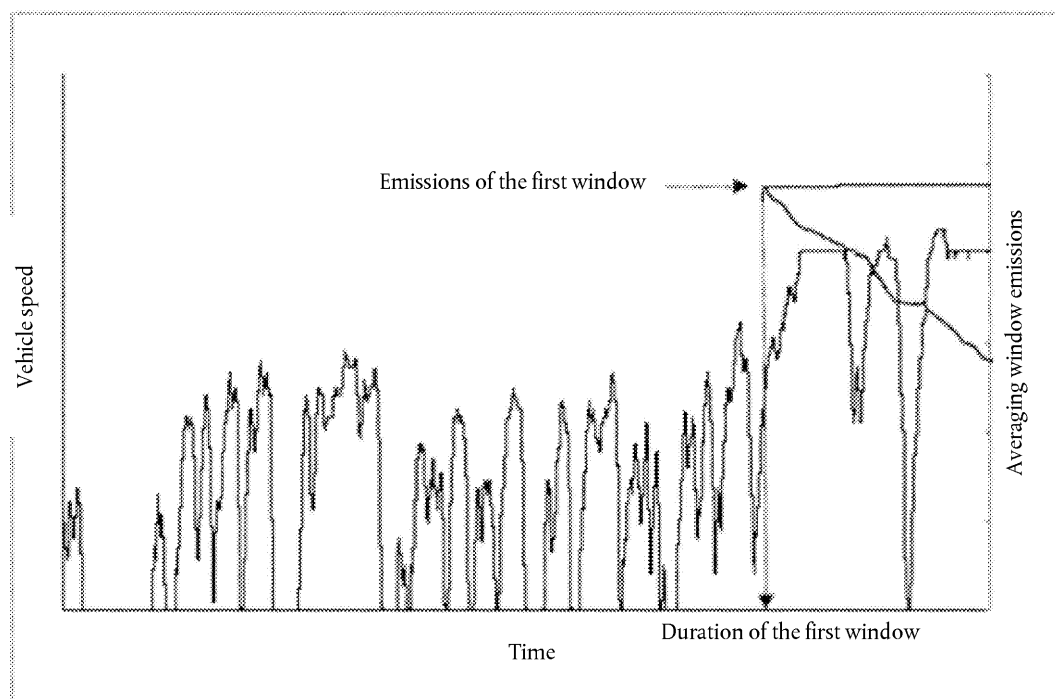
The following data shall be considered as not valid data:

- (a) zero drift check of the instruments;
- (b) the data outside the conditions specified in points 4.2 and 4.3 of Annex II.

The mass emissions (mg/window) shall be determined as described in paragraph 8.4.2.3 of Annex 4 to UN/ECE Regulation No 49.

Figure 1

Vehicle speed versus time and vehicle averaged emissions, starting from the first averaging window, versus time



(g) point 4.2.2 is replaced by the following:

4.2.2. Selection of valid windows

4.2.2.1. Before the dates referred to in Article 17a, points 4.2.2.1.1 to 4.2.2.1.4 shall apply.

4.2.2.1.1. The valid windows are the windows whose average power exceeds the power threshold of 20 % of the maximum engine power. The percentage of valid windows shall be equal or greater than 50 %.

4.2.2.1.2. If the percentage of valid windows is less than 50 %, the data evaluation shall be repeated using lower power thresholds. The power threshold shall be reduced in steps of 1 % until the percentage of valid windows is equal to or greater than 50 %.

4.2.2.1.3. In any case, the lower threshold shall not be lower than 15 %.

4.2.2.1.4. The test shall be void if the percentage of valid windows is less than 50 % at a power threshold of 15 %.

4.2.2.2. From the dates referred to in Article 17a, points 4.2.2.2.1 and 4.2.2.2.2 shall apply.

4.2.2.2.1. The valid windows are the windows whose average power exceeds the power threshold of 10 % of the maximum engine power.

4.2.2.2.2. The test shall be void if the percentage of valid windows is less than 50 % or if there are no valid windows left in urban only operations after the 90 percentile rule has been applied.;

(h) point 4.3.1 is replaced by the following:

4.3.1. Selection of valid windows

4.3.1.1. Before the dates referred to in Article 17a, points 4.3.1.1.1 to 4.3.1.1.4 shall apply.

- 4.3.1.1.1. The valid windows shall be the windows whose duration does not exceed the maximum duration calculated from:

$$D_{\max} = 3\,600 \cdot \frac{W_{\text{ref}}}{0,2 \cdot P_{\max}}$$

where:

- D max is the maximum window duration, s,
- P max is the maximum engine power, kW.

- 4.3.1.1.2. If the percentage of valid windows is less than 50 %, the data evaluation shall be repeated using longer window durations. This is achieved by decreasing the value of 0,2 in the formula given in point 4.3.1 by steps of 0,01 until the percentage of valid windows is equal to or greater than 50 %.

- 4.3.1.1.3. In any case, the lowered value in above formula shall not be lower than 0,15.

- 4.3.1.1.4. The test shall be void if the percentage of valid windows is less than 50 % at a maximum window duration calculated in accordance with points 4.3.1.1, 4.3.1.1.2 and 4.3.1.1.3.

- 4.3.1.2. From the dates referred to in Article 17a, points 4.3.1.2.1 and 4.3.1.2.2 shall apply.

- 4.3.1.2.1. The valid windows shall be the windows whose duration does not exceed the maximum duration calculated from:

$$D_{\max} = 3\,600 \cdot \frac{W_{\text{ref}}}{0,1 \cdot P_{\max}}$$

where:

- D max is the maximum window duration, s,
- P max is the maximum engine power, kW.

- 4.3.1.2.2. The test shall be void if the percentage of valid windows is less than 50 %;

(9) in Appendix 2, point 3.1 is replaced by the following:

‘3.1. Exhaust gas flow meter (EFM) tailpipe connection

The installation of the EFM shall not increase the backpressure by more than the value recommended by the engine manufacturer, nor increase the length of the tailpipe by more than 2 m. As for the all the components of the PEMS equipment, the installation of the EFM shall comply with the locally applicable road safety regulations and insurance requirements.’.

ANNEX III

Annex VI to Regulation (EU) No 582/2011 is amended as follows:

(1) point 8 is replaced by the following:

‘8. DOCUMENTATION

Paragraph 11 of Annex 10 to UNECE Regulation No 49 shall be understood as follows:

The Approval Authority shall require that the manufacturer provides a documentation package. This should describe any element of design and emission control strategy of the engine system and the means by which it controls its output variables, whether that control is direct or indirect.

The information shall include a full description of the emission control strategy. In addition, this shall include information on the operation of all AES and BES, including a description of the parameters that are modified by any AES and the boundary conditions under which the AES operate, and indication of which AES and BES are likely to be active under the conditions of the test procedures in this Annex.

This documentation package shall be provided in accordance with the provisions of Section 8 of Annex I to this Regulation.’

(2) Appendix 1 is amended as follows:

(a) the following point 2.3 is inserted

‘2.3. Manufacturers shall ensure that vehicles can be tested with PEMS by an independent party on public roads by making available suitable adapters for exhaust pipes, granting access to ECU signals and making the necessary administrative arrangements. The manufacturer may charge a reasonable fee as set out in Article 7(1) of Regulation (EC) No 715/2007.’;

(b) point 3.1 is replaced by the following:

‘3.1. Vehicle payload

For the purpose of the PEMS demonstration test, the payload may be reproduced and an artificial load may be used.

The vehicle payload shall be 50-60 % of the maximum vehicle payload. The additional requirements set out in Annex II shall apply.’.

ANNEX IV

Annex XI to Regulation (EU) No 582/2011 is amended as follows:

- (1) point 4.3.2.4 is replaced by the following:

‘4.3.2.4. Durability of emissions performance

The exhaust after-treatment system tested in accordance with point 4.3.2.2 and incorporating the replacement pollution control device shall be subjected to the durability procedures described in Appendix 3.’;

- (2) the following point 4.3.5 is inserted:

‘4.3.5. Fuels

In the case described in point 1.1.2 of Annex I, the test procedure laid down in points 4.3.1 to 4.3.2.7 of this Annex shall be conducted with the fuels declared by the manufacturer of the original engine system. However, in agreement with the type-approval authority, the durability procedure set out in Appendix 3 and referred to in point 4.3.2.4 may be performed only with the fuel which represents the worst case in terms of ageing.’;

- (3) the following points 4.6 to 4.6.5 are inserted:

‘4.6. Requirements regarding compatibility with the NO_x control measures (applicable only to replacement pollution control devices to be fitted to vehicles equipped with sensors directly measuring NO_x concentration in the exhaust)

4.6.1. NO_x control measures compatibility demonstration is required only when the original pollution control device was monitored in the original configuration.

4.6.2. The compatibility of the replacement pollution control device with the NO_x control measures shall be demonstrated by using the procedures described in Annex XIII to this Regulation, for replacement pollution control devices intended to be fitted to engines or vehicles type-approved in accordance with Regulation (EC) No 595/2009 and this Regulation.

4.6.3. The provisions in UN/ECE Regulation No 49 applicable to components other than pollution control devices shall not apply.

4.6.4. The replacement pollution control device manufacturer may use the same preconditioning and test procedure as used during the original type-approval. In that case, the approval authority which granted original type-approval of an engine of a vehicle shall provide, on request and on a non-discriminatory basis, an information document presented as an appendix to the Information Document provided for in Appendix 4 to Annex I, which contains the number and type of preconditioning cycles and the type of test cycle used by the original equipment manufacturer for NO_x control measures testing of the pollution control device.

4.6.5. Point 4.5.5 shall apply to NO_x control measures monitored by the OBD system.’;

- (4) Appendix 3 is replaced by the following:

‘Appendix 3

Durability procedure for evaluation of emissions performance of a replacement pollution control device

1. This Appendix sets out the durability procedure referred to in point 4.3.2.4 of Annex XI, for the purpose of evaluating the emissions performance of a replacement pollution control device.

2. DESCRIPTION OF THE DURABILITY PROCEDURE

2.1. The durability procedure shall consist of a data collection phase and a service accumulation schedule.

2.2. Data collection phase

2.2.1. The selected engine, equipped with the complete exhaust after-treatment system incorporating the replacement pollution control device, shall be cooled down to ambient temperature and run one cold start WHTC test-cycle in accordance with paragraphs 7.6.1 and 7.6.2 of Annex 4 to UN/ECE Regulation No 49.

2.2.2. Immediately after the cold start WHTC test-cycle, the engine shall be run for nine consecutive hot start WHTC test-cycles in accordance with paragraph 7.6.4 of Annex 4 to UN/ECE Regulation No 49.

2.2.3. The test sequence set out in points 2.2.1 and 2.2.2 shall be carried out in accordance with the instructions laid down in paragraph 7.6.5 of Annex 4 to UN/ECE Regulation No 49.

2.2.4. Alternatively, the relevant data can be collected by driving a fully loaded vehicle equipped with the selected exhaust after-treatment system incorporating the replacement pollution control device. The test can be carried out either on the road following the trip requirements of points 4.5 to 4.5.5 of Annex II to this Regulation with comprehensive recording of the driving data, or on a suitable chassis dynamometer. If an on-road test is chosen, the vehicle shall be driven over a cold test-cycle, as set out in Appendix 5 to this Annex, followed by nine hot test-cycles, identical to the cold one, in a way that the work developed by the engine is the same as the one achieved under points 2.2.1 and 2.2.2. If a chassis dynamometer is chosen, the simulated road gradient of the test-cycle in Appendix 5 shall be adapted to match the work developed by the engine over the WHTC.

2.2.5. The type-approval authority shall refuse the temperature data obtained under point 2.2.4 if it deems those data to be unrealistic and shall request either the repetition of the test, or the carrying out of a test pursuant to points 2.2.1, 2.2.2 and 2.2.3.

2.2.6. Temperatures in the replacement pollution control device shall be recorded during the whole test sequence, at the location with the highest temperature.

2.2.7. In cases where the location with the highest temperature varies over time, or where that location is difficult to define, multiple bed temperatures should be recorded at suitable locations.

2.2.8. The number and locations of the temperature measurements shall be selected by the manufacturer, in agreement with the type-approval authority, based on best engineering judgement.

2.2.9. With the agreement of the type-approval authority, a single catalyst bed temperature or the catalyst inlet temperature may be used if measuring multiple bed temperatures is proven to be unfeasible or too difficult.

Figure 1

Example of temperature sensors location in a generic after-treatment device

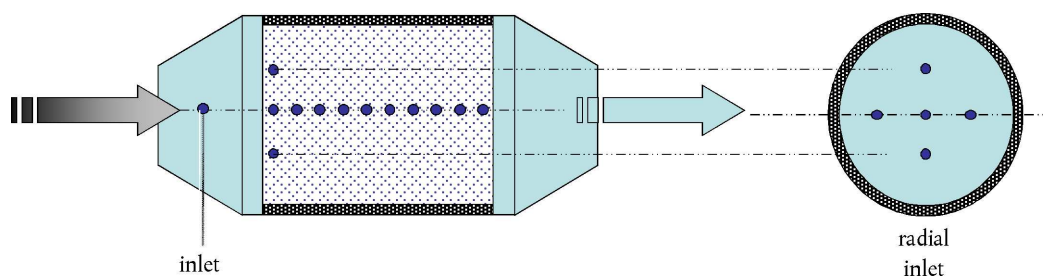
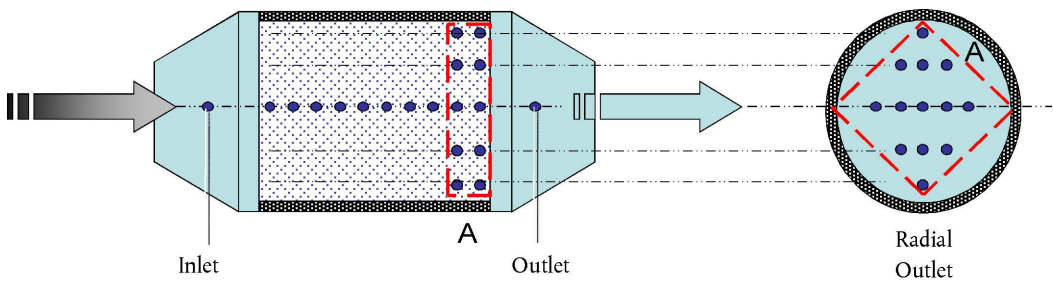


Figure 2

Example of temperature sensors location for DPF



- 2.2.10. The temperatures shall be measured and recorded at a minimum rate of once every second (1 Hz) during the test sequence.
- 2.2.11. The measured temperatures shall be tabulated into a histogram with temperature bins no larger than 10 °C. In the case mentioned in point 2.2.7, the highest temperature each second shall be the one recorded in the histogram. Each bar of the histogram shall represent the cumulated frequency in seconds of the measured temperatures falling in the specific bin.
- 2.2.12. The time in hours corresponding to each temperature bin must be determined and then extrapolated to the useful life of the replacement pollution control device, in accordance with the values specified in Table 1. The extrapolation shall be based on the assumption that one WHTC cycle corresponds to 20 km driving.

Table 1

Useful life of the replacement pollution control device for each vehicle category, and equivalent WHTC test-cycles and hours of operation

Vehicle category	Mileage (km)	Equivalent number of WHTC test-cycles	Equivalent number of hours
Engine systems fitted to vehicles of category M ₁ , N ₁ and N ₂	114 286	5 714	2 857
Engine systems fitted to vehicles of category N ₂ , N ₃ with a maximum technically permissible mass not exceeding 16 tonnes and M ₃ Class I, Class II and Class A, and Class B with a maximum technically permissible mass exceeding 7,5 tonnes	214 286	10 714	5 357
Engine systems fitted to vehicles of category N ₃ with a maximum technically permissible mass exceeding 16 tonnes, and M ₃ , Class III and Class B with a maximum technically permissible mass exceeding 7,5 tonnes	500 000	25 000	12 500

- 2.2.13. It is allowed to perform the data collection phase for different devices at the same time.
- 2.2.14. In the case of systems operating in the presence of active regeneration, the number, length and temperatures of the regenerations occurring during the test sequence defined in points 2.2.1 and 2.2.2 shall be recorded. If no active regeneration has occurred, the hot sequence defined in point 2.2.2 shall be extended in order to include at least two active regenerations.

2.2.15. The total lubricant consumed during the data collection period, in g/h, shall be recorded, using any suitable method, as for example the drain and weigh procedure described in Appendix 6. For this purpose, the engine shall be run during 24 hours, performing consecutive WHTC test-cycles. In cases where an accurate measurement of oil consumption cannot be obtained, the manufacturer, in agreement with the type-approval authority, may use the following options for the determination of the lubricant consumption:

- (a) a default value of 30 g/h;
- (b) a value requested by the manufacturer, based on sound data and information, and agreed with the type-approval authority.

2.3. Calculation of the equivalent ageing time corresponding to a reference temperature

2.3.1. The temperatures recorded pursuant to points 2.2 to 2.2.15 shall be reduced to a reference temperature T_r , requested by the manufacturer in agreement with the type-approval authority, within the range of the temperatures recorded during the data collection phase.

2.3.2. In the case specified in point 2.2.13, the value of T_r for each one of the devices may vary.

2.3.3. The equivalent ageing time corresponding to the reference temperature shall be calculated, for each bin referred to in 2.2.11, in accordance with the following equation:

Equation 1:

$$t_e^i = t_{bin}^i \times e^{\left(\left(\frac{R}{T_r} \right) - \left(\frac{R}{T_{bin}^i} \right) \right)}$$

Where:

R = thermal reactivity of the replacement pollution control device.

The following values shall be used:

- Diesel oxidation catalyst (DOC): 18 050
- Catalysed DPF: 18 050
- SCR or ammonia oxidation catalyst (AMOX) based on iron-zeolite (Fe-Z): 5 175
- SCR copper-zeolite (Cu-Z): 11 550
- SCR Vanadium (V): 5 175
- LNT (lean- NO_x trap): 18 050

T_r = reference temperature, in K.

T_{bin}^i = mid-point temperature, in K, of the temperature bin i to which the replacement pollution control device is exposed during the data collection phase, registered in the temperature histogram.

t_{bin}^i = the time, in hours, corresponding to the temperature T_{bin}^i , adjusted to a full useful life basis e.g. if the histogram represented 5 hours, and useful life is 4 000 hours according to Table 1, all histogram time entries would be multiplied by $\frac{4\,000}{5} = 800$.

t_e^i = the equivalent ageing time, in hours, needed to achieve, by exposing the replacement pollution control device at the temperature T_r , the same amount of ageing as the one that would result from exposure of the replacement pollution control device at the temperature T_{bin}^i during the time t_{bin}^i .

i = bin number, where 1 is number for the bin with the lowest temperature and n the value for the bin with the highest temperature.

- 2.3.4. The total equivalent ageing time shall be calculated in accordance with the following equation:

Equation 2:

$$AT = \sum_{i=1}^n t_e^i$$

Where:

AT = total equivalent ageing time, in hours, needed to achieve, by exposing the replacement pollution control device at the temperature T_p , the same amount of ageing as the one that would result from exposure of the replacement pollution control device, over its useful life, to the temperature T_{bin}^i during the time t_{bin}^i of each one of the i bins registered in the histogram.

t_e^i = the equivalent ageing time, in hours, needed to achieve, by exposing the replacement pollution control device at the temperature T_p , the same amount of ageing as the one that would result from exposure of the replacement pollution control device at the temperature T_{bin}^i during the time t_{bin}^i .

i = bin number, where 1 is number for the bin with the lowest temperature and n the value for the bin with the highest temperature.

n = Total number of temperature bins.

- 2.3.5. In the case referred to in point 2.2.13, AT shall be calculated for each device.

2.4. Service accumulation schedule

2.4.1. General requirements

- 2.4.1.1. The service accumulation schedule shall allow acceleration of the ageing of the replacement pollution control device, using the information gathered during the data collection phase set out in point 2.2.

- 2.4.1.2. The service accumulation schedule shall consist of a thermal accumulation schedule and a lubricant consumption accumulation schedule in accordance with point 2.4.4.6. The manufacturer, in agreement with the type-approval authority, may not have to carry out a lubricant consumption accumulation schedule in case the replacement pollution control devices are placed downstream of an after-treatment filter component (e.g. diesel particulate filter). Both the thermal accumulation schedule and the lubricant consumption accumulation schedule shall consist of a repetition of, respectively, a series of thermal and lubricant consumption sequences.

- 2.4.1.3. In the case of replacement pollution control devices operating in the presence of active regeneration, the thermal sequence shall be complemented with an active regeneration mode.

- 2.4.1.4. For service accumulation schedules consisting of both thermal and lubricant consumption accumulation schedules, their respective sequences shall be alternated, so that for each thermal sequence that has to be performed, the following sequence corresponds to lubricant consumption.

- 2.4.1.5. It is allowed to perform the service accumulation schedule at the same time for different devices. In that case, a single service accumulation schedule shall be set for all the devices.

2.4.2. Thermal accumulation schedule

- 2.4.2.1. The thermal accumulation schedule shall simulate the effect of thermal ageing on the performance of a replacement pollution control device until the end of its lifetime.

- 2.4.2.2. The engine used for the performance of the service accumulation schedule, fitted with the exhaust after-treatment system incorporating the replacement pollution control device, is operated for a minimum of three consecutive thermal sequences, as set out in Appendix 4.

- 2.4.2.3. The temperatures shall be recorded over a minimum of two thermal sequences. The first sequence, conducted for warming up, shall not be taken into account for the purpose of temperature gathering.
- 2.4.2.4. The temperatures shall be recorded at suitable locations, chosen in accordance with points 2.2.6 to 2.2.9, at a minimum rate of once every second (1 Hz).
- 2.4.2.5. The effective ageing time corresponding to the thermal sequences referred to in point 2.4.2.3, shall be calculated in accordance with the following equations:

Equation 3:

$$t_e^i = \frac{\sum_{n_c=1}^C e^{\left(\left(\frac{R}{T_r}\right) - \left(\frac{R}{T_i}\right)\right)}}{C}$$

Equation 4:

$$AE = \sum_{i=1}^p t_e^i$$

Where:

t_e^i = the effective ageing time, in hours, needed to achieve, by exposing the replacement pollution control device at the temperature T_r , the same amount of ageing as the one that would result from exposure of the replacement pollution control device at the temperature T_i during the second i .

T_i = the temperature, in K, measured in the second i , in each one of the thermal sequences.

R = thermal reactivity of the replacement pollution control device. The manufacturer shall agree with the type-approval authority on the R value to be used. It will also be possible, as alternative, to use the following default values:

- Diesel oxidation catalyst (DOC): 18 050.
- Catalysed DPF: 18 050
- SCR or ammonia oxidation catalyst (AMOX) based on iron-zeolite (Fe-Z): 5 175
- SCR copper-zeolite (Cu-Z): 11 550
- SCR Vanadium (V): 5 175
- LNT (lean-NO_x trap): 18 050

T_r = reference temperature, in K, being the same value as in equation 1.

AE = Effective ageing time, in hours, needed to achieve, by exposing the replacement pollution control device at the temperature T_r , the same amount of ageing as the one that would result from exposure of the replacement pollution control device during the duration of the thermal sequence.

AT = total equivalent ageing time, in hours, needed to achieve, by exposing the replacement pollution control device at the temperature T_r , the same amount of ageing as the one that would result from exposure of the replacement pollution control device, over its useful life, to the temperature T_{bin}^i during the time t_{bin}^i of each one of the i bins registered in the histogram.

i = number of temperature measurement.

p = total number of temperature measurements.

n_c = thermal sequence number, of those conducted for the purpose of temperature gathering, in accordance with point 2.4.2.3.

C = total number of thermal sequences conducted for the purpose of temperature gathering.

- 2.4.2.6. The total number of thermal sequences to be included in the service accumulation schedule shall be determined by applying the following equation:

Equation 5:

$$N_{TS} = AT/AE$$

Where:

N_{TS} = total number of thermal sequences to be carried out during the service accumulation schedule

AT = total equivalent ageing time, in hours, needed to achieve, by exposing the replacement pollution control device at the temperature T_p , the same amount of ageing as the one that would result from exposure of the replacement pollution control device, over its useful life, to the temperature T_{bin}^i during the time t_{bin}^i of each one of the i bins registered in the histogram.

AE = Effective ageing time, in hours, needed to achieve, by exposing the replacement pollution control device at the temperature T_p , the same amount of ageing as the one that would result from exposure of the replacement pollution control device during the duration of the thermal sequence.

- 2.4.2.7. It is allowed to reduce N_{TS} and, consequently the service accumulation schedule, by increasing the temperatures at which each device is exposed at each mode of the ageing cycle through the application of one or several of the following measures:

- (a) insulating the exhaust pipe;
- (b) moving the replacement pollution control device closer to the exhaust manifold;
- (c) artificially heating up the temperature of the exhaust;
- (d) optimising the engine settings without substantially changing the emission behaviour of the engine.

- 2.4.2.8. When applying the measures referred to in points 2.4.4.6 and 2.4.4.7, the total ageing time calculated from N_{TS} shall not be less than 10 % of the useful life listed in Table 1, e.g. the vehicle category N_1 shall not have an N_{TS} of less than 286 thermal sequences, assuming that each sequence is 1 hour long.

- 2.4.2.9. It is allowed to increase N_{TS} and, consequently, the duration of the service accumulation schedule, by lowering the temperatures at each mode of the ageing cycle through the application of one or several of the following measures:

- (a) moving the replacement pollution control device further away from the exhaust manifold;
- (b) artificially cooling down the temperature of the exhaust;
- (c) optimising the engine settings.

- 2.4.2.10. In the case referred to in point 2.4.1.5, the following shall apply:

- 2.4.2.10.1. N_{TS} shall be the same for each device, so that a single service accumulation schedule can be set up.
- 2.4.2.10.2. In order to achieve the same N_{TS} for each device, a first N_{TS} value shall be calculated for each device, with its own AT and AE values.
- 2.4.2.10.3. If the calculated N_{TS} values are different, one or more of the measures set out in points 2.4.2.7 to 2.4.2.10 may be applied on the device or devices for which N_{TS} needs to be modified, over the thermal sequences referred to in point 2.4.2.3, in order to influence the measured T_i and therefore conveniently speed up or slow down the artificial ageing of the targeted device or devices.
- 2.4.2.10.4. The new N_{TS} values corresponding to the new temperatures T_i obtained in point 2.4.2.10.3 shall be calculated.

- 2.4.2.10.5. The steps set out in points 2.4.2.10.3 and 2.4.2.10.4 shall be repeated until the N_{TS} values obtained for each device in the system match.
- 2.4.2.10.6. The T_r values used for obtaining the different N_{TS} in points 2.4.2.10.4 and 2.4.2.10.5 shall be the same ones as those used in points 2.3.2 and 2.3.5 for calculating AT for each device.
- 2.4.2.11. In the case of an assembly of replacement pollution control devices constituting a system within the meaning of Article 3(25) of Directive 2007/46/EC, one of the following two options may be considered for the thermal ageing of the devices:
- 2.4.2.11.1. The devices within the assembly may be either separately or jointly aged, in accordance with point 2.4.2.10.
- 2.4.2.11.2. If the assembly is built in such a way that it is not possible to decouple the devices (e.g. DOC + SCR in a can), the thermal ageing of the assembly shall be carried out with the highest N_{TS} .
- 2.4.3. Modified thermal accumulation schedule for devices operating in the presence of active regeneration
- 2.4.3.1. The modified thermal accumulation schedule for devices operating in the presence of active regeneration shall simulate the effect of ageing due to both thermal load and active regeneration on a replacement pollution control device at the end of its lifetime.
- 2.4.3.2. The engine used for the service accumulation schedule, fitted with the exhaust after-treatment system incorporating the replacement pollution control device, is operated for a minimum of three modified thermal sequences, consisting each sequence of a thermal sequence as set out in Appendix 4, followed by a complete active regeneration, during which the peak temperature reached in the after-treatment system should be not lower than the peak temperature recorded in the data collection phase.
- 2.4.3.3. The temperatures shall be recorded over a minimum of two modified thermal sequences. The first sequence, conducted for warming up, shall not be taken into account for the purpose of temperature gathering.
- 2.4.3.4. In order to minimise the time elapsed between the thermal sequence as set out in Appendix 4 and the subsequent active regeneration, the manufacturer may artificially trigger the active regeneration by running, after each thermal sequence as set out in Appendix 4, the engine at a steady mode that enables a high production of soot by the engine. In that case, the steady mode shall also be considered as part of the modified thermal sequence set out in point 2.4.3.2.
- 2.4.3.5. The effective ageing time corresponding to each modified thermal sequence shall be calculated using equations 3 and 4.
- 2.4.3.6. The total number of modified thermal sequences to be conducted during the service accumulation schedule shall be calculated using equation 5.
- 2.4.3.7. It is allowed to reduce N_{TS} , and consequently the duration of the service accumulation schedule, by increasing the temperatures at each mode of the modified thermal sequence, applying one or several of the measures set out in point 2.4.2.7.
- 2.4.3.8. In addition to the measures referred to in point 2.4.3.7, N_{TS} can also be reduced by increasing the peak temperature of the active regeneration within the modified thermal sequence, without exceeding a bed temperature of 800 °C under any circumstances.
- 2.4.3.9. N_{TS} shall never be less than 50 % of the number of active regenerations to which the replacement pollution control device is subjected during its useful life, calculated in accordance with the following equation:

Equation 5:

$$N_{AR} = \frac{t_{WHTC}}{t_{AR} + t_{BAR}}$$

Where:

N_{AR} = number of active regeneration sequences over the useful life of the replacement pollution control device.

t_{WHTC} = equivalent number of hours corresponding to the vehicle category for which the replacement pollution control device is intended, obtained from Table 1.

t_{AR} = duration, in hours, of an active regeneration.

t_{BAR} = time, in hours, between two consecutive active regenerations.

- 2.4.3.10. If, as consequence of the application of the minimum number of modified thermal sequences as set out in point 2.4.3.9, $AE \times N_{TS}$ calculated using equation 4 exceeds the AT calculated using equation 2, the time of each mode of the thermal sequence set out in Appendix 4, and embedded in the modified thermal sequence as set out in point 2.4.3.2, may be reduced in the same proportion, in order to make $AE \times N_{TS} = AT$.
- 2.4.3.11. It is allowed to increase N_{TS} and consequently the duration of the service accumulation schedule, by lowering the temperatures at each mode of the thermal-active regeneration sequence by applying one or several of the measures set out in point 2.4.2.9.
- 2.4.3.12. In the case referred to in point 2.4.1.5, points 2.4.2.10 and 2.4.2.11 shall apply
- 2.4.4. Lubricant consumption accumulation schedule
- 2.4.4.1. The lubricant consumption accumulation schedule shall simulate the effect of ageing due to chemical poisoning or deposit formation as a result of lubricant consumption, on the performance of a replacement pollution control device at the end of its lifetime.
- 2.4.4.2. The lubricant consumed, in g/h, shall be determined over a minimum of 24 thermal sequences or a corresponding number of modified thermal sequences, using any suitable method, as for example the drain and weigh procedure described in Appendix 6. Fresh lubricant shall be used.
- 2.4.4.3. The engine shall be equipped with a constant volume oil sump in order to avoid the need of “top-offs”, since oil level influences the oil consumption rate. Any suitable method, as for example the one described in the ASTM standard D7156-09, may be used.
- 2.4.4.4. The theoretical time, in hours, that the thermal accumulation schedule or modified thermal accumulation schedule, as it corresponds, would have to be conducted, in order to obtain the same lubricant consumption as the one corresponding to the useful life of the replacement control device, shall be calculated by applying the following equation:

Equation 6:

$$t_{TAS} = \frac{LCR_{WHTC} \times t_{WHTC}}{LCR_{TAS}}$$

Where:

t_{TAS} = theoretical duration, in hours, of the service accumulation schedule required to obtain the same lubricant consumption as the one corresponding to the useful life of the replacement pollution control device, provided that the service accumulation schedule is only made up of a series of consecutive thermal sequences or consecutive modified thermal sequences.

LCR_{WHTC} = lubricant consumption rate, in g/h determined as set out in point 2.2.15.

t_{WHTC} = equivalent number of hours corresponding to the vehicle category for which the replacement pollution control device is intended, obtained from Table 1.

LCR_{TAS} = lubricant consumption rate, in g/h, determined as set out in point 2.4.4.2.

- 2.4.4.5. The number of thermal sequences or modified thermal sequences corresponding to t_{TAS} shall be calculated by applying the following ratio:

Equation 7:

$$N = \frac{t_{TAS}}{T_{TS}}$$

Where:

N = number of thermal sequences or modified thermal sequences corresponding to t_{TAS} .

t_{TAS} = theoretical duration, in hours, of the service accumulation schedule required to obtain the same lubricant consumption as the one corresponding to the useful life of the replacement pollution control device, provided that the service accumulation schedule was only made up of a series of consecutive thermal sequences or consecutive modified thermal sequences.

t_{TS} = duration, in hours, of a single thermal sequence or modified thermal sequence.

- 2.4.4.6. The value of N shall be compared to the value of N_{TS} calculated in accordance with point 2.4.2.6 or, for devices operating in the presence of active regeneration, in accordance with point 2.4.3.5. If $N \leq N_{TS}$, it is not necessary to add a lubricant consumption accumulation schedule to the thermal accumulation schedule. If $N > N_{TS}$, a lubricant consumption accumulation schedule shall be added to the thermal accumulation schedule.
- 2.4.4.7. A lubricant consumption accumulation schedule may not have to be added if, by increasing the lubricant consumption as described in point 2.4.4.8.4, the needed lubricant consumption is already achieved with the conduction of the corresponding thermal accumulation schedule consisting of the performance of N_{TS} thermal sequences or modified thermal sequences.
- 2.4.4.8. Development of the lubricant consumption accumulation schedule
- 2.4.4.8.1. The lubricant consumption accumulation schedule shall consist of a number of lubricant consumption sequences repeated several times, each lubricant consumption sequence being alternated with each thermal sequence or each modified thermal sequence.
- 2.4.4.8.2. Each lubricant consumption sequence shall consist of a steady mode at constant load and speed, the load and the speed being selected in such a way that the lubricant consumption is maximised and effective thermal aging is minimised. The mode shall be determined by the manufacturer in agreement with the type-approval authority, based on best engineering judgement.
- 2.4.4.8.3. The duration of each lubricant consumption sequence shall be determined as follows:
- 2.4.4.8.3.1. The engine shall be run for an appropriate period of time at the load and speed determined by the manufacturer in accordance with point 2.4.4.8.2 and the lubricant consumed, in g/h, shall be determined using any suitable method, as for example the drain and weigh procedure described in Appendix 6. Lubricant changes are to be completed at the recommended intervals.
- 2.4.4.8.3.2. The duration of each lubricant consumption sequence shall be calculated by applying the following equation:

Equation 8:

$$t_{LS} = \frac{LCR_{WHIC} \times t_{WHIC} - LCR_{TAS} \times N_{TS} \times t_{TS}}{LCR_{LAS} \times N_{TS}}$$

Where:

t_{LS} = the duration, in hours, of a single lubricant consumption sequence

LCR_{WHTC} = lubricant consumption rate, in g/h determined as set out in point 2.2.15.

t_{WHTC} = equivalent number of hours corresponding to the vehicle category for which the replacement pollution control device is intended, obtained from Table 1.

LCR_{TAS} = lubricant consumption rate, in g/h, determined as set out in point 2.4.4.2.

LCR_{LAS} = lubricant consumption rate, in g/h, determined as set out in point 2.4.4.8.3.1.

t_{TS} = duration, in hours, of a single thermal sequence, as set out in Appendix 4, or modified thermal sequence, as set out in point 2.4.3.2.

N_{TS} = total number of thermal sequences or modified thermal sequences to be carried out during the service accumulation schedule.

2.4.4.8.4. The lubricant consumption rate shall always remain below 0,5 % of the engine fuel consumption rate in order to avoid excessive ash accumulation on the front face of the replacement pollution control device.

2.4.4.8.5. It is allowed to add the thermal ageing due to the conduction of the lubricant consumption sequence to the AE calculated in equation 4.

2.4.5. Development of the complete service accumulation schedule

2.4.5.1. The service accumulation schedule shall be built up alternating a thermal or a modified thermal sequence, as appropriate, with a lubricant consumption sequence. The aforementioned pattern shall be repeated N_{TS} times, being the N_{TS} value the one calculated either in accordance with Section 2.4.2 or with Section 2.4.3, as appropriate. An example of a complete service accumulation schedule is given in Appendix 7. A flowchart describing the development of a complete service accumulation schedule is given in Appendix 8.

2.4.6. Operation of the service accumulation schedule

2.4.6.1. The engine, fitted with the exhaust after-treatment system incorporating the replacement pollution control device, shall run the service accumulation schedule set out in point 2.4.5.1.

2.4.6.2. The engine used for the performance of the service accumulation schedule may be different to the engine used in the data collection phase, being the latter always the one for which the replacement pollution control device to be type-approved has been designed, and the one to be tested for emissions under point 2.4.3.2.

2.4.6.3. If the engine used for the performance of the service accumulation schedule features a larger displacement by 20 % or more than the engine used in the data collection phase, the exhaust system of the former should be equipped with a by-pass in order to replicate as closely as possible the exhaust flow rate of the latter at the ageing conditions selected.

2.4.6.4. In the case referred to in point 2.4.6.2, the engine used for the performance of the service accumulation schedule shall be type-approved under Regulation (EC) No 595/2009. In addition, if the device or devices under test are intended for being fitted in an engine system with exhaust gas recirculation (EGR), the engine system used for the service accumulation schedule shall also be fitted with an EGR. If the device or devices under test are intended for not being fitted in an engine system with EGR, the engine system used for the service accumulation schedule shall also not be fitted with an EGR.

2.4.6.5. The lubricant and the fuel used in the service accumulation schedule shall be as similar as possible to those used during the data collection phase set out in point 2.2. The lubricant must be in line with the recommendation of the engine manufacturer for which the pollution control device is designed. The fuels used should be market fuels fulfilling the corresponding requirements of Directive 98/70/EC. On the request of the manufacturer also reference fuels in accordance with this Regulation can be used.

2.4.6.6. The lubricant shall be changed for maintenance, at the intervals scheduled by the manufacturer of the engine used in the data collection phase.

2.4.6.7. In the case of an SCR, the urea injection shall be performed in accordance with the strategy defined by the manufacturer of the replacement pollution control device.;

(5) the following Appendices 4 to 8 are added:

Appendix 4

Sequence for thermal ageing

Mode	Speed (% of high idle)	Load (% for a given speed)	Time (s)
1	2,92	0,58	626
2	45,72	1,58	418
3	38,87	3,37	300
4	20,23	11,36	102
5	11,37	14,90	62
6	32,78	18,52	370
7	53,12	20,19	410
8	59,53	34,73	780
9	78,24	54,38	132
10	39,07	62,85	212
11	47,82	62,94	188
Regeneration mode (if applicable)	To be defined (see point 2.4.3.4)	To be defined (see point 2.4.3.4)	To be defined (see point 2.4.3.4)
Lubricant consumption mode (if applicable)	To be defined according to point 2.4.4.8.2	To be defined according to point 2.4.4.8.2	To be defined according to point 2.4.4.8.3

Note: The sequence of the modes 1 to 11 has been arranged by ascending load in order to maximise the temperature of the exhaust gas in the high load modes. With the agreement of the type-approval authority, this order can be modified in order to optimise the temperature of the exhaust gas if this can help in reducing the actual aging time.

Appendix 5

Test-cycle for chassis dynamometer or on-road data gathering

Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed
s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h
1	0	261	22,38	521	35,46	781	18,33	1 041	39,88	1 301	66,39	1 561	86,88
2	0	262	24,75	522	36,81	782	18,31	1 042	41,25	1 302	66,74	1 562	86,7
3	0	263	25,55	523	37,98	783	18,05	1 043	42,07	1 303	67,43	1 563	86,81
4	0	264	25,18	524	38,84	784	17,39	1 044	43,03	1 304	68,44	1 564	86,81
5	0	265	23,94	525	39,43	785	16,35	1 045	44,4	1 305	69,52	1 565	86,81
6	0	266	22,35	526	39,73	786	14,71	1 046	45,14	1 306	70,53	1 566	86,81
7	2,35	267	21,28	527	39,8	787	11,71	1 047	45,44	1 307	71,47	1 567	86,99
8	5,57	268	20,86	528	39,69	788	7,81	1 048	46,13	1 308	72,32	1 568	87,03
9	8,18	269	20,65	529	39,29	789	5,25	1 049	46,79	1 309	72,89	1 569	86,92
10	9,37	270	20,18	530	38,59	790	4,62	1 050	47,45	1 310	73,07	1 570	87,1
11	9,86	271	19,33	531	37,63	791	5,62	1 051	48,68	1 311	73,03	1 571	86,85
12	10,18	272	18,23	532	36,22	792	8,24	1 052	50,13	1 312	72,94	1 572	87,14
13	10,38	273	16,99	533	34,11	793	10,98	1 053	51,16	1 313	73,01	1 573	86,96
14	10,57	274	15,56	534	31,16	794	13,15	1 054	51,37	1 314	73,44	1 574	86,85
15	10,95	275	13,76	535	27,49	795	15,47	1 055	51,3	1 315	74,19	1 575	86,77
16	11,56	276	11,5	536	23,63	796	18,19	1 056	51,15	1 316	74,81	1 576	86,81
17	12,22	277	8,68	537	20,16	797	20,79	1 057	50,88	1 317	75,01	1 577	86,85
18	12,97	278	5,2	538	17,27	798	22,5	1 058	50,63	1 318	74,99	1 578	86,74
19	14,33	279	1,99	539	14,81	799	23,19	1 059	50,2	1 319	74,79	1 579	86,81
20	16,38	280	0	540	12,59	800	23,54	1 060	49,12	1 320	74,41	1 580	86,7
21	18,4	281	0	541	10,47	801	24,2	1 061	48,02	1 321	74,07	1 581	86,52
22	19,86	282	0	542	8,85	802	25,17	1 062	47,7	1 322	73,77	1 582	86,7
23	20,85	283	0,5	543	8,16	803	26,28	1 063	47,93	1 323	73,38	1 583	86,74
24	21,52	284	0,57	544	8,95	804	27,69	1 064	48,57	1 324	72,79	1 584	86,81
25	21,89	285	0,6	545	11,3	805	29,72	1 065	48,88	1 325	71,95	1 585	86,85
26	21,98	286	0,58	546	14,11	806	32,17	1 066	49,03	1 326	71,06	1 586	86,92

Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed
s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h
27	21,91	287	0	547	15,91	807	34,22	1 067	48,94	1 327	70,45	1 587	86,88
28	21,68	288	0	548	16,57	808	35,31	1 068	48,32	1 328	70,23	1 588	86,85
29	21,21	289	0	549	16,73	809	35,74	1 069	47,97	1 329	70,24	1 589	87,1
30	20,44	290	0	550	17,24	810	36,23	1 070	47,92	1 330	70,32	1 590	86,81
31	19,24	291	0	551	18,45	811	37,34	1 071	47,54	1 331	70,3	1 591	86,99
32	17,57	292	0	552	20,09	812	39,05	1 072	46,79	1 332	70,05	1 592	86,81
33	15,53	293	0	553	21,63	813	40,76	1 073	46,13	1 333	69,66	1 593	87,14
34	13,77	294	0	554	22,78	814	41,82	1 074	45,73	1 334	69,26	1 594	86,81
35	12,95	295	0	555	23,59	815	42,12	1 075	45,17	1 335	68,73	1 595	86,85
36	12,95	296	0	556	24,23	816	42,08	1 076	44,43	1 336	67,88	1 596	87,03
37	13,35	297	0	557	24,9	817	42,27	1 077	43,59	1 337	66,68	1 597	86,92
38	13,75	298	0	558	25,72	818	43,03	1 078	42,68	1 338	65,29	1 598	87,14
39	13,82	299	0	559	26,77	819	44,14	1 079	41,89	1 339	63,95	1 599	86,92
40	13,41	300	0	560	28,01	820	45,13	1 080	41,09	1 340	62,84	1 600	87,03
41	12,26	301	0	561	29,23	821	45,84	1 081	40,38	1 341	62,21	1 601	86,99
42	9,82	302	0	562	30,06	822	46,4	1 082	39,99	1 342	62,04	1 602	86,96
43	5,96	303	0	563	30,31	823	46,89	1 083	39,84	1 343	62,26	1 603	87,03
44	2,2	304	0	564	30,29	824	47,34	1 084	39,46	1 344	62,87	1 604	86,85
45	0	305	0	565	30,05	825	47,66	1 085	39,15	1 345	63,55	1 605	87,1
46	0	306	0	566	29,44	826	47,77	1 086	38,9	1 346	64,12	1 606	86,81
47	0	307	0	567	28,6	827	47,78	1 087	38,67	1 347	64,73	1 607	87,03
48	0	308	0	568	27,63	828	47,64	1 088	39,03	1 348	65,45	1 608	86,77
49	0	309	0	569	26,66	829	47,23	1 089	40,37	1 349	66,18	1 609	86,99
50	1,87	310	0	570	26,03	830	46,66	1 090	41,03	1 350	66,97	1 610	86,96
51	4,97	311	0	571	25,85	831	46,08	1 091	40,76	1 351	67,85	1 611	86,96
52	8,4	312	0	572	26,14	832	45,45	1 092	40,02	1 352	68,74	1 612	87,07
53	9,9	313	0	573	27,08	833	44,69	1 093	39,6	1 353	69,45	1 613	86,96
54	11,42	314	0	574	28,42	834	43,73	1 094	39,37	1 354	69,92	1 614	86,92

Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed
s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h
55	15,11	315	0	575	29,61	835	42,55	1 095	38,84	1 355	70,24	1 615	87,07
56	18,46	316	0	576	30,46	836	41,14	1 096	37,93	1 356	70,49	1 616	86,92
57	20,21	317	0	577	30,99	837	39,56	1 097	37,19	1 357	70,63	1 617	87,14
58	22,13	318	0	578	31,33	838	37,93	1 098	36,21	1 358	70,68	1 618	86,96
59	24,17	319	0	579	31,65	839	36,69	1 099	35,32	1 359	70,65	1 619	87,03
60	25,56	320	0	580	32,02	840	36,27	1 100	35,56	1 360	70,49	1 620	86,85
61	26,97	321	0	581	32,39	841	36,42	1 101	36,96	1 361	70,09	1 621	86,77
62	28,83	322	0	582	32,68	842	37,14	1 102	38,12	1 362	69,35	1 622	87,1
63	31,05	323	0	583	32,84	843	38,13	1 103	38,71	1 363	68,27	1 623	86,92
64	33,72	324	3,01	584	32,93	844	38,55	1 104	39,26	1 364	67,09	1 624	87,07
65	36	325	8,14	585	33,22	845	38,42	1 105	40,64	1 365	65,96	1 625	86,85
66	37,91	326	13,88	586	33,89	846	37,89	1 106	43,09	1 366	64,87	1 626	86,81
67	39,65	327	18,08	587	34,96	847	36,89	1 107	44,83	1 367	63,79	1 627	87,14
68	41,23	328	20,01	588	36,28	848	35,53	1 108	45,33	1 368	62,82	1 628	86,77
69	42,85	329	20,3	589	37,58	849	34,01	1 109	45,24	1 369	63,03	1 629	87,03
70	44,1	330	19,53	590	38,58	850	32,88	1 110	45,14	1 370	63,62	1 630	86,96
71	44,37	331	17,92	591	39,1	851	32,52	1 111	45,06	1 371	64,8	1 631	87,1
72	44,3	332	16,17	592	39,22	852	32,7	1 112	44,82	1 372	65,5	1 632	86,99
73	44,17	333	14,55	593	39,11	853	33,48	1 113	44,53	1 373	65,33	1 633	86,92
74	44,13	334	12,92	594	38,8	854	34,97	1 114	44,77	1 374	63,83	1 634	87,1
75	44,17	335	11,07	595	38,31	855	36,78	1 115	45,6	1 375	62,44	1 635	86,85
76	44,51	336	8,54	596	37,73	856	38,64	1 116	46,28	1 376	61,2	1 636	86,92
77	45,16	337	5,15	597	37,24	857	40,48	1 117	47,18	1 377	59,58	1 637	86,77
78	45,64	338	1,96	598	37,06	858	42,34	1 118	48,49	1 378	57,68	1 638	86,88
79	46,16	339	0	599	37,1	859	44,16	1 119	49,42	1 379	56,4	1 639	86,63
80	46,99	340	0	600	37,42	860	45,9	1 120	49,56	1 380	54,82	1 640	86,85
81	48,19	341	0	601	38,17	861	47,55	1 121	49,47	1 381	52,77	1 641	86,63
82	49,32	342	0	602	39,19	862	49,09	1 122	49,28	1 382	52,22	1 642	86,77

Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed
s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h
83	49,7	343	0	603	40,31	863	50,42	1 123	48,58	1 383	52,48	1 643	86,77
84	49,5	344	0	604	41,46	864	51,49	1 124	48,03	1 384	52,74	1 644	86,55
85	48,98	345	0	605	42,44	865	52,23	1 125	48,2	1 385	53,14	1 645	86,59
86	48,65	346	0	606	42,95	866	52,58	1 126	48,72	1 386	53,03	1 646	86,55
87	48,65	347	0	607	42,9	867	52,63	1 127	48,91	1 387	52,55	1 647	86,7
88	48,87	348	0	608	42,43	868	52,49	1 128	48,93	1 388	52,19	1 648	86,44
89	48,97	349	0	609	41,74	869	52,19	1 129	49,05	1 389	51,09	1 649	86,7
90	48,96	350	0	610	41,04	870	51,82	1 130	49,23	1 390	49,88	1 650	86,55
91	49,15	351	0	611	40,49	871	51,43	1 131	49,28	1 391	49,37	1 651	86,33
92	49,51	352	0	612	40,8	872	51,02	1 132	48,84	1 392	49,26	1 652	86,48
93	49,74	353	0	613	41,66	873	50,61	1 133	48,12	1 393	49,37	1 653	86,19
94	50,31	354	0,9	614	42,48	874	50,26	1 134	47,8	1 394	49,88	1 654	86,37
95	50,78	355	2	615	42,78	875	50,06	1 135	47,42	1 395	50,25	1 655	86,59
96	50,75	356	4,08	616	42,39	876	49,97	1 136	45,98	1 396	50,17	1 656	86,55
97	50,78	357	7,07	617	40,78	877	49,67	1 137	42,96	1 397	50,5	1 657	86,7
98	51,21	358	10,25	618	37,72	878	48,86	1 138	39,38	1 398	50,83	1 658	86,63
99	51,6	359	12,77	619	33,29	879	47,53	1 139	35,82	1 399	51,23	1 659	86,55
100	51,89	360	14,44	620	27,66	880	45,82	1 140	31,85	1 400	51,67	1 660	86,59
101	52,04	361	15,73	621	21,43	881	43,66	1 141	26,87	1 401	51,53	1 661	86,55
102	51,99	362	17,23	622	15,62	882	40,91	1 142	21,41	1 402	50,17	1 662	86,7
103	51,99	363	19,04	623	11,51	883	37,78	1 143	16,41	1 403	49,99	1 663	86,55
104	52,36	364	20,96	624	9,69	884	34,89	1 144	12,56	1 404	50,32	1 664	86,7
105	52,58	365	22,94	625	9,46	885	32,69	1 145	10,41	1 405	51,05	1 665	86,52
106	52,47	366	25,05	626	10,21	886	30,99	1 146	9,07	1 406	51,45	1 666	86,85
107	52,03	367	27,31	627	11,78	887	29,31	1 147	7,69	1 407	52	1 667	86,55
108	51,46	368	29,54	628	13,6	888	27,29	1 148	6,28	1 408	52,3	1 668	86,81
109	51,31	369	31,52	629	15,33	889	24,79	1 149	5,08	1 409	52,22	1 669	86,74
110	51,45	370	33,19	630	17,12	890	21,78	1 150	4,32	1 410	52,66	1 670	86,63

Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed
s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h
111	51,48	371	34,67	631	18,98	891	18,51	1 151	3,32	1 411	53,18	1 671	86,77
112	51,29	372	36,13	632	20,73	892	15,1	1 152	1,92	1 412	53,8	1 672	87,03
113	51,12	373	37,63	633	22,17	893	11,06	1 153	1,07	1 413	54,53	1 673	87,07
114	50,96	374	39,07	634	23,29	894	6,28	1 154	0,66	1 414	55,37	1 674	86,92
115	50,81	375	40,08	635	24,19	895	2,24	1 155	0	1 415	56,29	1 675	87,07
116	50,86	376	40,44	636	24,97	896	0	1 156	0	1 416	57,31	1 676	87,18
117	51,34	377	40,26	637	25,6	897	0	1 157	0	1 417	57,94	1 677	87,32
118	51,68	378	39,29	638	25,96	898	0	1 158	0	1 418	57,86	1 678	87,36
119	51,58	379	37,23	639	25,86	899	0	1 159	0	1 419	57,75	1 679	87,29
120	51,36	380	34,14	640	24,69	900	0	1 160	0	1 420	58,67	1 680	87,58
121	51,39	381	30,18	641	21,85	901	0	1 161	0	1 421	59,4	1 681	87,61
122	50,98	382	25,71	642	17,45	902	2,56	1 162	0	1 422	59,69	1 682	87,76
123	48,63	383	21,58	643	12,34	903	4,81	1 163	0	1 423	60,02	1 683	87,65
124	44,83	384	18,5	644	7,59	904	6,38	1 164	0	1 424	60,21	1 684	87,61
125	40,3	385	16,56	645	4	905	8,62	1 165	0	1 425	60,83	1 685	87,65
126	35,65	386	15,39	646	1,76	906	10,37	1 166	0	1 426	61,16	1 686	87,65
127	30,23	387	14,77	647	0	907	11,17	1 167	0	1 427	61,6	1 687	87,76
128	24,08	388	14,58	648	0	908	13,32	1 168	0	1 428	62,15	1 688	87,76
129	18,96	389	14,72	649	0	909	15,94	1 169	0	1 429	62,7	1 689	87,8
130	14,19	390	15,44	650	0	910	16,89	1 170	0	1 430	63,65	1 690	87,72
131	8,72	391	16,92	651	0	911	17,13	1 171	0	1 431	64,27	1 691	87,69
132	3,41	392	18,69	652	0	912	18,04	1 172	0	1 432	64,31	1 692	87,54
133	0,64	393	20,26	653	0	913	19,96	1 173	0	1 433	64,13	1 693	87,76
134	0	394	21,63	654	0	914	22,05	1 174	0	1 434	64,27	1 694	87,5
135	0	395	22,91	655	0	915	23,65	1 175	0	1 435	65,22	1 695	87,43
136	0	396	24,13	656	0	916	25,72	1 176	0	1 436	66,25	1 696	87,47
137	0	397	25,18	657	0	917	28,62	1 177	0	1 437	67,09	1 697	87,5
138	0	398	26,16	658	2,96	918	31,99	1 178	0	1 438	68,37	1 698	87,5

Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed
s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h
139	0	399	27,41	659	7,9	919	35,07	1 179	0	1 439	69,36	1 699	87,18
140	0	400	29,18	660	13,49	920	37,42	1 180	0	1 440	70,57	1 700	87,36
141	0	401	31,36	661	18,36	921	39,65	1 181	0	1 441	71,89	1 701	87,29
142	0,63	402	33,51	662	22,59	922	41,78	1 182	0	1 442	73,35	1 702	87,18
143	1,56	403	35,33	663	26,26	923	43,04	1 183	0	1 443	74,64	1 703	86,92
144	2,99	404	36,94	664	29,4	924	43,55	1 184	0	1 444	75,81	1 704	87,36
145	4,5	405	38,6	665	32,23	925	42,97	1 185	0	1 445	77,24	1 705	87,03
146	5,39	406	40,44	666	34,91	926	41,08	1 186	0	1 446	78,63	1 706	87,07
147	5,59	407	42,29	667	37,39	927	40,38	1 187	0	1 447	79,32	1 707	87,29
148	5,45	408	43,73	668	39,61	928	40,43	1 188	0	1 448	80,2	1 708	86,99
149	5,2	409	44,47	669	41,61	929	40,4	1 189	0	1 449	81,67	1 709	87,25
150	4,98	410	44,62	670	43,51	930	40,25	1 190	0	1 450	82,11	1 710	87,14
151	4,61	411	44,41	671	45,36	931	40,32	1 191	0	1 451	82,91	1 711	86,96
152	3,89	412	43,96	672	47,17	932	40,8	1 192	0	1 452	83,43	1 712	87,14
153	3,21	413	43,41	673	48,95	933	41,71	1 193	0	1 453	83,79	1 713	87,07
154	2,98	414	42,83	674	50,73	934	43,16	1 194	0	1 454	83,5	1 714	86,92
155	3,31	415	42,15	675	52,36	935	44,84	1 195	0	1 455	84,01	1 715	86,88
156	4,18	416	41,28	676	53,74	936	46,42	1 196	1,54	1 456	83,43	1 716	86,85
157	5,07	417	40,17	677	55,02	937	47,91	1 197	4,85	1 457	82,99	1 717	86,92
158	5,52	418	38,9	678	56,24	938	49,08	1 198	9,06	1 458	82,77	1 718	86,81
159	5,73	419	37,59	679	57,29	939	49,66	1 199	11,8	1 459	82,33	1 719	86,88
160	6,06	420	36,39	680	58,18	940	50,15	1 200	12,42	1 460	81,78	1 720	86,66
161	6,76	421	35,33	681	58,95	941	50,94	1 201	12,07	1 461	81,81	1 721	86,92
162	7,7	422	34,3	682	59,49	942	51,69	1 202	11,64	1 462	81,05	1 722	86,48
163	8,34	423	33,07	683	59,86	943	53,5	1 203	11,69	1 463	80,72	1 723	86,66
164	8,51	424	31,41	684	60,3	944	55,9	1 204	12,91	1 464	80,61	1 724	86,74
165	8,22	425	29,18	685	61,01	945	57,11	1 205	15,58	1 465	80,46	1 725	86,37
166	7,22	426	26,41	686	61,96	946	57,88	1 206	18,69	1 466	80,42	1 726	86,48

Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed
s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h
167	5,82	427	23,4	687	63,05	947	58,63	1 207	21,04	1 467	80,42	1 727	86,33
168	4,75	428	20,9	688	64,16	948	58,75	1 208	22,62	1 468	80,24	1 728	86,3
169	4,24	429	19,59	689	65,14	949	58,26	1 209	24,34	1 469	80,13	1 729	86,44
170	4,05	430	19,36	690	65,85	950	58,03	1 210	26,74	1 470	80,39	1 730	86,33
171	3,98	431	19,79	691	66,22	951	58,28	1 211	29,62	1 471	80,72	1 731	86
172	3,91	432	20,43	692	66,12	952	58,67	1 212	32,65	1 472	81,01	1 732	86,33
173	3,86	433	20,71	693	65,01	953	58,76	1 213	35,57	1 473	81,52	1 733	86,22
174	4,17	434	20,56	694	62,22	954	58,82	1 214	38,07	1 474	82,4	1 734	86,08
175	5,32	435	19,96	695	57,44	955	59,09	1 215	39,71	1 475	83,21	1 735	86,22
176	7,53	436	20,22	696	51,47	956	59,38	1 216	40,36	1 476	84,05	1 736	86,33
177	10,89	437	21,48	697	45,98	957	59,72	1 217	40,6	1 477	84,85	1 737	86,33
178	14,81	438	23,67	698	41,72	958	60,04	1 218	41,15	1 478	85,42	1 738	86,26
179	17,56	439	26,09	699	38,22	959	60,13	1 219	42,23	1 479	86,18	1 739	86,48
180	18,38	440	28,16	700	34,65	960	59,33	1 220	43,61	1 480	86,45	1 740	86,48
181	17,49	441	29,75	701	30,65	961	58,52	1 221	45,08	1 481	86,64	1 741	86,55
182	15,18	442	30,97	702	26,46	962	57,82	1 222	46,58	1 482	86,57	1 742	86,66
183	13,08	443	31,99	703	22,32	963	56,68	1 223	48,13	1 483	86,43	1 743	86,66
184	12,23	444	32,84	704	18,15	964	55,36	1 224	49,7	1 484	86,58	1 744	86,59
185	12,03	445	33,33	705	13,79	965	54,63	1 225	51,27	1 485	86,8	1 745	86,55
186	11,72	446	33,45	706	9,29	966	54,04	1 226	52,8	1 486	86,65	1 746	86,74
187	10,69	447	33,27	707	4,98	967	53,15	1 227	54,3	1 487	86,14	1 747	86,21
188	8,68	448	32,66	708	1,71	968	52,02	1 228	55,8	1 488	86,36	1 748	85,96
189	6,2	449	31,73	709	0	969	51,37	1 229	57,29	1 489	86,32	1 749	85,5
190	4,07	450	30,58	710	0	970	51,41	1 230	58,73	1 490	86,25	1 750	84,77
191	2,65	451	29,2	711	0	971	52,2	1 231	60,12	1 491	85,92	1 751	84,65
192	1,92	452	27,56	712	0	972	53,52	1 232	61,5	1 492	86,14	1 752	84,1
193	1,69	453	25,71	713	0	973	54,34	1 233	62,94	1 493	86,36	1 753	83,46
194	1,68	454	23,76	714	0	974	54,59	1 234	64,39	1 494	86,25	1 754	82,77

Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed
s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h
195	1,66	455	21,87	715	0	975	54,92	1 235	65,52	1 495	86,5	1 755	81,78
196	1,53	456	20,15	716	0	976	55,69	1 236	66,07	1 496	86,14	1 756	81,16
197	1,3	457	18,38	717	0	977	56,51	1 237	66,19	1 497	86,29	1 757	80,42
198	1	458	15,93	718	0	978	56,73	1 238	66,19	1 498	86,4	1 758	79,21
199	0,77	459	12,33	719	0	979	56,33	1 239	66,43	1 499	86,36	1 759	78,48
200	0,63	460	7,99	720	0	980	55,38	1 240	67,07	1 500	85,63	1 760	77,49
201	0,59	461	4,19	721	0	981	54,99	1 241	68,04	1 501	86,03	1 761	76,69
202	0,59	462	1,77	722	0	982	54,75	1 242	69,12	1 502	85,92	1 762	75,92
203	0,57	463	0,69	723	0	983	54,11	1 243	70,08	1 503	86,14	1 763	75,08
204	0,53	464	1,13	724	0	984	53,32	1 244	70,91	1 504	86,32	1 764	73,87
205	0,5	465	2,2	725	0	985	52,41	1 245	71,73	1 505	85,92	1 765	72,15
206	0	466	3,59	726	0	986	51,45	1 246	72,66	1 506	86,11	1 766	69,69
207	0	467	4,88	727	0	987	50,86	1 247	73,67	1 507	85,91	1 767	67,17
208	0	468	5,85	728	0	988	50,48	1 248	74,55	1 508	85,83	1 768	64,75
209	0	469	6,72	729	0	989	49,6	1 249	75,18	1 509	85,86	1 769	62,55
210	0	470	8,02	730	0	990	48,55	1 250	75,59	1 510	85,5	1 770	60,32
211	0	471	10,02	731	0	991	47,87	1 251	75,82	1 511	84,97	1 771	58,45
212	0	472	12,59	732	0	992	47,42	1 252	75,9	1 512	84,8	1 772	56,43
213	0	473	15,43	733	0	993	46,86	1 253	75,92	1 513	84,2	1 773	54,35
214	0	474	18,32	734	0	994	46,08	1 254	75,87	1 514	83,26	1 774	52,22
215	0	475	21,19	735	0	995	45,07	1 255	75,68	1 515	82,77	1 775	50,25
216	0	476	24	736	0	996	43,58	1 256	75,37	1 516	81,78	1 776	48,23
217	0	477	26,75	737	0	997	41,04	1 257	75,01	1 517	81,16	1 777	46,51
218	0	478	29,53	738	0	998	38,39	1 258	74,55	1 518	80,42	1 778	44,35
219	0	479	32,31	739	0	999	35,69	1 259	73,8	1 519	79,21	1 779	41,97
220	0	480	34,8	740	0	1 000	32,68	1 260	72,71	1 520	78,83	1 780	39,33
221	0	481	36,73	741	0	1 001	29,82	1 261	71,39	1 521	78,52	1 781	36,48
222	0	482	38,08	742	0	1 002	26,97	1 262	70,02	1 522	78,52	1 782	33,8

Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed
s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h
223	0	483	39,11	743	0	1 003	24,03	1 263	68,71	1 523	78,81	1 783	31,09
224	0	484	40,16	744	0	1 004	21,67	1 264	67,52	1 524	79,26	1 784	28,24
225	0	485	41,18	745	0	1 005	20,34	1 265	66,44	1 525	79,61	1 785	26,81
226	0,73	486	41,75	746	0	1 006	18,9	1 266	65,45	1 526	80,15	1 786	23,33
227	0,73	487	41,87	747	0	1 007	16,21	1 267	64,49	1 527	80,39	1 787	19,01
228	0	488	41,43	748	0	1 008	13,84	1 268	63,54	1 528	80,72	1 788	15,05
229	0	489	39,99	749	0	1 009	12,25	1 269	62,6	1 529	81,01	1 789	12,09
230	0	490	37,71	750	0	1 010	10,4	1 270	61,67	1 530	81,52	1 790	9,49
231	0	491	34,93	751	0	1 011	7,94	1 271	60,69	1 531	82,4	1 791	6,81
232	0	492	31,79	752	0	1 012	6,05	1 272	59,64	1 532	83,21	1 792	4,28
233	0	493	28,65	753	0	1 013	5,67	1 273	58,6	1 533	84,05	1 793	2,09
234	0	494	25,92	754	0	1 014	6,03	1 274	57,64	1 534	85,15	1 794	0,88
235	0	495	23,91	755	0	1 015	7,68	1 275	56,79	1 535	85,92	1 795	0,88
236	0	496	22,81	756	0	1 016	10,97	1 276	55,95	1 536	86,98	1 796	0
237	0	497	22,53	757	0	1 017	14,72	1 277	55,09	1 537	87,45	1 797	0
238	0	498	22,62	758	0	1 018	17,32	1 278	54,2	1 538	87,54	1 798	0
239	0	499	22,95	759	0	1 019	18,59	1 279	53,33	1 539	87,25	1 799	0
240	0	500	23,51	760	0	1 020	19,35	1 280	52,52	1 540	87,04	1 800	0
241	0	501	24,04	761	0	1 021	20,54	1 281	51,75	1 541	86,98		
242	0	502	24,45	762	0	1 022	21,33	1 282	50,92	1 542	87,05		
243	0	503	24,81	763	0	1 023	22,06	1 283	49,9	1 543	87,1		
244	0	504	25,29	764	0	1 024	23,39	1 284	48,68	1 544	87,25		
245	0	505	25,99	765	0	1 025	25,52	1 285	47,41	1 545	87,25		
246	0	506	26,83	766	0	1 026	28,28	1 286	46,5	1 546	87,07		
247	0	507	27,6	767	0	1 027	30,38	1 287	46,22	1 547	87,29		
248	0	508	28,17	768	0	1 028	31,22	1 288	46,44	1 548	87,14		
249	0	509	28,63	769	0	1 029	32,22	1 289	47,35	1 549	87,03		
250	0	510	29,04	770	0	1 030	33,78	1 290	49,01	1 550	87,25		

Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed	Time	Speed
s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h	s	km/h
251	0	511	29,43	771	0	1 031	35,08	1 291	50,93	1 551	87,03		
252	0	512	29,78	772	1,6	1 032	35,91	1 292	52,79	1 552	87,03		
253	1,51	513	30,13	773	5,03	1 033	36,06	1 293	54,66	1 553	87,07		
254	4,12	514	30,57	774	9,49	1 034	35,5	1 294	56,6	1 554	86,81		
255	7,02	515	31,1	775	13	1 035	34,76	1 295	58,55	1 555	86,92		
256	9,45	516	31,65	776	14,65	1 036	34,7	1 296	60,47	1 556	86,66		
257	11,86	517	32,14	777	15,15	1 037	35,41	1 297	62,28	1 557	86,92		
258	14,52	518	32,62	778	15,67	1 038	36,65	1 298	63,9	1 558	86,59		
259	17,01	519	33,25	779	16,76	1 039	37,57	1 299	65,2	1 559	86,92		
260	19,48	520	34,2	780	17,88	1 040	38,51	1 300	66,02	1 560	86,59		

Appendix 6

Drain and weigh procedure

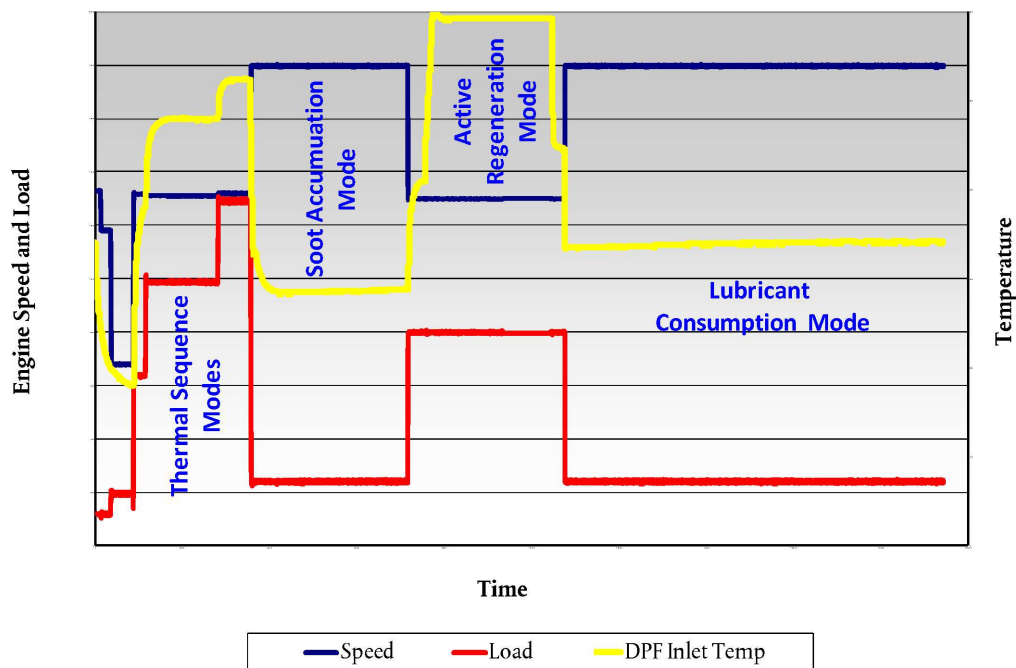
1. The engine shall be filled with new oil. If a constant volume oil sump system (as described in ASTM standard D7156-09) is used, the oil pump shall be turned on while filling the engine. Enough oil charge shall be added to fill up both the engine and external sump.
2. The engine shall be started and operated over the desired test cycle (see points 2.2.15 and 2.4.4.8.3.1) for a minimum of 1 hour.
3. Once the cycle is complete, oil temperature shall be allowed to stabilise at a steady-state engine condition before shutting the engine down.
4. A clean, empty oil drain pan shall be weighed.
5. Any clean supplies that are to be used during the oil drain (e.g. rags) shall be weighed.
6. The oil shall be drained for 10 minutes with the external oil pump (if equipped) powered on followed by an additional ten minutes with the pump powered off. If a constant volume sump system is not used, the oil shall be drained from the engine for a total of 20 minutes.
7. The drained oil shall be weighed.
8. The weight determined in accordance with step 7 shall be subtracted from the weight determined in accordance with step 4. The difference corresponds to the total weight of the oil removed from the engine and collected in the drain pan.
9. The oil shall be carefully returned to the engine.
10. The empty drain pan shall be weighed.
11. The weight determined in accordance with step 10 shall be subtracted from the weight determined in accordance with step 4. The result corresponds to the weight of the residual oil in the drain pan that was not returned to the engine.

12. Any dirty supplies which have previously been weighed pursuant to step 5 shall be weighed.
13. The weight determined in accordance with step 12 shall be subtracted from the weight determined in accordance with step 5. The result corresponds to the weight of the residual oil which remained on the dirty supplies that was not returned to the engine.
14. The residual oil weights calculated in accordance with steps 11 and 13 shall be subtracted from the total weight of the oil removed, calculated in accordance with step 8. The difference between those weights corresponds to the total weight of the oil returned to the engine.
15. The engine shall be operated under the desired test cycle(s) (see points 2.2.15 and 2.4.4.8.3.1).
16. Steps 3-8 shall be repeated.
17. The weight of the oil drained pursuant to step 16 shall be subtracted from the weight obtained in accordance with step 14. The difference between those weights corresponds to the total weight of the oil consumed.
18. The total weight of the oil consumed calculated pursuant to step 14 shall be divided by the duration, in hours, of the test cycles carried out in accordance with step 15. The result is the lubricant consumption rate.

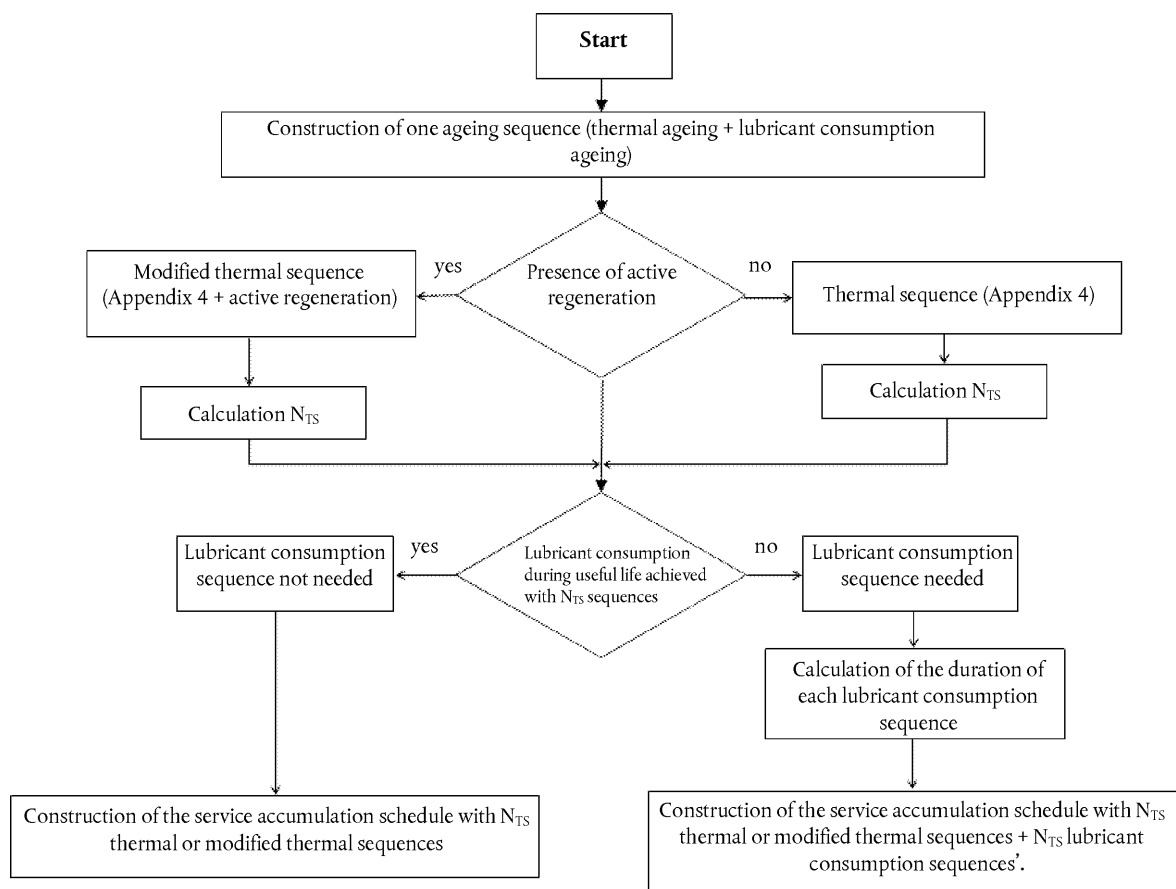
Appendix 7

Example of service accumulation schedule including thermal, lubricant consumption and regeneration sequences

Example Service Accumulation Cycle



Appendix 8

Flowchart on the performance of the service accumulation schedule

ANNEX V

Annex XIII to Regulation (EU) No 582/2011 is amended as follows:

(1) points 2.1.2.2.1 and 2.1.2.2.2 are replaced by the following:

‘2.1.2.2.1. The provisions on reagent quality monitoring set out in points 7 to 7.1.3 of this Annex shall apply, instead of points 4.1 and 4.2 of Annex XVI to Regulation (EC) No 692/2008.

2.1.2.2.2. The provisions on reagent consumption monitoring and dosing activity set out in points 8, 8.1 and 8.1.1 of this Annex shall apply, instead of points 5 to 5.5 of Annex XVI to Regulation (EC) No 692/2008.’;

(2) points 8 and 8.1 are replaced by the following:

‘8. REAGENT CONSUMPTION AND DOSING ACTIVITY

8.1. The measures regarding reagent consumption monitoring and dosing activity shall be those set out in paragraph 8 of Annex 11 to UN/ECE Regulation No 49.’.

ANNEX VI

Annex XIV to Regulation (EU) No 582/2011 is amended as follows:

(1) point 2.2.1 is replaced by the following:

‘2.2.1. For positive-ignition engines fuelled with petrol or E85, paragraph 5.2.3.1 of UN/ECE Regulation No 85 shall be understood as follows:

“The fuel used shall be the one available on the market. In any case of dispute the fuel shall be the appropriate reference fuel specified in Annex IX to Regulation (EU) No 582/2011.”;

(2) point 2.2.4 is replaced by the following:

‘2.2.4. For compression-ignition engines, paragraph 5.2.3.4 of UN/ECE Regulation 85 shall be understood as follows:

“The fuel used shall be the one available on the market. In any case of dispute the fuel shall be the appropriate reference fuel specified in Annex IX to Regulation (EU) No 582/2011.”.

COMMISSION REGULATION (EU) 2016/1719
of 26 September 2016
establishing a guideline on forward capacity allocation
(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003 ⁽¹⁾ and in particular Article 18(3)(b) and (5), thereof,

Whereas:

- (1) The urgent completion of a fully functioning and interconnected internal energy market is crucial to the objectives of maintaining security of energy supply, increasing competitiveness and ensuring that all consumers can purchase energy at affordable prices. A well-functioning internal market in electricity should provide producers with appropriate incentives for investing in new power generation, including in electricity from renewable energy sources, paying special attention to the most isolated Member States and regions in the Union's energy market. A well-functioning market should also provide consumers with adequate measures to promote more efficient use of energy, which presupposes a secure supply of energy.
- (2) Security of energy supply is an essential element of public security and is therefore inherently connected to the efficient functioning of the internal market in electricity and the integration of the isolated electricity markets of Member States. Electricity can reach the citizens of the Union only through the network. Functioning electricity markets and, in particular, the networks and other assets associated with electricity supply are essential to public security, to economic competitiveness and to the well-being of the citizens of the Union.
- (3) Regulation (EC) No 714/2009 sets out non-discriminatory rules for access conditions to the network for cross-border exchanges in electricity and, in particular, rules on capacity allocation and congestion management for interconnections and transmission systems affecting cross-border electricity flows. In order to move towards a genuinely integrated electricity market, efficient hedging opportunities should be developed for generators, consumers and retailers to mitigate future price risk in the area where they operate, including harmonisation of the current auction rules on forward capacity allocation.
- (4) Long-term capacity calculation for the year- and month-ahead market time frames should be coordinated by the transmission system operators (hereinafter 'TSOs') at least at regional level to ensure that capacity calculation is reliable and that optimal capacity is made available to the market. For this purpose, TSOs should establish a common grid model gathering all the necessary data for the long-term capacity calculation and taking into account the uncertainties inherent to the long-term time frames. The coordinated net transmission capacity based approach should apply to calculate and allocate long-term cross-border capacities. The flow-based approach might be applied where cross-zonal capacities between bidding zones are highly interdependent and the approach is justified from an economic efficiency point of view.
- (5) Harmonised long-term cross-zonal capacity allocation rules require the establishment and operation of a single allocation platform at European level. This central platform should be developed by all TSOs to facilitate the allocation of long-term transmission rights for market participants and should provide for the transfer of long-term transmission rights from one eligible market participant to another.
- (6) In order to allow a transparent and non-discriminatory allocation of long-term transmission rights, the single allocation platform needs to publish all the relevant information about the auction before its opening. Nomination rules should contain detailed information on the nomination procedure for physical transmission rights including requirements, timings, gate closures and eligibility for exchange between market participants.

⁽¹⁾ OJ L 211, 14.8.2009, p. 15.

- (7) Long-term transmission rights holders should be entitled to return to the TSOs their long-term transmission rights for reallocation in a subsequent forward capacity allocation. For the return of the long-term transmission rights, the holders may receive a payment. In addition, market participants should be entitled to either transfer or purchase already allocated long-term transmission rights. The market participants should inform TSOs about such transfers or purchases and about the counterparties including involved market participants and respective TSOs.
- (8) It is important that the administrative burdens and costs associated with the participation in the single allocation platform are kept within reasonable limits, notably as regards the harmonisation of the contractual framework with market participants.
- (9) Currently there are multiple allocation rules across the Union governing the contractual arrangements for long-term transmission rights. TSOs should develop harmonised allocation rules for physical transmission rights, financial transmission rights — options (hereinafter 'FTRs — options') and financial transmission rights — obligations (hereinafter 'FTRs — obligations') at Union level.
- (10) Those harmonised allocation rules should at least contain the description of the allocation process/procedure for long-term transmission rights, including the minimum requirements for participation, financial matters, type of products offered in explicit auctions, nomination rules, curtailment and compensation rules, rules for market participants in case they are transferring their long-term transmission rights, the use-it-or-sell-it (hereinafter 'UIOSI') principle, rules as regards *force majeure* and liability. Those harmonised allocation rules should also outline the contractual obligations to be respected by market participants.
- (11) Commission Regulation (EU) 2015/1222 ⁽¹⁾ establishes a day-ahead firmness deadline and a related compensation regime for long-term transmission rights curtailed after such deadline. Similarly, long-term transmission rights curtailed before the day-ahead firmness deadline should be reimbursed or compensated by TSOs to the long-term transmission rights holders.
- (12) Caps on the compensation to be paid to holders whose long-term transmission rights have been curtailed before the day-ahead firmness deadline may be introduced, taking into the account the liquidity of the relevant markets and the possibility for market participants to adjust their positions.
- (13) In line with Article 8 of Regulation (EC) No 713/2009 of the European Parliament and of the Council ⁽²⁾, the Agency for the Cooperation of Energy Regulators ('the Agency') should take a decision as regards common terms and conditions of access or methodologies, where the competent national regulatory authorities are not able to reach an agreement on those regulatory issues.
- (14) This Regulation has been developed in close cooperation with the Agency, the European Network of Transmission System Operators for Electricity (the 'ENTSO for Electricity') and stakeholders, in order to adopt effective, balanced and proportionate rules in a transparent and participative manner. In accordance with Article 18(3) of Regulation (EC) No 714/2009, the Commission will consult the Agency, ENTSO for Electricity and other relevant stakeholders, before proposing any amendment to this regulation.
- (15) This Regulation supplements Annex I to Regulation (EC) No 714/2009, in accordance with the principles set out in Article 16 of that Regulation.
- (16) The measures provided for in this Regulation are in accordance with the opinion of the Committee referred to in Article 23(1) of Regulation (EC) No 714/2009,

⁽¹⁾ Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management (OJ L 197, 25.7.2015, p. 24).

⁽²⁾ Regulation (EC) No 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators (OJ L 211, 14.8.2009, p. 1).

HAS ADOPTED THIS REGULATION:

TITLE I

GENERAL PROVISIONS

Article 1

Subject matter and scope

1. This Regulation lays down detailed rules on cross-zonal capacity allocation in the forward markets, on the establishment of a common methodology to determine long-term cross-zonal capacity, on the establishment of a single allocation platform at European level offering long-term transmission rights, and on the possibility to return long-term transmission rights for subsequent forward capacity allocation or transfer long-term transmission rights between market participants.
2. This Regulation shall apply to all transmission systems and interconnections in the Union, except the transmission systems on islands which are not connected with other transmission systems via interconnectors.
3. In Member States where more than one TSO exists, this Regulation shall apply to all TSOs within that Member State. Where a TSO does not have a function relevant to one or more obligations under this Regulation, Member States may provide that the responsibility for complying with those obligations is assigned to one or more different, specific TSOs.
4. The single allocation platform may be opened to market operators and TSOs operating in Switzerland on the condition that its national law implements the main provisions of Union electricity market legislation and that there is an intergovernmental agreement on electricity cooperation between the Union and Switzerland.
5. Subject to the conditions of paragraph 4, the participation of Switzerland in the single allocation platform shall be decided by the Commission based on an opinion given by the Agency. The rights and responsibilities of Swiss TSOs joining the single allocation platform shall be consistent with the rights and responsibilities of TSOs operating in the Union, allowing for a smooth functioning of the allocation of the long-term transmission rights implemented at Union level and a level playing field for all stakeholders.

Article 2

Definitions

For the purposes of this Regulation, the definitions in Article 2 of Regulation (EC) No 714/2009, Article 2 of Regulation (EU) 2015/1222, Article 2 of Commission Regulation (EU) No 543/2013 ⁽¹⁾ as well as Article 2 of Directive 2009/72/EC of the European Parliament and of the Council ⁽²⁾ shall apply.

In addition, the following definitions shall apply:

- (1) 'forward capacity allocation' means the attribution of long-term cross-zonal capacity through an auction before the day-ahead time frame;
- (2) 'long-term transmission right' means a physical transmission right or a FTR — option or a FTR — obligation acquired in the forward capacity allocation;
- (3) 'allocation rules' means the rules for forward capacity allocation applied by the single allocation platform;
- (4) 'single allocation platform' means the European platform established by all TSOs for forward capacity allocation;
- (5) 'auction' means the process by which long-term cross-zonal capacity is offered and allocated to market participants who submit bids;

⁽¹⁾ Commission Regulation (EU) No 543/2013 of 14 June 2013 on submission and publication of data in electricity markets and amending Annex I to Regulation (EC) No 714/2009 of the European Parliament and of the Council (OJ L 163, 15.6.2013, p. 1).

⁽²⁾ Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC (OJ L 211, 14.8.2009, p. 55).

- (6) 'UIOSI' means the principle according to which the underlying cross-zonal capacity of physical transmission rights purchased and non-nominated is automatically made available for day-ahead capacity allocation and according to which the holder of these physical transmission rights receives remuneration from the TSOs.
- (7) 'nomination' means the notification of the use of long-term cross-zonal capacity by a physical transmission rights holder and its counterparty, or an authorised third party, to the respective TSOs;
- (8) 'nomination rules' means the rules with regard to the notification of use of long-term cross-zonal capacity by a physical transmission rights holder and their counterparty, or an authorised third party, to the respective TSOs;
- (9) 'market spread' means the difference between the hourly day-ahead prices of the two concerned bidding zones for the respective market time unit in a specific direction;
- (10) 'compensation rules' means the rules according to which each TSO responsible for the bidding zone border, where long-term transmission rights have been allocated, compensates transmission right holders for curtailing the long-term transmission rights.

Article 3

Objectives of forward capacity allocation

This Regulation aims at:

- (a) promoting effective long-term cross-zonal trade with long-term cross-zonal hedging opportunities for market participants;
- (b) optimising the calculation and allocation of long-term cross-zonal capacity;
- (c) providing non-discriminatory access to long-term cross-zonal capacity;
- (d) ensuring fair and non-discriminatory treatment of TSOs, the Agency, regulatory authorities and market participants;
- (e) respecting the need for a fair and orderly forward capacity allocation and orderly price formation;
- (f) ensuring and enhancing the transparency and reliability of information on forward capacity allocation;
- (g) contributing to the efficient long-term operation and development of the electricity transmission system and electricity sector in the Union.

Article 4

Adoption of terms and conditions or methodologies

1. TSOs shall develop the terms and conditions or methodologies required by this Regulation and submit them for approval to the competent regulatory authorities within the respective deadlines set out in this Regulation. Where a proposal for terms and conditions or methodologies pursuant to this Regulation needs to be developed and agreed by more than one TSO, the participating TSOs shall closely cooperate. TSOs, with the assistance of ENTSO for Electricity, shall regularly inform the competent regulatory authorities and the Agency about the progress of the development of these terms and conditions or methodologies.

2. TSOs deciding on proposals for terms and conditions or methodologies in accordance with Article 4(6) shall decide with qualified majority if no consensus could be reached among them. A qualified majority for proposals in accordance with Article 4(6) shall require a majority of:

- (a) TSOs representing at least 55 % of the Member States; and
- (b) TSOs representing Member States comprising at least 65 % of the population of the Union.

A blocking minority for decisions in accordance with Article 4(6) must include TSOs representing at least four Member States, failing of which the qualified majority shall be deemed attained.

For TSO decisions under Article 4(6), one vote shall be attributed per Member State. If there is more than one TSO in the territory of a Member State, the Member State shall allocate the voting powers among the TSOs.

3. TSOs deciding on proposals for terms and conditions or methodologies in accordance with Article 4(7) shall decide with qualified majority if no consensus can be reached amongst them and where the regions concerned are composed of more than five Member States. A qualified majority for proposals in accordance with Article 4(7) shall require a majority of:

- (a) TSOs representing at least 72 % of the Member States concerned; and
- (b) TSOs representing Member States comprising at least 65 % of the population of the concerned region.

A blocking minority for decisions in accordance with Article 4(7) must include at least the minimum number of TSOs representing more than 35 % of the population of the participating Member States, plus TSOs representing at least one additional Member State concerned, failing of which the qualified majority shall be deemed attained.

TSOs deciding on proposals for terms and conditions or methodologies in accordance with Article 4(7) in relation to regions composed of five Member States or less shall decide based on consensus.

For TSO decisions under Article 4(7), one vote shall be attributed per Member State. If there is more than one TSO in the territory of a Member State, the Member States shall allocate the voting powers among the TSOs.

4. If TSOs fail to submit a proposal for terms and conditions or methodologies to the national regulatory authorities within the deadlines defined in this Regulation, they shall provide the competent regulatory authorities and the Agency with the relevant drafts of the terms and conditions or methodologies, and explain what has prevented an agreement. The Agency shall inform the Commission and shall, in cooperation with the competent regulatory authorities, at the Commission's request, investigate the reasons for the failure and inform the Commission thereof. The Commission shall take the appropriate steps to make possible the adoption of the required terms and conditions or methodologies within four months from the receipt of the Agency's information.

5. Each regulatory authority shall be responsible for approving the terms and conditions or methodologies referred to in paragraphs 6 and 7.

6. The proposals for the following terms and conditions or methodologies shall be subject to approval by all regulatory authorities:

- (a) the generation and load data provision methodology pursuant to Article 17;
- (b) the common grid model methodology pursuant to Article 18;
- (c) the requirements for the single allocation platform pursuant to Article 49;
- (d) the harmonised allocation rules pursuant to Article 51;
- (e) the congestion income distribution methodology pursuant to Article 57;
- (f) the methodology for sharing costs of establishing, developing and operating the single allocation platform pursuant to Article 59;
- (g) the methodology for sharing costs incurred to ensure firmness and remuneration of long-term transmission rights pursuant to Article 61.

7. The proposals for the following terms and conditions or methodologies shall be subject to approval by all regulatory authorities of the concerned region:

- (a) the capacity calculation methodology pursuant to Article 10;
- (b) the methodology for splitting cross-zonal capacity pursuant to Article 16;

- (c) the regional design of long-term transmission rights pursuant to Article 31;
- (d) the establishment of fallback procedures in accordance with Article 42;
- (e) the regional requirements of the harmonised allocation rules pursuant to Article 52, including the regional compensation rules pursuant to Article 55.

8. The proposal for terms and conditions or methodologies shall include a proposed timescale for their implementation and a description of their expected impact on the objectives of this Regulation. Proposals on terms and conditions or methodologies subject to the approval by several or all regulatory authorities shall be submitted to the Agency at the same time that they are submitted to regulatory authorities. Upon request by the competent regulatory authorities, the Agency shall issue an opinion within three months on the proposals for terms and conditions or methodologies.

9. Where the approval of the terms and conditions or methodologies requires a decision by more than one regulatory authority, the competent regulatory authorities shall consult and closely cooperate and coordinate with each other in order to reach an agreement. Where applicable, the competent regulatory authorities shall take into account the opinion of the Agency. Regulatory authorities shall take decisions concerning the submitted terms and conditions or methodologies in accordance with paragraphs 6 and 7, within six months following the receipt of the terms and conditions or methodologies by the regulatory authority or, where applicable, by the last regulatory authority concerned.

10. Where the regulatory authorities have not been able to reach an agreement within the period referred to in paragraph 9, or upon their joint request, the Agency shall adopt a decision concerning the submitted proposals for terms and conditions or methodologies within six months, in accordance with Article 8(1) of Regulation (EC) No 713/2009.

11. In the event that one or several regulatory authorities request an amendment to approve the terms and conditions or methodologies submitted in accordance with paragraphs 6 and 7, the relevant TSOs shall submit a proposal for amended terms and conditions or methodologies for approval within two months following the requirement from the regulatory authorities. The competent regulatory authorities shall decide on the amended terms and conditions or methodologies within two months following their submission. Where the competent regulatory authorities have not been able to reach an agreement on terms and conditions or methodologies pursuant to paragraphs 6 and 7 within the two-month deadline, or upon their joint request, the Agency shall adopt a decision concerning the amended terms and conditions or methodologies within six months, in accordance with Article 8(1) of Regulation (EC) No 713/2009. If the relevant TSOs fail to submit a proposal for amended terms and conditions or methodologies, the procedure provided for in paragraph 4 shall apply.

12. TSOs responsible for developing a proposal for terms and conditions or methodologies or regulatory authorities responsible for their adoption in accordance with paragraphs 6 and 7, may request amendments of these terms and conditions or methodologies.

The proposals for amendment to the terms and conditions or methodologies shall be submitted to consultation in accordance with the procedure set out in Article 6 and approved in accordance with the procedure set out in this Article.

13. TSOs responsible for establishing the terms and conditions or methodologies in accordance with this Regulation shall publish them on the internet after approval by the competent regulatory authorities or, if no such approval is required, after their establishment, except where such information is considered as confidential in accordance with Article 7.

Article 5

Stakeholder involvement

The Agency, in close cooperation with ENTSO for Electricity, shall organise stakeholder involvement regarding forward capacity allocation and other aspects of the implementation of this Regulation. This shall include regular meetings with stakeholders to identify problems and propose improvements notably related to the operation and development of the forward capacity allocation, including the harmonisation of auction rules. This shall not replace the stakeholder consultations in accordance with Article 6.

*Article 6***Consultation**

1. TSOs responsible for submitting proposals for terms and conditions or methodologies or their amendments in accordance with this Regulation shall consult stakeholders, including the relevant authorities of each Member State, on the draft proposals for terms and conditions or methodologies where explicitly set out in this Regulation. The consultation shall last for a period of not less than one month.
2. The proposals for terms and conditions or methodologies submitted by the TSOs at Union level shall be published and submitted to consultation at Union level. Proposals submitted by the TSOs at regional level shall be submitted to consultation at least at regional level. Parties submitting proposals at bilateral or at multilateral level shall consult at least the Member States concerned.
3. The entities responsible for the proposal for terms and conditions or methodologies shall duly consider the views of stakeholders resulting from the consultations undertaken in accordance with paragraph 1, prior to its submission for regulatory approval if required in accordance with Article 4 or prior to publication in all other cases. In all cases, a clear and robust justification for including or not the views resulting from the consultation shall be developed and published in a timely manner before or simultaneously with the publication of the proposal for terms and conditions or methodologies.

*Article 7***Confidentiality obligations**

1. Any confidential information received, exchanged or transmitted pursuant to this Regulation shall be subject to the conditions of professional secrecy laid down in paragraphs 2, 3 and 4.
2. The obligation of professional secrecy shall apply to any persons subject to the provisions of this Regulation.
3. Confidential information received by the persons referred to in paragraph 2 in the course of their duties may not be divulged to any other person or authority, without prejudice to cases covered by national law, the other provisions of this Regulation or other relevant Union legislation.
4. Without prejudice to cases covered by national law or Union law, regulatory authorities, bodies or persons which receive confidential information pursuant to this Regulation may use it only for the purpose of the performance of their functions under this Regulation.

TITLE II

REQUIREMENTS FOR TERMS, CONDITIONS AND METHODOLOGIES

CHAPTER 1

Forward capacity calculation

Section 1

General requirements*Article 8***Capacity calculation regions**

For the purposes of this Regulation the capacity calculation regions shall be those established pursuant to Article 15 of Regulation (EU) 2015/1222.

*Article 9***Capacity calculation time frames**

All TSOs in each capacity calculation region shall ensure that long-term cross-zonal capacity is calculated for each forward capacity allocation and at least on annual and monthly time frames.

*Section 2***Capacity calculation methodology***Article 10***Capacity calculation methodology**

1. No later than six months after the approval of the common coordinated capacity calculation methodology referred to in Article 9(7) of Regulation (EU) 2015/1222, all TSOs in each capacity calculation region shall submit a proposal for a common capacity calculation methodology for long-term time frames within the respective region. The proposal shall be subject to consultation in accordance with Article 6.
2. The approach used in the common capacity calculation methodology shall be either a coordinated net transmission capacity approach or a flow-based approach.
3. The capacity calculation methodology shall be compatible with the capacity calculation methodology established for the day-ahead and intraday time frames pursuant to Article 21(1) of Regulation (EU) 2015/1222.
4. The uncertainty associated with long-term capacity calculation time frames shall be taken into account when applying:
 - (a) a security analysis based on multiple scenarios and using the capacity calculation inputs, the capacity calculation approach referred to in Article 21(1)(b) and the validation of cross-zonal capacity referred to in Article 21(1)(c) of Regulation (EU) 2015/1222; or
 - (b) a statistical approach based on historical cross-zonal capacity for day-ahead or intraday time frames if it can be demonstrated that this approach may:
 - (i) increase the efficiency of the capacity calculation methodology;
 - (ii) better take into account the uncertainties in long-term cross-zonal capacity calculation than the security analysis in accordance with paragraph 4(a);
 - (iii) increase economic efficiency with the same level of system security.
5. All TSOs in each capacity calculation region may jointly apply the flow-based approach for long-term capacity calculation time frames on the following conditions:
 - (a) the flow-based approach leads to an increase of economic efficiency in the capacity calculation region with the same level of system security;
 - (b) the transparency and accuracy of the flow-based results have been confirmed in the capacity calculation region;
 - (c) the TSOs provide market participants with six months to adapt their processes.
6. Where a security analysis based on multiple scenarios is applied for developing the capacity calculation methodology in a capacity calculation region, the requirements for the capacity calculation inputs, the capacity calculation approach and the validation of cross-zonal capacity as provided for in Article 21(1) of Regulation (EU) 2015/1222, except Article 21(1)(a)(iv) where relevant, shall apply.
7. When developing the capacity calculation methodology, the requirements for the fallback procedures and the requirement provided for in Article 21(3) of Regulation (EU) 2015/1222 shall be taken into account.

*Article 11***Reliability margin methodology**

The proposal for a common capacity calculation methodology shall include a reliability margin methodology which shall meet the requirements set out in Article 22 of Regulation (EU) 2015/1222.

*Article 12***Methodologies for operational security limits and contingencies**

The proposal for a common capacity calculation methodology shall include methodologies for operational security limits and contingencies which shall meet the requirements set out in Article 23(1) and (2) of Regulation (EU) 2015/1222.

*Article 13***Generation shift keys methodology**

The proposal for a common capacity calculation methodology shall include a methodology to determine generation shift keys which shall meet the requirements set out in Article 24 of Regulation (EU) 2015/1222.

*Article 14***Methodology for remedial actions**

If remedial actions are taken into account in the long-term capacity calculation, each TSO shall ensure that those remedial actions are technically available in real time operation and meet the requirements set out in Article 25 of Regulation (EU) 2015/1222.

*Article 15***Cross-zonal capacity validation methodology**

The proposal for a common capacity calculation methodology shall include a cross-zonal validation methodology which shall meet the requirements set out in Article 26 of Regulation (EU) 2015/1222.

*Article 16***Methodology for splitting long-term cross-zonal capacity**

1. No later than the submission of the capacity calculation methodology referred to in Article 10, the TSOs of each capacity calculation region shall jointly develop a proposal for a methodology for splitting long-term cross-zonal capacity in a coordinated manner between different long-term time frames within the respective region. The proposal shall be subject to consultation in accordance with Article 6.

2. The methodology for splitting long-term cross-zonal capacity shall comply with the following conditions:

- (a) it shall meet the hedging needs of market participants;
- (b) it shall be coherent with the capacity calculation methodology;
- (c) it shall not lead to restrictions in competition, in particular for access to long-term transmission rights.

Section 3

Common grid model*Article 17***Generation and load data provision methodology**

1. No later than six months after the approval of the generation and load data provision methodology established for the day-ahead and intraday time frames referred to in Article 9(6) of Regulation (EU) 2015/1222, all TSOs shall jointly develop a proposal for a single generation and load data provision methodology for delivering the generation and load data required to establish the common grid model for long-term time frames. The proposal shall be subject to consultation in accordance with Article 6. The methodology shall take into account and complement the generation and load data provision methodology according to Article 16 of Regulation (EU) 2015/1222.
2. When developing the generation and load data provision methodology, the requirements set in Article 16 of Regulation (EU) 2015/1222 shall apply.

*Article 18***Common grid model methodology**

1. No later than six months after the approval of the common grid model methodology established for the day-ahead and intraday time frames referred to in Article 9(6) of Commission Regulation (EU) 2015/1222, all TSOs shall jointly develop a proposal for a common grid model methodology for long-term time frames. The methodology shall be subject to consultation in accordance with Article 6.
2. The common grid model methodology shall take into account and complement the common grid model methodology developed pursuant to Article 17 of Regulation (EU) 2015/1222. The methodology shall enable the establishment of the common grid model for long-term capacity calculation time frames in capacity calculation regions where security analysis based on multiple scenarios pursuant to Article 10 is applied.
3. When developing the common grid model methodology, the requirements set in Article 17 of Regulation (EU) 2015/1222 shall apply.

*Article 19***Scenarios**

1. All TSOs in capacity calculation regions, where security analysis based on multiple scenarios pursuant to Article 10 is applied, shall jointly develop a common set of scenarios to be used in the common grid model for each long-term capacity calculation time frame.
2. When developing the common set of scenarios, the relevant requirements set in Article 18 of Regulation (EU) 2015/1222 shall apply.

*Article 20***Individual grid model**

When developing the individual grid model for a long-term capacity calculation time frame in capacity calculation regions, where security analysis based on multiple scenarios pursuant to Article 10 is applied, each TSO shall apply the requirements set in Article 19 of Regulation (EU) 2015/1222.

Section 4

Capacity calculation process*Article 21***General provisions**

1. The process of merging the individual grid models established in accordance with Article 27 of Regulation (EU) 2015/1222 shall apply when merging the individual grid models into a common grid model for each long-term time frame. No later than six months after the approval of the generation and load data provision methodology for long-term time frames referred to in Article 17 and the common grid model methodology for long-term time frames referred to in Article 18, all TSOs in each capacity calculation region shall jointly develop operational rules for long-term capacity calculation time frames supplementing the rules defined for the operation to merge the individual grid models pursuant to Article 27 of Regulation (EU) 2015/1222.
2. The coordinated capacity calculators established in Article 27 of Regulation (EU) 2015/1222 shall calculate long-term cross-zonal capacities for their capacity calculation region. For this purpose, no later than six months after the approval of the capacity calculation methodology for long-term time frames referred to in Article 10, all TSOs in each capacity calculation region shall jointly develop operational rules for long-term capacity calculation time frames supplementing the rules defined for the operation of the coordinated capacity calculators pursuant to Article 27 of Regulation (EU) 2015/1222.
3. The relevant requirements set in Article 27 of Regulation (EU) 2015/1222 shall apply for long-term capacity calculation time frames.

*Article 22***Creation of a common grid model**

The process and requirements set in Article 28 of Regulation (EU) 2015/1222 for creating a common grid model shall apply when creating the common grid model for long-term capacity calculation time frames in capacity calculation regions, where security analysis based on multiple scenarios pursuant to Article 10 is applied.

*Article 23***Regional calculations of long-term cross-zonal capacities**

1. Where TSOs apply the statistical approach pursuant to Article 10, the process for the calculation of long-term cross-zonal capacity shall include at least:
 - (a) a selection of historical day-ahead or intraday cross-zonal capacity data sets from a single period or a set of periods and order the data into a duration curve;
 - (b) a calculation of capacity corresponding to the risk level for the selected data set;
 - (c) a calculation of long-term cross-zonal capacity to be offered to forward capacity allocation taking into account a margin to reflect the difference between historical cross-zonal capacity values and forecasted long-term cross-zonal capacity values;
 - (d) common rules to take into account available information about planned outages, new infrastructure and generation and load pattern for the long-term capacity calculation time frames.
2. Where TSOs apply the security analysis based on multiple scenarios pursuant to Article 10, the requirements set in Article 29 of Regulation (EU) 2015/1222, except Article 29(4) where relevant, shall apply to long-term capacity calculation time frames in capacity calculation regions.
3. Each coordinated capacity calculator shall split the calculated long-term cross-zonal capacity for each forward capacity allocation by applying the methodology for splitting cross-zonal capacity pursuant to Article 16.

4. Each coordinated capacity calculator shall submit the calculated long-term cross-zonal capacity and the splitting of long-term cross-zonal capacity for validation to each TSO within the relevant capacity calculation region pursuant to Article 24.

Article 24

Validation and delivery of cross-zonal capacity and split cross-zonal capacity

1. Each TSO shall validate the results of the calculation for long-term cross-zonal capacity on its bidding zone borders or critical network elements for each long-term capacity calculation time frame pursuant to Article 15.
2. Each TSO shall validate the results of the calculation for splitting of long-term cross-zonal capacity on its bidding zone borders or critical network elements pursuant to Article 16.
3. Each TSO shall send its capacity validation and validated splitting of this capacity for each forward capacity allocation to the relevant coordinated capacity calculators and to the other TSOs of the relevant capacity calculation regions.
4. Validated splitting of long-term cross-zonal capacity shall be provided by each coordinated capacity calculator for the execution of forward capacity allocation pursuant to Article 29.
5. TSOs shall, upon request, provide to their regulatory authorities a report detailing how the value of long-term cross-zonal capacity for a specific long-term capacity calculation time frame has been obtained.

Article 25

Coordinated curtailment of cross-zonal capacity

1. TSOs shall coordinate curtailments of already allocated long-term cross-zonal capacity, if the curtailments concern a time frame of more than 48 hours ahead of the start of the delivery day. In case of curtailment of long-term transmission rights, including nominations in respect of such rights, within 48 hours ahead of the start of the delivery day, TSOs in each capacity calculation region shall apply the day-ahead and intraday capacity calculation process as referred in Article 29 of Regulation (EU) 2015/1222.
2. If a TSO needs to curtail already allocated long-term cross-zonal capacity, it shall send a request to the responsible coordinated capacity calculator to launch the coordinated calculation of necessary curtailments of long-term cross-zonal capacity for the capacity calculation region. The TSO shall support its request with all relevant information.
3. The coordinated capacity calculator shall provide the updated cross-zonal capacity to the relevant TSOs for validation.
4. Each TSO shall validate the updated cross-zonal capacity on its bidding zone borders or critical network elements pursuant to Article 24.
5. The coordinated capacity calculator shall provide the validated updated cross-zonal capacity to the relevant TSOs and single allocation platform to perform curtailment pursuant to Article 53.

Section 5

Biennial report on capacity calculation

Article 26

Biennial report on capacity calculation and allocation

1. No later than two years after the entry into force of this Regulation, ENTSO for Electricity shall draft a report on long-term capacity calculation and allocation, and submit it to the Agency.

2. If the Agency requests it, in every second subsequent year, ENTSO for Electricity shall draft a report on long-term capacity calculation and allocation. If applicable, this report shall be submitted to the Agency together with the biennial report on the capacity calculation and allocation according to Article 31 of Regulation (EU) 2015/1222.
3. For each bidding zone, bidding zone border and capacity calculation region, the report on capacity calculation and allocation shall contain at least:
 - (a) the capacity calculation approach used;
 - (b) statistical indicators on reliability margins;
 - (c) statistical indicators of cross-zonal capacity, where appropriate for each capacity calculation time frame;
 - (d) quality indicators for the information used for the capacity calculation;
 - (e) where appropriate, proposed measures to improve capacity calculation;
 - (f) recommendations for further development of the forward capacity calculation, including further harmonisation of methodologies, processes and governance arrangements.
4. After consulting the Agency, all TSOs shall jointly agree on the statistical and quality indicators for the report. The Agency may require the amendment of those indicators, prior to the agreement by the TSOs or during their application.
5. The Agency shall decide whether to publish all or part of the biennial report.

CHAPTER 2

Bidding zones

Article 27

General provisions

1. The bidding zones applicable to day-ahead and intraday trading shall apply to forward capacity calculation and allocation.
2. Where a bidding zone border no longer exist, holders of long-term transmission rights on this bidding zone border shall be entitled to reimbursement by the concerned TSOs based on the initial price paid for the long-term transmission rights.

CHAPTER 3

Forward capacity allocation

Section 1

General provisions

Article 28

General principles

The allocation of forward capacity shall take place in a way which:

- (a) uses the marginal pricing principle to generate results for each bidding zone border, direction of utilisation and market time unit;

- (b) allocates no more than the offered long-term cross-zonal capacity in accordance with Article 39;
- (c) is repeatable.

Article 29

Input and results

1. The single allocation platform shall use the following inputs for determining the allocation of forward capacity in accordance with paragraph 2:
 - (a) validated splitting of long-term cross-zonal capacity submitted by each coordinated capacity calculator and capacities associated with returned long-term transmission rights pursuant to Article 43;
 - (b) bids submitted by market participants.
2. For each forward capacity allocation, the single allocation platform shall simultaneously determine at least the following results for each bidding zone border, direction of utilisation and market time unit:
 - (a) the volume of allocated long-term transmission rights expressed in MW;
 - (b) the price of long-term transmission rights pursuant to Article 40;
 - (c) the execution status of bids.
3. The single allocation platform shall ensure that auction results are accurate.
4. Each TSO shall ensure that the auction results are consistent with the inputs provided to the single allocation platform in accordance with paragraph 1.

Section 2

Options for cross-zonal transmission risk hedging

Article 30

Decision on cross-zonal risk hedging opportunities

1. TSOs on a bidding zone border shall issue long-term transmission rights unless the competent regulatory authorities of the bidding zone border have adopted coordinated decisions not to issue long-term transmission rights on the bidding zone border. When adopting their decisions, the competent regulatory authorities of the bidding zone border shall consult the regulatory authorities of the relevant capacity calculation region and take due account of their opinions.
2. Where long-term transmission rights do not exist on a bidding zone border at the entry into force of this Regulation, the competent regulatory authorities of the bidding zone border shall adopt coordinated decisions on the introduction of long-term transmission rights no later than six months after the entry into force of this Regulation.
3. The decisions pursuant to paragraphs 1 and 2 shall be based on an assessment, which shall identify whether the electricity forward market provides sufficient hedging opportunities in the concerned bidding zones. The assessment shall be carried out in a coordinated manner by the competent regulatory authorities of the bidding zone border and shall include at least:
 - (a) a consultation with market participants about their needs for cross-zonal risk hedging opportunities on the concerned bidding zone borders;
 - (b) an evaluation.

4. The evaluation referred to in paragraph 3(b) shall investigate the functioning of wholesale electricity markets and shall be based on transparent criteria which include at least:
- (a) an analysis of whether the products or combination of products offered on forward markets represent a hedge against the volatility of the day-ahead price of the concerned bidding zone. Such product or combination of products shall be considered as an appropriate hedge against the risk of change of the day-ahead price of the concerned bidding zone where there is a sufficient correlation between the day-ahead price of the concerned bidding zone and the underlying price against which the product or combination of products are settled;
 - (b) an analysis of whether the products or combination of products offered on forward markets are efficient. For this purpose, at least the following indicators shall be assessed:
 - (i) trading horizon;
 - (ii) bid-ask spread;
 - (iii) traded volumes in relation to physical consumption;
 - (iv) open interest in relation to physical consumption.
5. In case the assessment referred to in paragraph 3 shows that there are insufficient hedging opportunities in one or more bidding zones, the competent regulatory authorities shall request the relevant TSOs:
- (a) to issue long-term transmission rights; or
 - (b) to make sure that other long-term cross-zonal hedging products are made available to support the functioning of wholesale electricity markets.
6. In case the competent regulatory authorities choose to issue a request as referred to in paragraph 5(b), the relevant TSOs shall develop the necessary arrangements and submit them to the competent regulatory authorities' approval no later than six months after the request by the competent regulatory authorities. Those necessary arrangements shall be implemented no later than six months after approval by the competent regulatory authorities. The competent regulatory authorities may extend the implementation time upon request from the relevant TSOs by a period of no more than 6 months.
7. Where regulatory authorities decide that long-term transmission rights shall not be issued by the respective TSOs or that other long-term cross-zonal hedging products shall be made available by the respective TSOs, Articles 16, 28, 29, 31 to 57, 59 and 61 shall not apply to the TSOs of the bidding zone borders.
8. Upon a joint request of the TSOs on a bidding zone border or at their own initiative, and at least every 4 years, the competent regulatory authorities of the bidding zone border shall perform, in cooperation with the Agency, an assessment pursuant to paragraphs 3 to 5.

Article 31

Regional design of long-term transmission rights

1. Long-term cross-zonal capacity shall be allocated to market participants by the allocation platform in the form of physical transmission rights pursuant to the UIOSI principle or in the form of FTRs — options or FTRs — obligations.
2. All TSOs issuing long-term transmission rights shall offer long-term cross-zonal capacity, through the single allocation platform, to market participants for at least annual and monthly time frames. All TSOs in each capacity calculation region may jointly propose to offer long-term cross-zonal capacity on additional time frames.
3. No later than six months after the entry into force of this Regulation, TSOs in each capacity calculation region where long-term transmission rights exist shall jointly develop a proposal for the regional design of long-term transmission rights to be issued on each bidding zone border within the capacity calculation region.

No later than six months after the coordinated decisions of the regulatory authorities of the bidding zone border to introduce long-term transmission rights pursuant Article 30(2), TSOs of the concerned capacity calculation region, shall jointly develop a proposal for the regional design of long-term transmission rights to be issued on each bidding zone border within the concerned capacity calculation region.

Regulatory authorities of Member States in which the current regional design of long-term transmission rights is part of a TSO cross-border re-dispatch arrangement for the purpose of ensuring that operation remains within operational security limits may decide to maintain physical long-term transmission rights on its bidding zone borders.

4. The proposals referred to in paragraph 3 shall include a time schedule for implementation and at least the description of the following items specified in the allocation rules:

- (a) type of long-term transmission rights;
- (b) forward capacity allocation time frames;
- (c) form of product (base load, peak load, off-peak load);
- (d) the bidding zone borders covered.

5. The proposals shall be subject to consultation in accordance with Article 6. For the proposed long-term transmission rights to be issued, each TSO shall duly consider the result of the consultation.

6. The allocation of physical transmission rights and FTRs — options in parallel at the same bidding zone border is not allowed. The allocation of physical transmission rights and FTRs — obligations in parallel at the same bidding zone border is not allowed.

7. A review of long-term transmission rights offered on a bidding zone border may be launched by:

- (a) all regulatory authorities of the bidding zone border, at their own initiative; or
- (b) all regulatory authorities of the bidding zone border based upon a recommendation from the Agency or joint request by all TSOs of the concerned bidding zone border.

8. All TSOs in each capacity calculation region shall be responsible for undertaking the review as provided for in paragraph 9.

9. Each TSO involved in the review of long-term transmission rights shall:

- (a) assess the offered long-term transmission rights taking into account the characteristics in paragraph 4;
- (b) if considered necessary, propose alternative long-term transmission rights, taking into account the result of the assessment in subparagraph (a);
- (c) carry out a consultation in accordance with Article 6 regarding:
 - (i) the results of the assessment of the offered long-term transmission rights;
 - (ii) if applicable, the proposal for alternative long-term transmission rights.

10. Following the consultation referred to in paragraph 9(c) and within three months of the issuance of the decision to launch a review, the TSOs of the capacity calculation region concerned shall jointly submit a proposal to the competent regulatory authorities to maintain or amend the type of long-term transmission rights.

Article 32

Physical transmission rights

1. Each physical transmission right holder shall be entitled to nominate all or part of its physical transmission rights pursuant to Article 36.

2. Where the physical transmission rights holders do not make a nomination by the deadline specified in the nomination rules, they shall be entitled to obtain remuneration in accordance with Article 35.

Article 33

Financial transmission rights — options

1. Holders of FTRs — options shall be entitled to obtain remuneration in accordance with Article 35.
2. The implementation of FTRs — options shall be subject to the application of day-ahead price coupling in accordance with Articles 38 to 50 of Regulation (EU) 2015/1222.

Article 34

Financial transmission rights — obligations

1. Holders of FTRs — obligations shall be entitled to receive or obliged to pay the financial remuneration pursuant to Article 35.
2. The implementation of FTRs — obligations shall be subject to the application of day-ahead price coupling according to Articles 38 to 50 of Regulation (EU) 2015/1222.

Article 35

Principles for long-term transmission rights remuneration

1. The relevant TSOs performing the allocation of transmission rights on a bidding zone border through the single allocation platform shall remunerate the long-term transmission rights holders in case the price difference is positive in the direction of the long-term transmission rights.
2. The holders of FTRs — obligations shall remunerate the relevant TSOs through the single allocation platform allocating transmission rights on a bidding zone border in case the price difference is negative in the direction of the FTRs — obligations.
3. The remuneration of long-term transmission rights in paragraphs 1 and 2 shall comply with the following principles:
 - (a) where the cross-zonal capacity is allocated through implicit allocation or another method resulting from a fallback situation in the day-ahead time frame, the remuneration of long-term transmission rights shall be equal to the market spread;
 - (b) where the cross-zonal capacity is allocated through explicit auction in the day-ahead time frame, the remuneration of long-term transmission rights shall be equal to the clearing price of the daily auction.
4. In case allocation constraints on interconnections between bidding zones have been included in the day-ahead capacity allocation process in accordance with Article 23(3) of Regulation (EU) 2015/1222, they may be taken into account for the calculation of the remuneration of long-term transmission rights pursuant to paragraph 3.

Section 3

Nomination procedures for physical transmission rights

Article 36

General provisions for physical transmission rights nomination

1. Where TSOs issue and apply physical transmission rights on bidding zone borders, they shall enable physical transmission rights holders and/or their counterparties to nominate their electricity exchange schedules. Physical transmission rights holders may authorise eligible third parties to nominate their electricity exchange schedules on their behalf in line with the nomination rules in accordance with paragraph 3.

2. No later than 12 months after the entry into force of this Regulation, all TSOs issuing physical transmission rights on a bidding zone border shall submit to the relevant regulatory authorities' approval a proposal for nomination rules for electricity exchange schedules between bidding zones. The proposal shall be subject to consultation in accordance with Article 6. Nomination rules shall contain at least the following information:

- (a) the entitlement of a physical transmission rights holder to nominate electricity exchange schedules;
- (b) minimum technical requirements to nominate;
- (c) description of the nomination process;
- (d) nomination timings;
- (e) format of nomination and communication.

3. All TSOs shall progressively harmonise the nomination rules on all bidding zone borders on which physical transmission rights are applied.

4. Physical transmission rights holders, their counterparties where applicable or an authorised third party acting on their behalf shall nominate all or part of their physical transmission rights between bidding zones in compliance with the nomination rules.

5. In case allocation constraints on interconnections between bidding zones have been included in the day-ahead capacity allocation process in accordance with Article 23(3) of Regulation (EU) 2015/1222, they shall be taken into account in the proposal for nomination rules referred to in paragraph 2.

Section 4

Processes and operation

Article 37

Terms and conditions for participation in the forward capacity allocation

1. Market participants shall be registered with the single allocation platform and meet all eligibility requirements under the harmonised allocation rules before being entitled to participate in the auctions or transfer their long-term transmission rights. The eligibility requirements shall comply with the principles of non-discrimination and transparency.

2. Following a market participant's request for registration, the single allocation platform shall notify the market participant whether it fulfils all eligibility requirements and is entitled to participate in the auctions or transfer its long-term transmission rights from a specified date.

3. Market participants shall fully comply with the harmonised allocation rules. They shall keep all information relating to their participation up to date and notify the single allocation platform of any changes to this information without delay.

4. The single allocation platform shall be entitled to suspend or withdraw a market participant's right to participate in the auctions or transfer its long-term transmission rights following a breach of its contractual obligations under the harmonised allocation rules.

5. The suspension or withdrawal of the right of the market participant to participate in the auctions or transfer its long-term transmission right pursuant to the harmonised allocation rules shall not exonerate a market participant or the single allocation platform from their obligations deriving from long-term transmission rights allocated and paid before the suspension or withdrawal.

Article 38

Submission of input data to the single allocation platform

Each TSO shall ensure that validated splitting of long-term cross-zonal capacity is submitted to the single allocation platform prior to the publication of the auction specification in accordance with Article 39.

*Article 39***Operation of the forward capacity allocation**

1. No later than the time specified in the harmonised allocation rules for each forward capacity allocation, an auction specification containing at least the following information shall be defined and published on the single allocation platform:
 - (a) date and time of gate opening and gate closure of the auction;
 - (b) validated splitting of long-term cross-zonal capacity and type of the long-term transmission rights that will be auctioned;
 - (c) format of bids;
 - (d) date and time of publication of auction results;
 - (e) the period during which auction results can be contested.
2. The published long-term cross-zonal capacity shall not be modified during a period prior to the gate closure of the auction. The harmonised allocation rules shall specify that period.
3. Each market participant shall submit its bids to the single allocation platform prior to the gate closure time and in accordance with the conditions set out in the auction specification.
4. The single allocation platform shall ensure the confidentiality of submitted bids.

*Article 40***Pricing of the long-term transmission rights**

The price of long-term transmission rights for each bidding zone border, direction of utilisation and market time unit shall be determined based on the marginal price principle and expressed in euro per megawatt. In case the demand for the long-term cross-zonal capacity for a bidding zone border, direction of utilisation and market time unit is lower or equal to the offered long-term cross-zonal capacity, the price shall be zero.

*Article 41***Financial requirements and settlement**

1. The single allocation platform shall provide invoicing or self-billing procedures for the settlement of debits or credits resulting from the allocation of long-term transmission rights, the return of long-term transmission rights and the remuneration of long-term transmission rights. The harmonised allocation rules shall specify those procedures.
2. In order to participate in the auctions, a market participant shall have sufficient collaterals to secure bids and allocated long-term transmission rights in accordance with the conditions set out in the harmonised allocation rules.

*Article 42***Establishment of fallback procedures**

1. In the event that forward capacity allocation is unable to produce results, the default fallback procedure shall be the postponement of the forward capacity allocation.
2. All TSOs in each capacity calculation region shall be entitled to implement alternative coordinated fallback solutions. In such cases, all TSOs in each capacity calculation region shall develop a coordinated proposal for reliable fallback procedures.

*Article 43***Return of long-term transmission rights**

1. Long-term transmission rights holders may return their long-term transmission rights to the relevant TSOs through the single allocation platform for subsequent forward capacity allocation.
2. Long-term transmission rights holders willing to return their long-term transmission rights for subsequent forward capacity allocation shall notify this, directly or indirectly through a third party, to the single allocation platform as set out in the harmonised allocation rules.
3. Long-term transmission rights holders who return their long-term transmission rights shall be remunerated, directly or indirectly through a third party, by the relevant TSOs through the single allocation platform. Such remuneration shall be equal to the price resulting from the auction where the long-term transmission rights are reallocated.

*Article 44***Transfer of long-term transmission rights**

1. Long-term transmission rights holders shall be entitled to transfer all or part of their long-term transmission rights to other market participants in accordance with the harmonised allocation rules.
2. The rules on admissibility and a list of market participants registered with the single allocation platform and eligible to transfer long-term transmission rights shall be published on the single allocation platform.
3. Long-term transmission rights holders shall notify the transfer of long-term transmission rights, directly or indirectly through a third party, to the single allocation platform in accordance with the harmonised allocation rules.
4. Market participants acquiring those long-term transmission rights shall confirm, in accordance with the harmonised allocation rules, directly or indirectly through a third party, to the single allocation platform the notification sent by the previous long-term transmission rights holder.

*Article 45***Delivery of results**

1. The single allocation platform shall notify the TSOs responsible for the bidding zone border to which the long-term transmission rights are associated, the market participants and the long-term transmission rights holders about the result of the forward capacity allocation within the time frame provided in the auction specification.
2. The single allocation platform shall inform market participants about the execution status and clearing prices of their bids.

*Article 46***Initiation of fallback procedures**

1. In the event that the single allocation platform is unable to deliver either the auction specification in accordance with Article 39 or part or all of the results of the forward capacity allocation within the time frame specified in the harmonised allocation rules, the TSOs responsible on the bidding zone border shall implement the fallback procedures established pursuant to Article 42.

2. As soon as a failure to deliver the items referred to in paragraph 1 is identified, the single allocation platform shall notify the TSOs responsible on the bidding zone border. The single allocation platform shall notify market participants that fallback procedures may be applied.

Article 47

Publication of market information

1. At least the following information for each bidding zone border and direction of utilisation shall be published on the single allocation platform:

- (a) auction specification in accordance with Article 39;
- (b) an indicative auction calendar setting out the type of long-term transmission rights to be offered and the dates when those long-term transmission rights shall be offered to market participants;
- (c) forward capacity allocation results in accordance with Article 29;
- (d) number of market participants in each auction;
- (e) list of eligible market participants for the transfer of long-term transmission rights;
- (f) the single allocation platform's contact details.

2. The relevant TSOs shall publish, through the single allocation platform, the information required referred to in paragraph 1 in accordance with the timing set out in the auction specification and in Regulation (EU) No 543/2013.

3. The single allocation platform shall ensure that historical data for a period of not less than five years is made publicly available.

CHAPTER 4

Single allocation platform

Article 48

Establishment

1. All TSOs shall ensure that the single allocation platform is operational and complies with the functional requirements specified in Article 49 within 12 months after the approval of the proposal for a common set of requirements and for the establishment of the single allocation platform. The competent regulatory authorities may extend this period upon request from the relevant TSOs due to delays relating to public procurement procedures by a period of no more than 6 months.

2. Forward capacity allocations on Direct Current interconnectors shall take place on the single allocation platform no later than 24 months after the approval as referred to in paragraph 1.

Article 49

Functional requirements

1. Within six months after the entry into force of this Regulation, all TSOs shall submit to all regulatory authorities a common proposal for a set of requirements and for the establishment of the single allocation platform. The proposal shall identify different options for the establishment and governance of the single allocation platform, including the development by TSOs or by third parties on their behalf. The proposal by TSOs shall cover the general tasks of the single allocation platform provided for in Article 50 and the requirements for cost recovery in accordance with Article 59.

2. The functional requirements for the single allocation platform shall at least include:
 - (a) the expected bidding zone borders to be covered;
 - (b) the technical availability and reliability of provided services;
 - (c) the operational processes;
 - (d) the products to be offered;
 - (e) the forward capacity allocation time frames;
 - (f) the allocation methods and algorithms;
 - (g) the principles of financial settlement and risk management of allocated products;
 - (h) a harmonised contractual framework with market participants;
 - (i) the data interfaces.

Article 50

General tasks

The relevant TSOs shall use the single allocation platform, at least, for the following purposes:

- (a) the registration of market participants;
- (b) providing a single point of contact to market participants;
- (c) the operation of auction procedures;
- (d) the financial settlement of allocated long-term transmission rights with market participants, including management of collaterals;
- (e) the cooperation with a clearing house, if required by the common rules for the implementation of FTRs — obligations pursuant to Article 34;
- (f) the organisation of a fallback procedure pursuant to Article 42 and 46;
- (g) enabling the return of long-term transmission rights pursuant to Article 43;
- (h) facilitating the transfer of long-term transmission rights pursuant to Article 44;
- (i) the publication of market information pursuant to Article 47;
- (j) providing and operating interfaces for data exchange with market participants.

CHAPTER 5

Harmonised allocation rules

Article 51

Introduction of harmonised allocation rules

1. Within six months after the entry into force of this Regulation, all TSOs shall jointly develop a proposal for harmonised allocation rules for long-term transmission rights pursuant to Article 52(2). The proposal shall be subject to consultation in accordance with Article 6. This proposal shall include regional and bidding zone border specific requirements if developed by the TSOs of each capacity calculation region pursuant to Article 52(3).

2. Once the regional requirements have entered into force, they shall prevail over the general requirements defined in the harmonised allocation rules. In case the general requirements of the harmonised allocation rules are amended and submitted to all regulatory authorities' approval, the regional requirements shall also be submitted to regulatory authorities' approval of the concerned capacity calculation region.

Article 52

Requirements for the harmonised allocation rules

1. The requirements for the harmonised allocation rules for long-term transmission rights shall cover physical transmission rights, FTRs — options and FTRs — obligations. TSOs shall consider and duly take into account specificities related to the different types of products.

2. The harmonised allocation rules for long-term transmission rights shall follow the principles of non-discrimination and transparency and at least contain the following general requirements:

- (a) harmonised definitions and scope of applications;
- (b) a contractual framework between the single allocation platform and the market participants including provisions on the applicable law, the applicable language, confidentiality, dispute resolution, liability and *force majeure*;
- (c) harmonised UIOSI provisions in case of physical transmission rights pursuant to Article 32;
- (d) a description of the types of long-term transmission rights which are offered, including the remuneration principles pursuant to Article 35;
- (e) principle description of the applicable nomination rules pursuant to Article 36;
- (f) harmonised provisions on eligibility and entitlement, suspension and renewal and costs of participation pursuant to Article 37;
- (g) a description of the forward capacity allocation process including at least provisions on auction specification, submission of bids, publication of auction results, contestation period and fallback procedures pursuant to Articles 37, 38, 39, 42, 43 and 44;
- (h) harmonised provisions on financial requirements and settlement pursuant to Article 41;
- (i) harmonised provisions for the return of long-term transmission rights pursuant to Article 43;
- (j) harmonised provisions for notification of transfer of long-term transmission rights pursuant to Article 44;
- (k) provisions on firmness and compensation rules pursuant to Article 53 and Article 55;
- (l) harmonised provisions concerning netting policies and financial collaterals for FTRs — obligations, where applicable.

3. The harmonised allocation rules may also contain regional or bidding zone border specific requirements in particular for, but without limitation to:

- (a) the description of the type of long-term transmission rights which are offered on each bidding zone border within the capacity calculation region pursuant to Article 31;
- (b) the type of long-term transmission rights remuneration regime to be applied on each bidding zone border within the capacity calculation region according to the allocation in the day-ahead time frame pursuant to Article 35;
- (c) the implementation of alternative coordinated regional fallback solutions pursuant to Article 42;
- (d) the regional compensation rules defining regional firmness regimes pursuant to Article 55.

CHAPTER 6

Firmness of allocated cross-zonal capacity*Article 53***General firmness provisions**

1. All TSOs shall be entitled to curtail long-term transmission rights to ensure operation remains within operational security limits prior to the day-ahead firmness deadline. Where TSOs curtail long-term transmission rights, they shall report this to the respective regulatory authorities and also publish the factual reasons that lead to the curtailment.
2. The concerned TSOs on the bidding zone border where long-term transmission rights have been curtailed shall compensate the holders of curtailed long-term transmission rights with the market spread.

*Article 54***Definition of caps**

1. The concerned TSOs on a bidding zone border may propose a cap on the total compensation to be paid to all holders of curtailed long-term transmission rights in the relevant calendar year or the relevant calendar month in case of Direct Current interconnectors.
2. The cap shall not be lower than the total amount of congestion income collected by the concerned TSOs on the bidding zone border in the relevant calendar year. In case of Direct Current interconnectors, TSOs may propose a cap not lower than the total congestion income collected by the concerned TSOs on the bidding zone border in the relevant calendar month.
3. In case of several interconnectors operated by different TSOs on the same bidding zone border and subject to different regulatory regimes overseen by regulatory authorities, the total congestion income used for calculation of capped compensation pursuant to paragraph 2 may be dissociated between each interconnector. Such a division shall be proposed by the concerned TSOs and approved by the competent regulatory authorities.

*Article 55***Compensation rules**

Where TSOs propose to apply a cap referred to in Article 54, they shall jointly propose a set of compensation rules with regard to the applied cap.

*Article 56***Firmness in the event of *force majeure***

1. In the event of *force majeure*, TSOs may curtail long-term transmission rights. Such curtailment shall be undertaken in a coordinated manner following liaison with all TSOs directly affected.
2. The TSO which invokes the *force majeure* shall publish a notification describing the nature of the *force majeure* and its probable duration.
3. In the event of curtailment due to *force majeure* the concerned holders of long-term transmission rights shall receive compensation for the period of that *force majeure* by the TSO which invoked the *force majeure*. In this case, the compensation shall be equal to the amount initially paid for the concerned long-term transmission right during the forward allocation process.

4. The TSO which invokes a *force majeure* shall make every possible effort to limit the consequences and duration of the *force majeure*.
5. Where a Member State has so provided, upon request by the TSO concerned, the national regulatory authority shall assess whether an event qualifies as *force majeure*.

CHAPTER 7

Congestion income distribution

Article 57

Congestion income distribution methodology

1. Within six months after the approval of the methodology for sharing congestion income referred to in Article 9(6) of Regulation (EU) 2015/1222, all TSOs shall jointly develop a proposal for a methodology for sharing congestion income from forward capacity allocation.
2. When developing the methodology referred to in paragraph 1, TSOs shall take into account the methodology for sharing congestion income developed in accordance with Article 73 of Regulation (EU) 2015/1222.
3. When developing the methodology for sharing congestion income from forward capacity allocation, the requirements set in Article 73 of Regulation (EU) 2015/1222 shall apply.

CHAPTER 8

Cost recovery

Article 58

General provisions on cost recovery

1. Costs incurred by TSOs arising from obligations in this Regulation shall be assessed by all regulatory authorities.
2. Costs assessed as reasonable, efficient and proportionate shall be recovered in a timely manner through network tariffs or other appropriate mechanisms as determined by the competent regulatory authorities.
3. If requested by regulatory authorities, relevant TSOs shall, within three months of the request, provide information necessary to facilitate the assessment of the costs incurred.

Article 59

Cost of establishing, developing and operating the single allocation platform

All TSOs issuing long-term transmission rights on the single allocation platform shall jointly bear the costs related to the establishment and operation of the single allocation platform. Within six months of entry into force of this regulation, all TSOs shall propose a methodology for sharing these costs, which shall be reasonable, efficient and proportionate, for example on the basis of principles similar to those provided under Article 80 of Regulation (EU) No 2015/1222.

Article 60

Cost of establishing and operating the coordinated capacity calculation process

1. Each TSO shall individually bear the costs related to the provision of inputs to the capacity calculation.

2. All TSOs shall jointly bear the costs related to the establishment and operation of merging the individual grid models.
3. All TSOs in each capacity calculation region shall bear costs of establishing and operating the coordinated capacity calculators.

Article 61

Cost of ensuring firmness and remuneration of long-term transmission rights

1. The cost of ensuring firmness shall include costs incurred from compensation mechanisms associated with ensuring firmness of cross-zonal capacities as well as the cost of re-dispatching, countertrading and imbalance associated with compensating market participants and be borne by TSOs, to the extent possible in accordance with Article 16(6)(a) of Regulation (EC) No 714/2009.
2. When fixing or approving transmission tariffs or other appropriate mechanism in accordance with Article 37(1)(a) of Directive 2009/72/EC, and having regard to Article 14(1) of Regulation (EC) No 714/2009, regulatory authorities shall consider compensation payments as eligible costs provided that they are reasonable, efficient and proportionate.
3. Within six months after the approval of the methodology for sharing congestion income referred to in Article 57, all TSOs shall jointly develop a methodology for sharing costs incurred to ensure firmness and remuneration of long-term transmission rights. This methodology shall be consistent with the methodology for sharing congestion income from forward capacity allocation as referred to in Article 57.

TITLE III

DELEGATION OF TASKS AND MONITORING

Article 62

Delegation of tasks

1. A TSO may delegate all or part of any task assigned to it under this Regulation to one or more third parties in the case the third party can carry out the respective function at least as effectively as the delegating TSO. The delegating TSO shall remain responsible for ensuring compliance with the obligations under this Regulation, including ensuring access to information necessary for monitoring by the regulatory authority.
2. Prior to the delegation, the third party concerned shall have clearly demonstrated to the delegating TSO its ability to meet each of the obligations of this Regulation.
3. In the event that all or part of any task specified in this Regulation is delegated to a third party, the delegating TSO shall ensure that suitable confidentiality agreements in accordance with the confidentiality obligations of the delegating TSO have been put in place prior to delegation.

Article 63

Monitoring

1. ENTSO for Electricity shall monitor the implementation of forward capacity allocation and the establishment of single allocation platform in accordance with Article 8(8) of Regulation (EC) No 714/2009. Monitoring shall cover in particular the following matters:
 - (a) the progress and potential problems with the implementation of forward capacity allocation, including fair and transparent access for market participants to long-term transmission rights;
 - (b) the effectiveness of the methodologies for splitting long-term cross-zonal capacity in accordance with Article 16;

- (c) the report on capacity calculation and allocation in accordance with Article 26;
 - (d) the effectiveness of the operation of the forward capacity allocation and the single allocation platform.
2. ENTSO for Electricity shall submit a monitoring plan which includes the reports to be prepared and any updates in accordance with paragraph 1, to the Agency for an opinion by six months after entry into force of this Regulation.
3. The Agency, in cooperation with ENTSO for Electricity, shall draw up within six months after the entry into force of this Regulation a list of the relevant information to be communicated by ENTSO for Electricity to the Agency in accordance with Articles 8(9) and 9(1) of Regulation (EC) No 714/2009. The list of relevant information may be subject to updates. ENTSO for Electricity shall maintain a comprehensive, standardised format, digital data archive of the information required by the Agency. All TSOs shall submit to ENTSO for Electricity the information required to perform the tasks in accordance with paragraphs 1 and 3.
4. Market participants and other relevant organisations regarding forward capacity allocation shall, at the joint request of the Agency and ENTSO for Electricity, submit to ENTSO for Electricity the information required for monitoring in accordance with paragraphs 1 and 3, except for information already obtained by the regulatory authorities, the Agency or ENTSO for Electricity in the context of their respective implementation monitoring tasks.

TITLE IV

FINAL PROVISIONS

Article 64

Entry into force

This Regulation shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels, 26 September 2016.

For the Commission
The President
Jean-Claude JUNCKER

COMMISSION IMPLEMENTING REGULATION (EU) 2016/1720**of 26 September 2016****establishing the standard import values for determining the entry price of certain fruit and vegetables**

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Regulation (EU) No 1308/2013 of the European Parliament and of the Council of 17 December 2013 establishing a common organisation of the markets in agricultural products and repealing Council Regulations (EEC) No 922/72, (EEC) No 234/79, (EC) No 1037/2001 and (EC) No 1234/2007 ⁽¹⁾,

Having regard to Commission Implementing Regulation (EU) No 543/2011 of 7 June 2011 laying down detailed rules for the application of Council Regulation (EC) No 1234/2007 in respect of the fruit and vegetables and processed fruit and vegetables sectors ⁽²⁾, and in particular Article 136(1) thereof,

Whereas:

- (1) Implementing Regulation (EU) No 543/2011 lays down, pursuant to the outcome of the Uruguay Round multilateral trade negotiations, the criteria whereby the Commission fixes the standard values for imports from third countries, in respect of the products and periods stipulated in Annex XVI, Part A thereto.
- (2) The standard import value is calculated each working day, in accordance with Article 136(1) of Implementing Regulation (EU) No 543/2011, taking into account variable daily data. Therefore this Regulation should enter into force on the day of its publication in the *Official Journal of the European Union*,

HAS ADOPTED THIS REGULATION:

Article 1

The standard import values referred to in Article 136 of Implementing Regulation (EU) No 543/2011 are fixed in the Annex to this Regulation.

Article 2

This Regulation shall enter into force on the day of its publication in the *Official Journal of the European Union*.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels, 26 September 2016.

*For the Commission,
On behalf of the President,*

*Jerzy PLEWA
Director-General for Agriculture and Rural Development*

⁽¹⁾ OJ L 347, 20.12.2013, p. 671.

⁽²⁾ OJ L 157, 15.6.2011, p. 1.

ANNEX

Standard import values for determining the entry price of certain fruit and vegetables

(EUR/100 kg)		
CN code	Third country code ⁽¹⁾	Standard import value
0702 00 00	MA	180,4
	ZZ	180,4
0707 00 05	TR	118,8
	ZZ	118,8
0709 93 10	AR	162,6
	TR	141,7
	ZZ	152,2
0805 50 10	AR	108,6
	CL	123,7
	TR	109,1
	UY	92,6
	ZA	138,6
	ZZ	114,5
0806 10 10	TR	129,9
	ZA	80,3
	ZZ	105,1
0808 10 80	AR	148,2
	BR	97,9
	CL	138,1
	NZ	122,5
	US	144,0
	ZA	113,6
	ZZ	127,4
0808 30 90	CL	126,9
	CN	92,9
	TR	132,1
	ZA	155,4
	ZZ	126,8
0809 30 10, 0809 30 90	TR	128,6
	ZZ	128,6

⁽¹⁾ Nomenclature of countries laid down by Commission Regulation (EU) No 1106/2012 of 27 November 2012 implementing Regulation (EC) No 471/2009 of the European Parliament and of the Council on Community statistics relating to external trade with non-member countries, as regards the update of the nomenclature of countries and territories (OJ L 328, 28.11.2012, p. 7). Code 'ZZ' stands for 'of other origin'.

DECISIONS

COMMISSION IMPLEMENTING DECISION (EU) 2016/1721

of 26 September 2016

on the approval of the Toyota efficient exterior lighting using light emitting diodes for the use in non-externally chargeable hybrid electrified vehicles as an innovative technology for reducing CO₂ emissions from passenger cars pursuant to Regulation (EC) No 443/2009 of the European Parliament and of the Council

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Regulation (EC) No 443/2009 of the European Parliament and of the Council of 23 April 2009 setting emissions performance standards for new passenger cars as part of the Community's integrated approach to reduce CO₂ emissions from light-duty vehicles ⁽¹⁾, and in particular Article 12(4) thereof,

Whereas:

- (1) The manufacturer Toyota Motor Europe NV/SA (the 'Applicant') submitted an application for the approval of the Toyota light emitting diodes (LEDs) for the use in non-externally chargeable hybrid electrified M1 vehicles (NOVC-HEVs) as an innovative technology on 9 December 2015. The completeness of that application was assessed in accordance with Article 4 of Commission Implementing Regulation (EU) No 725/2011 ⁽²⁾. The application was found to be complete and the period for the Commission's assessment of the application started on the day following the date of official receipt of the complete information, i.e. 10 December 2015.
- (2) The application has been assessed in accordance with Article 12 of Regulation (EC) No 443/2009, Implementing Regulation (EU) No 725/2011 and the Technical Guidelines for the preparation of applications for the approval of innovative technologies pursuant to Regulation (EC) No 443/2009 (the Technical Guidelines, version February 2013) ⁽³⁾.
- (3) The application refers to the Toyota efficient LEDs for use in NOVC-HEV in the low beam headlamp, high beam headlamp, front position lamp, front fog lamp, rear fog lamp, front turn signal lamp, rear turn signal lamp, rear fog lamp, licence plate and reversing lamps.
- (4) The Commission finds that the information provided in the application demonstrates that the conditions and criteria referred to in Article 12 of Regulation (EC) No 443/2009 and in Articles 2 and 4 of Implementing Regulation (EU) No 725/2011 have been met.
- (5) The Applicant has demonstrated that the use of the Toyota LEDs in the relevant lamps did not exceed 3 % of the new passenger cars registered in the reference year 2009. In support of this the Applicant has referred to the Technical Guidelines, which provides for the summary of the CLEPA LIGHT Sight Safety report.
- (6) The Applicant has in accordance with the simplified approach described in the Technical Guidelines used halogen lighting as baseline technology for demonstrating the CO₂ reducing capacity of the Toyota LEDs.

⁽¹⁾ OJ L 140, 5.6.2009, p. 1.

⁽²⁾ Commission Implementing Regulation (EU) No 725/2011 of 25 July 2011 establishing a procedure for the approval and certification of innovative technologies for reducing CO₂ emissions from passenger cars pursuant to Regulation (EC) No 443/2009 of the European Parliament and of the Council (OJ L 194, 26.7.2011, p. 19).

⁽³⁾ <https://circabc.europa.eu/w/browse/42c4a33e-6fd7-44aa-adac-f28620bd436f>

- (7) In order to take into account the presence in a NOVC-HEV of two power sources (i.e. the internal combustion engine and the electric powertrain) a different approach is required for the conversion of power savings to CO₂ savings compared to the methodology set out in Commission Implementing Decision (EU) 2016/587 ⁽¹⁾.
- (8) The Applicant has provided a specific methodology for testing the CO₂ reductions from LEDs fitted in such vehicles. The Commission considers that the testing methodology is appropriate for addressing the issue and that it will provide testing results that are verifiable, repeatable and comparable and capable of demonstrating in a realistic manner the CO₂ emissions benefits of the innovative technology with strong statistical significance in accordance with Article 6 of Implementing Regulation (EU) No 725/2011.
- (9) Against that background the Commission finds that the Applicant has demonstrated satisfactorily that the emission reduction achieved by the Toyota LED lightings for the use in NOVC-HEV in appropriate combinations of a low beam headlamp, high beam headlamp, front position lamp, front fog lamp, rear fog lamp and licence plate lamp is at least 1 g CO₂/km.
- (10) Since the activation of the LED lightings for the lamps listed in the application is not required for the CO₂ emissions type-approval test referred to in Regulation (EC) No 715/2007 of the European Parliament and of the Council ⁽²⁾ and Commission Regulation (EC) No 692/2008 ⁽³⁾, the Commission is satisfied that the LED lighting functions in question are not covered by the standard test cycle.
- (11) The activation of the lighting functions concerned is mandatory to ensure the safe operation of the vehicle and as a consequence not dependant on the choice of the driver. On that basis the Commission finds that the manufacturer should be considered accountable for the CO₂ emission reduction due to the use of the innovative technology.
- (12) The Commission finds that the verification report has been prepared by Vehicles Certification Agency which is an independent and certified body and that the report supports the findings set out in the application.
- (13) Against that background, the Commission finds that no objections should be raised as regards the approval of the innovative technology in question.
- (14) For the purposes of determining the general eco-innovation code to be used in the relevant type-approval documents in accordance with Annexes I, VIII and IX to Directive 2007/46/EC of the European Parliament and of the Council ⁽⁴⁾, the individual code to be used for the innovative technology approved through this Implementing Decision should be specified,

HAS ADOPTED THIS DECISION:

Article 1

1. The Toyota light emitting diodes (LEDs) for use in non-externally chargeable hybrid electrified M₁ vehicles (NOVC-HEV) in the low beam headlamp, high beam headlamp, front position lamp, front fog lamp, front turn signal lamp, rear turn signal lamp, rear fog lamp, licence plate lamp and reversing lamp is approved as an innovative technology within the meaning of Article 12 of Regulation (EC) No 443/2009.

⁽¹⁾ Commission Implementing Decision (EU) 2016/587 of 14 April 2016 on the approval of the technology used in efficient vehicle exterior lighting using light emitting diodes as an innovative technology for reducing CO₂ emissions from passenger cars pursuant to Regulation (EC) No 443/2009 of the European Parliament and of the Council (OJ L 101, 16.4.2016, p. 17).

⁽²⁾ Regulation (EC) No 715/2007 of the European Parliament and of the Council of 20 June 2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information (OJ L 171, 29.6.2007, p. 1).

⁽³⁾ Commission Regulation (EC) No 692/2008 of 18 July 2008 implementing and amending Regulation (EC) No 715/2007 of the European Parliament and of the Council on type-approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information (OJ L 199, 28.7.2008, p. 1).

⁽⁴⁾ Directive 2007/46/EC of the European Parliament and of the Council of 5 September 2007 establishing a framework for the approval of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles (Framework Directive) (OJ L 263, 9.10.2007, p. 1).

2. The CO₂ emissions reduction from the use of the Toyota LEDs in NOVC-HEV in all, or an appropriate combination of the lighting functions referred to in paragraph 1 shall be determined using the methodology set out in the Annex.
3. The individual eco-innovation code to be entered into type-approval documentation to be used for the innovative technology approved through this Implementing Decision shall be '20'.

Article 2

This Decision shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.

Done at Brussels, 26 September 2016.

For the Commission

The President

Jean-Claude JUNCKER

ANNEX

Methodology to determine the CO₂ savings of exterior vehicle lighting using light emitting diodes (LEDs) for the use in M₁ non-externally chargeable hybrid electrified vehicles (NOVC-HEV)

1. INTRODUCTION

In order to determine the CO₂ emission reductions that can be attributed to a package of efficient exterior LED lights consisting of an appropriate combination of vehicle lights referred to in Article 1 for the use in M₁ non-externally chargeable hybrid electrified vehicles (NOVC-HEVs), it is necessary to establish the following:

- (1) Testing conditions;
- (2) Test equipment;
- (3) Determination of the power savings;
- (4) Calculation of the CO₂ savings;
- (5) Calculation of the statistical error.

2. SYMBOLS, PARAMETERS AND UNITS

Latin symbols

c	— Correction factor for the nominal voltage of the High Voltage battery
C_{CO_2}	— CO ₂ savings [g CO ₂ /km]
CO_2	— Carbon dioxide
k_{CO_2}	— CO ₂ correction factor [gCO ₂ /km · Ah], as defined in Regulation UN/ECE No 101, Annex 8
m	— Number of efficient exterior LED lights composing the package
n	— Number of measurements of the sample
P	— Power consumption of the vehicle light [W]
S_{PEI}	— Standard deviation of the LED light power consumption [W]
$\overline{S_{PEI}}$	— Standard deviation of the LED light power consumption mean [W]
$S_{C_{CO_2}}$	— Standard deviation of the total CO ₂ savings [g CO ₂ /km]
t	— Driving duration of the NEDC [s], which is 1 180 s
UF	— Usage factor of the vehicle light [-] as defined in Table 2
V_{HVnom}	— Nominal voltage of the High Voltage battery (traction battery) [V]
V_{HVop}	— Operative voltage of the High Voltage battery (traction battery) [V]
$\frac{\partial C_{CO_2}}{\partial P_{EI}}$	— Sensitivity of calculated CO ₂ savings related to the LED light power consumption
$\frac{\partial C_{CO_2}}{\partial k_{CO_2}}$	— Sensitivity of calculated CO ₂ savings related to the CO ₂ correction factor

Greek symbols

η_{DCDC}	— Efficiency of the DC-DC converter
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Subscripts

Index (i) refers to vehicle lights

Index (j) refers to measurement of the sample

B — Baseline

EI — Eco-innovative

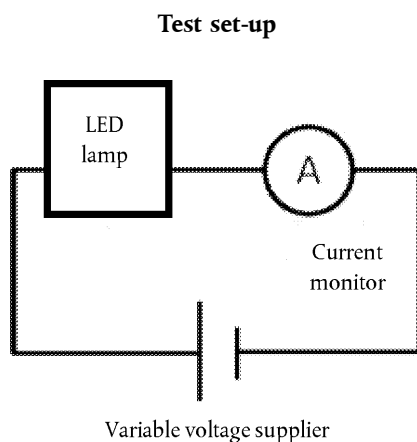
3. TESTING CONDITIONS

The testing conditions shall fulfil the requirements of Regulation UN/ECE 112 ⁽¹⁾ on Uniform provisions concerning the approval of motor vehicle headlamps emitting an asymmetrical passing beam or a driving beam or both and equipped with filament lamps and/or light-emitting diode (LED) modules. The power consumption shall be determined in accordance with point 6.1.4 of Regulation UN/ECE No 112 and points 3.2.1 and 3.2.2 of Annex 10 to that Regulation.

4. TEST EQUIPMENT

The following equipment is to be used, as shown in the figure:

- A power supply unit (i.e. variable voltage supplier);
- Two Digital Multi Meters, one for measuring the DC-current, and the other for measuring the DC-voltage. In the figure a possible test set-up is shown, when the DC-voltage meter is integrated in the power supply unit.



5. MEASUREMENTS AND DETERMINATION OF THE POWER SAVINGS

For each efficient exterior LED light included in the package the measurement of the current shall be performed as shown in the figure at a voltage of 13,2 V. LED module(s) operated by an electronic light source control gear, shall be measured as specified by the applicant.

The manufacturer may request that other measurements of the current shall be done at other additional voltages. In that case, the manufacturer must hand over verified documentation on the necessity to perform these other measurements to the type-approval authority. The measurements of the currents at each of those additional voltages are to be performed consecutively at least five (5) times. The exact installed voltages and the measured current is to be recorded in four decimals.

The power consumption has to be determined by multiplying the installed voltage with the measured current. The average of the power consumption for each efficient exterior LED light ($\overline{P_{Ei}}$) has to be calculated. Each value must be expressed in 4 decimals. When a stepper motor or electronic controller is used for the supply of the electricity to the LED lamps, then the electric load of this component part is to be excluded from the measurement.

⁽¹⁾ E/ECE/324/Rev.2/Add.111/Rev.3 — E/ECE/TRANS/505/Rev.2/Add.111/Rev.3, 9 January 2013

The resulting power savings of each efficient exterior LED light (ΔP_i) are to be calculated with the following formula:

Formula 1

$$\Delta P_i = P_{B_i} - \overline{P_{El_i}}$$

where the power consumption of the corresponding baseline vehicle light is defined by Table 1.

Table 1

Power requirements for different baseline vehicle lights

Vehicle light	Total electric power (P_B) [W]
Low beam headlamp	137
High beam headlamp	150
Front position	12
Licence plate	12
Front fog lamp	124
Rear fog lamp	26
Front turn signal lamp	13
Rear turn signal lamp	13
Reversing lamp	52

6. CALCULATION OF THE CO₂ SAVINGS

The total CO₂ savings of the lighting package are to be calculated by Formula 2.

Formula 2

$$C_{CO_2} = \left(\sum_{i=1}^m \Delta P_i \cdot UF_i \right) \cdot \frac{t \cdot k_{CO_2}}{V_{HVop} \cdot \eta_{DCDC}}$$

where

UF: Usage factor of the vehicle light [-] as defined in Table 2.

t: Driving duration of the NEDC [s], which is 1 180 s

k_{CO_2} : CO₂ correction factor [gCO₂/km · Ah], as defined in Regulation UN/ECE No 101, Annex 8

η_{DCDC} : Efficiency of the DC-DC converter [-]

V_{HVop} : Operative voltage of the High Voltage battery (traction battery) [V], defined by Formula 3

Formula 3

$$V_{HVop} = \frac{V_{HVnom}}{c}$$

where

V_{HVnom} : Nominal voltage of the High Voltage battery (traction battery) [V]

c : Correction factor for the nominal voltage of the High Voltage battery, which is 0,90 for nickel-metal hydride (NiMH) high voltage batteries [-]

The efficiency of the DC-DC converter (η_{DCDC}) shall be the highest value resulting from the efficiency tests performed in the operative electric current range. The measuring interval shall be equal or lower than 10 % of the operative electric current range.

Table 2

Usage factor for different vehicle lights

Vehicle light	Usage factor (UF) [-]
Low beam headlamp	0,33
High beam headlamp	0,03
Front position	0,36
Licence plate	0,36
Front fog lamp	0,01
Rear fog lamp	0,01
Front turn signal lamp	0,15
Rear turn signal lamp	0,15
Reversing lamp	0,01

7. CALCULATION OF THE STATISTICAL ERROR

The statistical errors in the outcomes of the testing methodology caused by the measurements are to be quantified. For each efficient exterior LED light included in the package the standard deviation is calculated as defined by Formula 4.

Formula 4

$$S_{\overline{P_{El_i}}} = \frac{S_{P_{El_i}}}{\sqrt{n}} = \sqrt{\frac{\sum_{j=1}^n (P_{El_{ij}} - \overline{P_{El_i}})^2}{n(n-1)}}$$

where:

n : Number of measurements of the sample, which is at least 5

The CO₂-emission correction coefficient k_{CO_2} shall be determined from a set of T measurements performed by the manufacturer, as defined in Regulation UN/ECE No 101, Annex 8. For each measurement, the electricity balance during the test and the measured CO₂-emissions shall be recorded.

In order to evaluate the statistical error of k_{CO_2} , all T combinations without repetitions of T-1 measurements has to be used to extrapolate T different values of k_{CO_2} (i.e. $k_{CO_{2t}}$). The extrapolation shall be performed according to the method defined in Regulation UN/ECE No 101, Annex 8.

The standard deviation of k_{CO_2} ($S_{k_{CO_2}}$) is thus calculated as defined by Formula 5.

Formula 5

$$S_{k_{CO_2}} = \frac{S_{k_{CO_2}}}{\sqrt{T}} = \sqrt{\frac{\sum_{t=1}^T (k_{CO_{2t}} - \overline{k_{CO_2}})^2}{T(T-1)}}$$

where:

T: Number of measurements performed by the manufacturer for the extrapolation of the k_{CO_2} as defined in Regulation UN/ECE No 101, Annex 8

$\overline{k_{CO_2}}$: mean of the T values of $k_{CO_{2t}}$

The standard deviation of the power consumption of each efficient exterior LED light ($S_{P_{ELi}}$) and the standard deviation of the k_{CO_2} ($S_{k_{CO_2}}$) lead to an error in the CO₂ savings ($S_{C_{CO_2}}$). This error is to be calculated by means of Formula 6.

Formula 6

$$S_{C_{CO_2}} = \sqrt{\sum_{i=1}^m \left(\frac{\partial C_{CO_2}}{\partial P_{ELi}} \cdot S_{P_{ELi}} \right)^2 + \left(\frac{\partial C_{CO_2}}{\partial k_{CO_2}} \cdot S_{k_{CO_2}} \right)^2} = \sqrt{\left(\frac{t \cdot k_{CO_2}}{V_{HVop} \cdot \eta_{DCCD}} \right)^2 \cdot \sum_{i=1}^m (U_{Fi} \cdot S_{P_{ELi}})^2 + \left(\sum_{i=1}^m \Delta P_i \cdot U_{Fi} \right)^2 \cdot \left(\frac{t \cdot S_{k_{CO_2}}}{V_{HVop} \cdot \eta_{DCCD}} \right)^2}$$

Statistical significance

It has to be demonstrated for each type, variant and version of a vehicle fitted with the package of the efficient exterior LED lights that the error in the CO₂ savings calculated with Formula 6 is not greater than the difference between the total CO₂ savings and the minimum savings threshold specified in Article 9(1) of Implementing Regulation (EU) No 725/2011 (see Formula 7).

Formula 7

$$MT \leq C_{CO_2} - S_{C_{CO_2}}$$

where:

MT: Minimum threshold [gCO₂/km], which is 1 gCO₂/km

Where the total CO₂ emission savings of the package of the efficient exterior LED lights, as a result of the calculation using Formula 2, and the error in the CO₂ savings calculated with Formula 6, are below the threshold specified in Article 9(1) of Implementing Regulation (EU) No 725/2011, the second subparagraph of Article 11(2) of that Regulation shall apply.

CORRIGENDA**Corrigendum to Commission Implementing Regulation (EU) 2016/1047 of 28 June 2016 amending Annex I to Council Regulation (EEC) No 2658/87 on the tariff and statistical nomenclature and on the Common Customs Tariff**

(Official Journal of the European Union L 170 of 29 June 2016)

On page 39, in the Annex, in point (b)(1) amending the rows concerning CN codes 3215 to 3215 90 00 of Part Two of Annex I to Regulation (EEC) No 2658/87, in footnote (5):

for: 'Solid ink in engineered shapes for insertion into apparatus of subheadings 8443 31, 8443 32 or 8443 39: **Free**';

read: 'Ink cartridges (without an integrated print head) for insertion into apparatus of subheadings 8443 31, 8443 32 or 8443 39, and incorporating mechanical or electrical components; solid ink in engineered shapes for insertion into apparatus of subheadings 8443 31, 8443 32 or 8443 39: **Free**'.

