II

(Non-legislative acts)

REGULATIONS

COMMISSION IMPLEMENTING REGULATION (EU) 2021/535

of 31 March 2021

laying down rules for the application of Regulation (EU) 2019/2144 of the European Parliament and of the Council as regards uniform procedures and technical specifications for the type-approval of vehicles, and of systems, components and separate technical units intended for such vehicles, as regards their general construction characteristics and safety

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

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

Having regard to Regulation (EU) 2019/2144 of the European Parliament and of the Council of 27 November 2019 on type-approval requirements for motor vehicles and their trailers, and systems, components and separate technical units intended for such vehicles, as regards their general safety and the protection of vehicle occupants and vulnerable road users, amending Regulation (EU) 2018/858 of the European Parliament and of the Council and repealing Regulations (EC) No 78/2009, (EC) No 79/2009 and (EC) No 661/2009 of the European Parliament and of the Council and Commission Regulations (EC) No 631/2009, (EU) No 406/2010, (EU) No 672/2010, (EU) No 1003/2010, (EU) No 1005/2010, (EU) No 1008/2010, (EU) No 1009/2010, (EU) No 19/2011, (EU) No 109/2011, (EU) No 458/2011, (EU) No 65/2012, (EU) No 130/2012, (EU) 347/2012, (EU) No 351/2012, (EU) No 1230/2012 and (EU) 2015/166 ([1]), and in particular Articles 4(7), 8(3) and 10(3) thereof,

Whereas:

(1) Regulation (EC) No 78/2009 of the European Parliament and of the Council ([2]), Regulation (EC) No 79/2009 of the European Parliament and of the Council ([3]), Regulation (EC) No 661/2009 of the European Parliament and of the Council ([4]) and Commission Regulations (EC) No 631/2009 ([5]), (EU) No 406/2010 ([6]), (EU) No 672/2010 ([7]),

([1]) OJ L 325, 16.12.2019, p. 1.

([2]) Regulation (EC) No 78/2009 of the European Parliament and of the Council of 14 January 2009 on the type-approval of motor vehicles with regard to the protection of pedestrians and other vulnerable road users, amending Directive 2007/46/EC and repealing Directives 2003/102/EC and 2005/66/EC (OJ L 35, 4.2.2009, p. 1).

([3]) Regulation (EC) No 79/2009 of the European Parliament and of the Council of 14 January 2009 on type-approval of hydrogen-powered motor vehicles, and amending Directive 2007/46/EC (OJ L 35, 4.2.2009, p. 32).

([4]) Regulation (EC) No 661/2009 of the European Parliament and of the Council of 13 July 2009 concerning type-approval requirements for the general safety of motor vehicles, their trailers and systems, components and separate technical units intended therefor (OJ L 200, 31.7.2009, p. 1).

([5]) Commission Regulation (EC) No 631/2009 of 22 July 2009 laying down detailed rules for the implementation of Annex I to Regulation (EC) No 78/2009 of the European Parliament and of the Council on the type-approval of motor vehicles with regard to the protection of pedestrians and other vulnerable road users, amending Directive 2007/46/EC and repealing Directives 2003/102/EC and 2005/66/EC (OJ L 195, 25.7.2009, p. 1).

([6]) Commission Regulation (EU) No 406/2010 of 26 April 2010 implementing Regulation (EC) No 79/2009 of the European Parliament and of the Council on type-approval of hydrogen-powered motor vehicles (OJ L 122, 18.5.2010, p. 1).

([7]) Commission Regulation (EU) No 672/2010 of 27 July 2010 concerning type-approval requirements for windscreen defrosting and demisting systems of certain motor vehicles and implementing Regulation (EC) No 661/2009 of the European Parliament and of the Council concerning type-approval requirements for the general safety of motor vehicles, their trailers and systems, components and separate technical units intended therefor (OJ L 196, 28.7.2010, p. 5).

(EU) No 1003/2010 ([8]), (EU) No 1005/2010 ([9]), (EU) No 1008/2010 ([10]), (EU) No 1009/2010 ([11]), (EU) No 19/2011 ([12]), (EU) No 109/2011 ([13]), (EU) No 65/2012 ([14]), (EU) No 130/2012 ([15]), (EU) No 347/2012 ([16]), (EU) No 351/2012 ([17]), (EU) No 1230/2012 ([18]) and (EU) 2015/166 ([19]) are repealed as of 6 July 2022. Their provisions should be carried over and, where necessary, amended to take account of current practice and technological developments.

(2) Provisions concerning uniform procedures and technical specifications for type-approval of vehicles and of certain systems, components and separate technical units regarding their general safety should be laid down in this Regulation.

(3) The scope of this Regulation should be in line with that of Regulation (EU) 2019/2144, in particular as defined in its Annex II.

(4) The provisions concerning the type-approval procedures set out in Regulation (EU) 2018/858 of the European Parliament and of the Council ([20]), and in particular in Chapters III and IV thereof, apply to the type-approval of vehicles, systems, components and separate technical units covered by this Regulation.

([8]) Commission Regulation (EU) No 1003/2010 of 8 November 2010 concerning type-approval requirements for the space for mounting and the fixing of rear registration plates on motor vehicles and their trailers and implementing Regulation (EC) No 661/2009 of the European Parliament and of the Council concerning type-approval requirements for the general safety of motor vehicles, their trailers and systems, components and separate technical units intended therefor (OJ L 291, 9.11.2010, p. 22).

([9]) Commission Regulation (EU) No 1005/2010 of 8 November 2010 concerning type-approval requirements for motor vehicle towing devices and implementing Regulation (EC) No 661/2009 of the European Parliament and of the Council concerning type-approval requirements for the general safety of motor vehicles, their trailers and systems, components and separate technical units intended therefor (OJ L 291, 9.11.2010, p. 36).

([10]) Commission Regulation (EU) No 1008/2010 of 9 November 2010 concerning type-approval requirements for windscreen wiper and washer systems of certain motor vehicles and implementing Regulation (EC) No 661/2009 of the European Parliament and of the Council concerning type-approval requirements for the general safety of motor vehicles, their trailers and systems, components and separate technical units intended therefor (OJ L 292, 10.11.2010, p. 2).

([11]) Commission Regulation (EU) No 1009/2010 of 9 November 2010 concerning type-approval requirements for wheel guards of certain motor vehicles and implementing Regulation (EC) No 661/2009 of the European Parliament and of the Council concerning type-approval requirements for the general safety of motor vehicles, their trailers and systems, components and separate technical units intended therefor (OJ L 292, 10.11.2010, p. 21).

([12]) Commission Regulation (EU) No 19/2011 of 11 January 2011 concerning type-approval requirements for the manufacturer's statutory plate and for the vehicle identification number of motor vehicles and their trailers and implementing Regulation (EC) No 661/2009 of the European Parliament and of the Council concerning type-approval requirements for the general safety of motor vehicles, their trailers and systems, components and separate technical units intended therefor (OJ L 8, 12.1.2011, p. 1).

([13]) Commission Regulation (EU) No 109/2011 of 27 January 2011 implementing Regulation (EC) No 661/2009 of the European Parliament and of the Council as regards type-approval requirements for certain categories of motor vehicles and their trailers as regards spray suppression systems (OJ L 34, 9.2.2011, p. 2).

([14]) Commission Regulation (EU) No 65/2012 of 24 January 2012 implementing Regulation (EC) No 661/2009 of the European Parliament and of the Council as regards gear shift indicators and amending Directive 2007/46/EC of the European Parliament and of the Council (OJ L 28, 31.1.2012, p. 24).

([15]) Commission Regulation (EU) No 130/2012 of 15 February 2012 concerning type-approval requirements for motor vehicles with regard to vehicle access and manoeuvrability and implementing Regulation (EC) No 661/2009 of the European Parliament and of the Council concerning type-approval requirements for the general safety of motor vehicles, their trailers and systems, components and separate technical units intended therefor (OJ L 43, 16.2.2012, p. 6).

([16]) Commission Regulation (EU) No 347/2012 of 16 April 2012 implementing Regulation (EC) No 661/2009 of the European Parliament and of the Council with respect to type-approval requirements for certain categories of motor vehicles with regard to advanced emergency braking systems (OJ L 109, 21.4.2012, p. 1).

([17]) Commission Regulation (EU) No 351/2012 of 23 April 2012 implementing Regulation (EC) No 661/2009 of the European Parliament and of the Council as regards type-approval requirements for the installation of lane departure warning systems in motor vehicles (OJ L 110, 24.4.2012, p. 18).

([18]) Commission Regulation (EU) No 1230/2012 of 12 December 2012 implementing Regulation (EC) No 661/2009 of the European Parliament and of the Council with regard to type-approval requirements for masses and dimensions of motor vehicles and their trailers and amending Directive 2007/46/EC of the European Parliament and of the Council (OJ L 353, 21.12.2012, p. 31).

([19]) Commission Regulation (EU) 2015/166 of 3 February 2015 supplementing and amending Regulation (EC) No 661/2009 of the European Parliament and of the Council as regards the inclusion of specific procedures, assessment methods and technical requirements, and amending Directive 2007/46/EC of the European Parliament and of the Council, and Commission Regulations (EU) No 1003/2010, (EU) No 109/2011 and (EU) No 458/2011 (OJ L 28, 4.2.2015, p. 3).

([20]) Regulation (EC) 2018/858 of the European Parliament and of the Council of 30 May 2018 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles, amending Regulations (EC) No 715/2007 and (EC) No 595/2009 and repealing Directive 2007/46/EC (OJ L 151, 14.6.2018, p. 1).

(5) To allow for a consistent approach with regard to the information to be provided in the information document referred to in Article 24(1)(a) of Regulation (EU) 2018/858, the information relevant for each type of vehicle system, component or separate technical unit in the scope of this Regulation should be further specified.

(6) The EU type-approval certificate, referred to in Article 28(1) of Regulation (EU) 2018/858, to be issued for each type of vehicle system, component or separate technical unit in the scope of this Regulation, should be based on the respective Model template laid down in Annex III to Commission Implementing Regulation (EU) 2020/683 ([21]). However, the addendum to each certificate should contain the information specific to the respective vehicle system, component or separate technical unit as defined in this Regulation.

(7) It is in particular necessary to set out specific provisions for type-approval in accordance with Article 30(1) of Regulation (EU) 2018/858 of the European Parliament and of the Council concerning virtual testing and Article 72(1) concerning in-house technical service, based on the requirements of the UN regulations listed in Annex II to Regulation (EU) 2019/2144.

(8) It is in principle not possible to obtain type-approval in accordance with UN regulations in the case of installed components or separate technical units which have only a valid EU type-approval. However, this should be made possible for the purposes of EU type-approval according to Regulation (EU) 2019/2144, based on the requirements of the UN regulations listed in Annex II to that Regulation.

(9) UN regulations contain specific provisions on the particulars that must accompany an application for type-approval. In the context of the procedures provided for in this Regulation, those particulars should equally be indicated in the information folder.In order to harmonise further the provisions concerning the space for mounting and fixing of registration plates, the requirements applicable for rear registration plate space should be complemented to also cover the front registration plate space.

(10) In order to prevent clerical errors in the vehicle identification number (VIN), the VIN should contain a check digit and the method of calculation of that check digit should be defined.

(11) Article 6(5) of Regulation (EU) 2018/858 provides the possibility for granting EU type-approvals to vehicles exceeding the harmonised dimensions. Member States may, however, decide not to allow the circulation on the road, the placing on the market, the registration or the entry into service of such vehicles. Therefore, it is necessary that the derogation from the maximum authorised dimensions set out in this Regulation is clearly indicated in the type-approval certificate and the certificate of conformity of the vehicles concerned.

(12) Global harmonisation of safety requirements with respect to hydrogen-powered vehicles is an important step to promote alternative fuel vehicles. UN Regulation No 134 ([22]) applies in the Union, however, it does not contain any requirements on material compatibility and hydrogen embrittlement for hydrogen systems and components for hydrogen-powered vehicles. Such requirements are necessary to ensure a high level of safety as regards material selection in hydrogen systems.

(13) Specific provisions for liquefied hydrogen storage systems as well as geometries of the fuelling receptacles are also not yet included in UN regulation 134, whereas they need to be carried over from Regulation (EC) No 79/2009 to ensure consistency.

(14) Sufficient time is needed for manufacturers to adjust to the new requirements with regard to the statutory markings and the space for mounting and fixing of the front registration plates. Therefore, transitional provisions are needed to ensure that those requirements will first apply to new vehicle types.

([21]) Commission Implementing Regulation (EU) 2020/683 of 15 April 2020 implementing Regulation (EU) 2018/858 of the European Parliament and of the Council with regards to the administrative requirements for the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles (OJ L 163, 26.5.2020, p. 1).

([22]) UN Regulation No 134 of the Economic Commission for Europe of the United Nations (UN/ECE) –Uniform provisions concerning the approval of motor vehicles and their components with regard to the safety-related performance of hydrogen-fuelled vehicles (OJ L 129, 17.5.2019, p. 43).

(15) As far as this Regulation does not modify the requirements under Regulations (EC) No 78/2009, (EC) No 79/2009 and (EC) No 661/2009 of the European Parliament and of the Council, type-approvals granted to vehicles, systems, components or separate technical units in accordance with those Regulations should remain valid and extensions of such approvals should remain possible under the terms of the repealed acts.

(16) The empowerments contained in Articles 4(7), 8(3) and 10 (3) of Regulation (EU) 2019/2144 aim at the introduction of uniform procedures and technical specifications for type-approval of vehicles, and of systems, components and separate technical units intended for such vehicles, as regards certain general characteristics of their construction and safety. As those empowerments are closely linked by their subject matter, they should be bundled in this Regulation.

(17) As the relevant provisions set out in Regulation (EU) 2019/2144 shall apply from 6 July 2022, the application of this Regulation should also be deferred to that date.

(18) The measures provided for in this Regulation are in accordance with the opinion of the Technical Committee – Motor Vehicles,

HAS ADOPTED THIS REGULATION:

CHAPTER I

SUBJECT MATTER AND DEFINITIONS

Article 1

Subject matter

1. This Regulation lays down provisions for uniform procedures and technical specifications for EU type-approval of vehicles of categories M, N and O, as well as of systems, components and separate technical units in accordance with Articles 4(7), 8(3), and 10(3) of Regulation (EU) 2019/2144 of the European Parliament and of the Council.

2. This Regulation also provides for uniform procedures allowing type-approval in one or more of the following cases:

(a) of vehicle systems where components and separate technical units bearing an EU type-approval mark are applied instead of an UN type-approval mark in the context of the requirements set out in the UN regulations listed in Annex II to Regulation (EU) 2019/2144 and,

(b) where a manufacturer is designated as technical service in accordance with Article 72(1) and Annex VII to Regulation (EU) 2018/858 of the European Parliament and of the Council, with regard to the requirements set out in the UN regulations listed in Annex II to Regulation (EU) 2019/2144, and

(c) where virtual testing in accordance with Article 30(7) and Annex VIII to Regulation (EU) 2018/858 of the European Parliament and of the Council, with regard to the requirements set out in the UN regulations listed in Annex II to Regulation (EU) 2019/2144, has been applied.

Article 2

Definitions

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

(1) '*vehicle type*' means a set of vehicles as defined in Part B of Annex I to Regulation (EU) 2018/858;

(2) '*vehicle type with regard to the statutory markings*' means vehicles which do not differ in such essential respects as:

(a) the composition of the vehicle identification number;

(b) the characteristics and location of the statutory markings;

(3) '*statutory plate*' means a plate or label, affixed by the manufacturer on a vehicle that provide the main technical characteristics which are necessary for the identification of the vehicle and provides the competent authorities with the relevant information concerning the permissible maximum laden masses;

(4) '*vehicle identification number (VIN)*' means the alphanumeric code assigned to a vehicle by the manufacturer in order to ensure proper identification of every vehicle;

(5) '*vehicle type with regard to the space for mounting and fixing of registration plates*' means vehicles which do not differ in such essential respects as:

(a) the dimensions of the space for mounting and fixing of the front and rear registration plates;

(b) the location of the space for mounting and fixing of the front and rear registration plates;

(c) the shape of the surface for mounting and fixing of the front and rear registration plates;

(6) '*vehicle type with regard to the windscreen wiper and washer system*' means vehicles which do not differ in such essential respects as the characteristics of the wiper and washer system or the shape, size and characteristics of the windscreen and its mounting;

(7) '*type of windscreen washer system*' means a group of windscreen washer systems which do not differ in such essential respects as the pump performance, materials used, storage capacity, number of nozzles, sizes, wall thicknesses or shape of the washer system;

(8) '*windscreen wiper system*' means the system consisting of a device for wiping the outer face of the windscreen, together with the accessories and controls necessary for starting and stopping the device;

(9) '*windscreen washer system*' means the system consisting of devices for storing, transferring and aiming fluid towards the outer face of the windscreen, together with the controls necessary for starting and stopping the device;

(10) '*vehicle type with regard to wheel guards*' means vehicles which do not differ in such essential respects as the characteristics of the wheel guards or the minimum and maximum tyre and wheel sizes suitable for fitment, taking into account the applicable tyre envelopes, rim sizes and wheel off-sets;

(11) '*vehicle type with regard to the windscreen defrosting and demisting systems*' means vehicles which do not differ in such essential respects as:

(a) the characteristics of the defrosting and demisting systems;

(b) the external and internal forms and arrangements within the 180° forward field of vision area of the driver which may affect visibility;

(c) the shape, size, thickness and characteristics of the windscreen and its mounting;

(d) the maximum number of seating positions;

(12) '*defrosting system*' means the system intended to eliminate frost or ice on the outside surface of the windscreen;

(13) '*demisting system*' means the system intended to remove mist on the inside surface of the windscreen;

(14) '*vehicle type with regard to the towing devices*' means vehicles which do not differ in such essential respects as the characteristics of the towing devices;

(15) '*towing device*' means a device in the shape of a hook, eye or other form, to which a connecting part, such as a towing bar or towing rope, can be fitted;

(16) '*vehicle type with regard to spray suppression*' means complete, incomplete or completed vehicles, which do not differ with respect to the following aspects:

(a) type of spray suppression device installed on the vehicle;

(b) manufacturer's spray suppression system type designation;

(17) '*type of spray suppression device*' means devices which do not differ with respect to the following main characteristics:

(a) the physical principle adopted in order to reduce emissions (water-energy absorption, air/water separator);

(b) materials;

(c) shape;

(d) dimensions, in so far as they may influence the behaviour of the material;

(18) '*spray suppression system*' means a system that reduces the pulverization of water thrown upwards by the tyres of a vehicle in motion and which is made up of a mudguard, rain flaps and valances equipped with a spray suppression device;

(19) '*spray suppression device*' means part of the spray suppression system, which may comprise an air/water separator and an energy absorber;

(20) '*vehicle type with regard to the gear shift indicator (GSI)*' means vehicles which do not differ in such essential respects as the functional characteristics of the GSI and the logic used by the GSI to determine when to indicate a gearshift point, including:

(a) upshifts indicated at specified engine speeds;

(b) upshifts indicated when specific fuel consumption engine maps show that a specified minimum fuel consumption improvement will be delivered in the higher gear;

(c) upshifts indicated when torque demand can be met in the higher gear;

(21) '*functional characteristics of the GSI*' means the set of input parameters, such as engine speed, power demand, torque and their variation in time, determining the GSI indication and the functional dependence of the GSI indications on these parameters;

(22) '*vehicle type with regard to vehicle access*' means vehicles which do not differ in such essential respects as the characteristics of door entry steps, handholds and running boards;

(23) '*vehicle type with regard to reversing motion*' means vehicles which do not differ in such essential respects as the characteristics of the reversing device;

(24) '*vehicle type with regard to the masses and dimensions*' means vehicles which do not differ in any of the following aspects:

(a) trade name or mark of their manufacturer;

(b) classification;

(c) main function;

(25) '*aerodynamic devices and equipment*' means devices or equipment that are designed to reduce the aerodynamic drag of road vehicles with the exception of elongated cabs;

(26) '*type of hydrogen storage system*' means an assembly of components which do not differ in such essential respects as the state of stored hydrogen fuel or compressed gas, the nominal working pressure, the structure, materials, capacity and physical dimensions of the container as well as the structure, materials and essential characteristics of the pressure relief devices, check valves and shut-off valves;

(27) '*vehicle type with regard to hydrogen safety*' means a group of vehicles which do not differ in such essential respects as the basic configuration and main characteristics of the vehicle's hydrogen fuel system;

(28) '*type of hydrogen component*' means a group of hydrogen components which do not differ in such essential respects as the state of stored hydrogen fuel or compressed gas, the function of the component and its structure, materials and physical dimensions.

CHAPTER II

TYPE-APPROVAL IN ACCORDANCE WITH ESSENTIAL REQUIREMENTS BASED ON UN REGULATIONS

Article 3

Application for type-approval

1. In one or more of the cases referred to in Article 1(2) of this Regulation, applications for approval of a type of vehicle, system, component or separate technical unit, in accordance with the requirements set out in the UN regulations listed in Annex II to Regulation (EU) 2019/2144, shall be submitted to the type-approval authority by manufacturers or their representatives, using the model information document laid down in Part 1 of Annex I.

2. Any EU or UN type-approved components and separate technical units which are installed on a vehicle or incorporated within a second component or separate technical unit need not to be fully described in terms of their particulars in the information document referred to in paragraph 1 where the type-approval certificate numbers and markings are provided in the information document and the relevant type-approval certificates, with their attachments, are made available to the type-approval authority.

3. Components and separate technical units which have a valid EU type-approval mark shall be accepted even in cases where they are applied instead of components and separate technical units that are required to bear an UN type-approval mark in accordance with Regulation (EU) 2019/2144 and the delegated acts and implementing acts adopted pursuant to it, setting out provisions in areas covered by UN regulations.

Article 4

Granting of the type-approval

1. Where the type of vehicle, system, component or separate technical unit, presented for type-approval, complies with the relevant technical requirements in the UN regulations, the EU type-approval certificate, issued by the type-approval authority in accordance with Article 28(1) of Regulation (EU) 2018/858, shall follow the model set out in Part 2 of Annex I together with the completed communication form corresponding to the relevant model in the applied UN regulation with the entry of its UN type-approval number left blank.

2. Each component or separate technical unit conforming to a type in respect of which a type-approval has been granted pursuant to Regulation (EU) 2019/2144 shall bear an EU separate technical unit type-approval mark in accordance with paragraph 4 of Annex V to Regulation (EU) 2020/683.

CHAPTER III

EU VEHICLE TYPE-APPROVAL WITH REGARD TO CERTAIN SPECIFIC CONSTRUCTION AND SAFETY REQUIREMENTS

Article 5

Application for the EU type-approval of a vehicle type as regards certain vehicle systems

1. A separate application for EU type-approval of a vehicle type as regards each of the following items shall be submitted to the type-approval authority by manufacturers or their representatives, using the respective model information document in accordance with Article 24(1)(a) of Regulation (EU) 2018/858:

(a) the lay-out and the location of the statutory plate and the composition and the location of the vehicle identification number, using the model containing the information listed in Part 1 of Annex II;

(b) the space for mounting and fixing of front and rear registration plates, using the model containing the information listed in Part 1 of Annex III;

(c) the windscreen wiper and washer systems, using the model containing the information listed in Annex IV, Part 1, Section A;

(d) the wheel guards, using the model containing the information listed in Part 1 of Annex V;

(e) the windscreen defrosting and demisting systems, using the model containing the information listed in Part 1 of Annex VI;

(f) the towing devices, using the model containing the information listed in Part 1 of Annex VII;

(g) the spray suppression system, using the model containing the information listed in Annex VIII, Part 1, Section A;

(h) the gear shift indicator, using the model containing the information listed in Part 1 of Annex IX;

(i) the vehicle access, using the model containing the information listed in Part 1 of Annex X;

(j) the reversing motion, using the model containing the information listed in Part 1 of Annex XI;

(k) the vehicle masses and dimensions, using the model containing the information listed in Annex XIII, Part 1, Section A;

(l) in case of hydrogen-powered vehicles, the vehicle fuel system of which incorporates liquefied hydrogen storage system (LHSS) or compressed hydrogen storage system (CHSS), using the model containing the information listed in Annex XIV, Part 1, Section A.

2. The application for the EU type-approval of a type of vehicle as regard the gear shift indicator referred to in point (h) of paragraph 1 shall be submitted together with a declaration of the manufacturer that the vehicle complies with the relevant technical specifications set out in this Regulation and a certificate drawn up in accordance with the model set out in the Appendix to Part 1 of Annex IX.

3. The manufacturer shall, when requested by the approval authority or the technical service, make available, for test purposes, a vehicle representative of the type to be approved.

Article 6

Granting the EU type-approval of a vehicle type as regards certain vehicle systems

1. Where the technical specifications set out in Part 2 of Annexes II to XIII and in Annex XIV, Part 2, Sections D and E with regard to the respective requirements listed in Annex II to Regulation (EU) 2019/2144 are met, the type-approval authority shall grant an EU type-approval and issue a type-approval certificate number in accordance with the method set out in Annex IV of Commission Implementing Regulation (EU) 2020/683.

2. The EU type-approval certificate, referred to in Article 28(1) of Regulation (EU) 2018/858, shall be drawn up in accordance with:

(a) Part 3 of Annex II for the item referred to in point (a) of Article 5(1);

(b) Part 3 of Annex III for the item referred to in point (b) of Article 5(1);

(c) Annex IV, Part 3, Section A for the item referred to in point (c) of Article 5(1);

(d) Part 3 of Annex V for the item referred to in point (d) of Article 5(1);

(e) Part 3 of Annex VI for the item referred to in point (e) of Article 5(1);

(f) Part 3 of Annex VII for the item referred to in point (f) of Article 5(1);

(g) Annex VIII, Part 3, Section A for the item referred to in point (g) of Article 5(1);

(h) Part 3 of Annex IX for the item referred to in point (h) of Article 5(1);

(i) Part 3 of Annex X for the item referred to in point (i) of Article 5(1);

(j) Part 3 of Annex XI for the item referred to in point (j) of Article 5(1);

(k) Annex XIII, Part 3, Section A for the item referred to in point (k) of Article 5(1); and

(l) Annex XIV, Part 3, Section A for the item referred to in point (l) of Article 5(1).

3. In accordance with the second subparagraph of Article 6(5) of Regulation (EU) 2018/858, an EU type-approval may be granted for vehicles exceeding the maximum authorised dimensions set out in point 1.1. of Sections B, C and D of Part 2 of Annex XIII to this Regulation, in which case the remark 'maximum authorised dimensions derogation' shall be included in point 52 of the type-approval certificate and the certificate of conformity.

4. An EU type-approval may be granted for vehicles intended for the transport of indivisible loads, the dimensions of which exceed the maximum authorised dimensions set out in point 1.1. of Sections B, C and D of Part 2 of Annex XIII to this Regulation, in which case the type-approval certificate and the certificate of conformity shall clearly indicate that the vehicle is intended for the transport of indivisible loads only.

CHAPTER IV

EU SEPARATE TECHNICAL UNIT AND EU COMPONENT TYPE-APPROVALS WITH REGARD TO CERTAIN VEHICLE SYSTEMS AND COMPONENTS

Article 7

Application for the EU separate technical unit type-approval of systems and equipment

Applications for EU separate technical unit type-approval with regard to each of the following systems and equipment shall be drawn up in accordance with the respective model information document as referred to in Article 24(1)(a) of Regulation (EU) 2018/858:

(a) the windscreen washer system, using the model containing the information listed in Annex IV, Part 1, Section B;

(b) the spray suppression system, using the model containing the information listed in Annex VIII, Part 1, Section B;

(c) the frontal protection system, using the model containing the information listed in Part 1 of Annex XII;

(d) the aerodynamic device or equipment, using the model containing the information listed in Annex XIII, Part 1, Section B.

Article 8

Granting the EU type-approval of a separate technical unit

1. In accordance with Article 29 of Regulation (EU) 2018/858, where the technical specifications set out in Part 2 of Annex IV to this Regulation with regard to the requirements for the windscreen washer systems, Part 2 of Annex VIII with regard to the spray suppression systems, Part 2 of Annex XII with regard to the frontal protection systems and Annex XIII, Part 2, Section I with regard to the aerodynamic devices and equipment are met, the type-approval authority shall grant an EU separate technical unit type-approval for those types of systems and equipment, and issue a type-approval certificate number in accordance with the method set out in Annex IV to Commission Implementing Regulation (EU) 2020/683.

2. The EU type-approval certificates, issued in accordance with Article 28(1) of Regulation (EU) 2018/858, for the systems and equipment referred to in Article 5 shall be drawn up in accordance with:

(a) Annex IV, Part 3, Section B for the system referred to in point (a) of Article 7;

(b) Annex VIII, Part 3, Section B for the system referred to in point (b) of Article 7;

(c) Annex XII, Part 3, Section B for the system referred to in point (c) of Article 7;

(d) Annex XIII, Part 3, Section B for the equipment referred to in point (d) of Article 7.

Article 9

Application for the EU component type-approval

Applications for EU component type-approval with regard to the following hydrogen components shall be drawn up in accordance with the respective model information document as referred to in Article 24(1)(a) of Regulation (EU) 2018/858 and contain the information listed in Annex XIV, Part 1, Section B:

(a) the liquefied hydrogen storage systems (LHSS), including their containers, pressure relief and shut-off devices, with respect to their safety performance and material compatibility;

(b) the compressed hydrogen storage systems (CHSS), including their containers and primary closing devices, comprising TPRD, check valve and automatic shut-off valves, with respect to their material compatibility.

Article 10

Granting the EU component type-approval

1. In accordance with Article 29 of Regulation (EU) 2018/858, where the technical specifications set out in Annex XIV, Part 2, Sections B, C and F, for components referred to in point (a) of Article 9, and Section F, for components referred to in point (b) of that Article, with regard to the respective requirements listed in Annex II to Regulation (EU) 2019/2144 are met, the type-approval authority shall grant an EU component type-approval for the type of hydrogen component and issue a type-approval certificate number in accordance with the method set out in Annex IV to Commission Implementing Regulation (EU) 2020/683.

2. The EU type-approval certificate for the components referred to in Article 9 shall be drawn up in accordance with Annex XIV, Part 3, Section B.

Article 11

Type-approval mark

1. The separate technical unit type-approval mark of a type of a system or equipment, as referred to in Article 38(2) of Regulation (EU) 2018/858, shall be composed and fixed in accordance with:

(a) Annex IV, Part 3, Section C with regard to the system referred to in point (a) of Article 7;

(b) Annex VIII, Part 3, Section C with regard to the system referred to in point (b) of Article 7;

(c) Annex XII, Part 3, Section B with regard to the system referred to in point (c) of Article 7;

(d) Annex XIII, Part 3, Section C with regard to the devices and equipment referred to in point (d) of Article 7.

2. The component type-approval mark of a type of a component referred to in Article 9 shall be composed and fixed in accordance with Annex XIV, Part 3, Section C.

CHAPTER V

FINAL PROVISIONS

Article 12

Transitional provision

1. With effect from 6 July 2022, type-approval authorities shall refuse to grant EU type-approval in respect of new types of vehicles, with regard to the check digit of the vehicle identification number, which do not comply with the technical specifications set out in Annex II, Part 2, Section C with regard to the respective requirements listed in Annex II to Regulation (EU) 2019/2144.

2. With effect from 7 July 2026, national authorities shall refuse, on grounds relating to the check digit of the vehicle identification number, the registration, placing on the market and entry into service of vehicles, which do not comply with the technical specifications set out in Annex II, Part 2, Section C with regard to the respective requirements listed in Annex II to Regulation (EU) 2019/2144.

3. With effect from 6 July 2022, type-approval authorities shall refuse to grant EU type-approval in respect of new types of vehicles, with regard to the space for mounting and fixing of the front registration plates, which do not comply with the technical specifications set out in Part 2 of Annex III with regard to the respective requirements listed in Annex II to Regulation (EU) 2019/2144.

4. With effect from 7 July 2026, national authorities shall refuse, on grounds relating to the space for mounting and fixing of the front registration plates, the registration, placing on the market and entry into service of vehicles, which do not comply with the technical specifications set out in Part 2 of Annex III with regard to the respective requirements listed in Annex II to Regulation (EU) 2019/2144.

5. In accordance with Article 15(1) of Regulation (EU) 2019/2144, national authorities shall permit the sale and entry into service of vehicles, systems, components and separate technical units type-approved before 6 July 2022, and continue to grant extension of approvals to those vehicles, systems, components and separate technical units under the terms of Regulation (EC) No 78/2009, Regulation (EC) No 79/2009 or Regulation (EC) No 661/2009 and their implementing measures, as regards the subject matter covered in Annexes II to XIV to this Regulation.

Article 13

Provision of information

For the purpose of evaluating the need for further developments, manufacturers and type-approval authorities shall make available to the Commission upon request the information set out in Parts 1, 2 and 3 of Annex IX. The information shall be treated in a confidential manner by the Commission and its representatives.

Article 14

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*.

It shall apply from 6 July 2022.

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

Done at Brussels, 31 March 2021.

For the Commission
The President
Ursula VON DER LEYEN

ANNEX I

TYPE-APPROVAL IN AREAS COVERED BY UN REGULATIONS

PART 1

Information document

MODEL

Information document No … relating to the EU type-approval of a vehicle with regard to a *system / component / separate technical unit* ([1]) with regard to UN Regulation No …, *as amended by the … series of amendments / as amended by Supplement … to the … series of amendments* ([1]), concerning … based on and formatted in accordance with the item numbering of Annex I to Commission Implementing Regulation (EU) 2020/683 ([2])

The following information, where applicable, shall be supplied in triplicate and include a list of contents. Any drawings or pictures shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

0. GENERAL

0.1. Make (trade name of manufacturer):

0.2. Type:

0.2.1. Commercial name(s) (if available):

0.3. Means of identification of type, if marked on the *vehicle / component / separate technical unit* ([1]) ([3]):

0.3.1. Location of that marking:

0.4. Category of vehicle ([4]):

0.5. Company name and address of manufacturer:

0.8. Name(s) and address(es) of assembly plant(s):

0.9. Name and address of the manufacturer's representative (if any):

1. GENERAL CONSTRUCTION CHARACTERISTICS OF THE VEHICLE

1.1. Photographs, pictures and/or drawings of a representative *vehicle / component / separate technical unit* ([1]):

All subsequent items and information relevant for the vehicle, component or separate technical unit shall be provided in agreement with the technical service and type-approval authority responsible for granting the EU type-approval for which the application was submitted. It may be based on a model for an information document if provided by UN Regulation No …, otherwise it shall insofar practicable be based on the item numbering of Annex I to Commission Implementing Regulation (EU) 2020/683 (i.e. the complete list of information for the purpose of EU type-approval of vehicles, components and separate technical units) and any additional information or particulars required for approval under UN Regulation No … shall be included.

Explanatory notes:

Information document numbering in accordance with the template laid down in Annex I to Regulation (EU) 2018/858

([1]) Delete where not applicable.

([2]) If a part (e.g. component or separate technical unit) has been type-approved, that part need not be described if reference is made to such approval. Similarly, a part need not be described if its construction is clearly apparent from the attached diagrams or drawings. For each item for which drawings, pictures or photographs shall be attached, give numbers of the corresponding attached documents.

([3]) If the means of identification of type contains characters not relevant to describe the vehicle, component or separate technical unit types covered by this information document, such characters shall be represented in the documentation by the symbol '?' (e.g. ABC??123??).

([4]) Classified according to the definitions set out in Part A of Annex I to Regulation (EU) 2018/858.

PART 2

MODEL

Format: A4 (210 × 297 mm)

TYPE-APPROVAL CERTIFICATE

Identification of type-approval authority

Communication concerning *granting | extension | refusal | withdrawal* [1] of type-approval of a type of *vehicle with regard to a system | component | separate technical unit* [1] complying with the requirements laid down in UN Regulation No … *as amended by the … series of amendments | as amended by Supplement … to the … series of amendments* [1], with regard to Regulation (EU) 2019/2144, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension | refusal | withdrawal* [1]:

SECTION I

0. GENERAL

0.1. Make (trade name of manufacturer):

0.2. Type:

0.2.1. Commercial name(s) (if available):

0.3. Means of identification of type, if marked on the *vehicle | component | separate technical unit* [1]:

0.3.1. Location of that marking:

0.4. Category of vehicle [2]:

0.5. Name and address of manufacturer:

0.8. Name(s) and address(es) of assembly plant(s):

0.9. Name and address of the manufacturer's representative (if any):

1. GENERAL CONSTRUCTION CHARACTERISTICS OF THE VEHICLE

1.1. Photographs and/or drawings of a representative vehicle:

SECTION II

1. Additional information (where applicable): see Addendum.

2. Technical service responsible for carrying out the tests:

3. Date of test report:

4. Number of test report:

[1] Delete where not applicable.
[2] Classified according to the definitions set out in Part A of Annex I to Regulation (EU) 2018/858.

5. Remarks (if any): see Addendum.

6. Place:

7. Date:

8. Signature:

Attachments:

— Information package

— Test report

— Completed communication form conforming to the relevant model in the applicable UN Regulation, albeit without the mentioning of an UN approval being granted or extended as well as without the mentioning of an UN type-approval number

Addendum

to type-approval certificate number …

1. Based on UN Regulation using EU type-approved components or separate technical units: *yes* / *no* ([3])
2. Approval procedure according to Article 30(7) of Regulation EU 2018/858 (virtual testing): *yes* / *no* ([3])
3. Approval procedure according to Article 72(1) and Annex VII of Regulation EU 2018/858 (in-house technical service): *yes* / *no* ([3])
4. In case of components and separate technical units, example of the type-approval marking on the component or separate technical unit:
5. Remarks:

([3]) Delete where not applicable.

ANNEX II

STATUTORY PLATE AND THE VEHICLE IDENTIFICATION NUMBER

PART 1

Information document for EU type-approval of motor vehicles and their trailers with regard to the statutory plate and the vehicle identification number (VIN)

MODEL

Information document No … relating to the EU type-approval of a vehicle with regard to the vehicle statutory plate and the vehicle identification number.

The following information shall be supplied in triplicate and include a list of contents. Any drawings or pictures shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

0.1.

0.2.

0.2.1.

0.3.

0.3.1.

0.4.

0.5.

0.6.

0.6.1.

0.6.2.

0.8.

0.9.

1.

1.1.

9.

9.17.

9.17.1.

9.17.2.

9.17.3.

9.17.4.

9.17.4.1.

9.17.4.2.

9.17.4.3.

Explanatory notes:

This information document is based on the template laid down in Annex I to Commission Implementing Regulation (EU) 2020/683 and shall be completed with the relevant information under the point numbers listed above as defined in that template.

PART 2

Section A

Technical specifications

1. Manufacturer's statutory plate

1.1. General provisions:

1.1.1. Each vehicle shall be fitted with the manufacturer's statutory plate described in this section

1.1.2. The manufacturer's statutory plate shall be affixed by the vehicle manufacturer or the vehicle manufacturer's representative.

1.1.3. The manufacturer's statutory plate shall consist of either of the following:

(a) a rectangular sheet of metal;

(b) a rectangular self-adhesive label.

1.1.4. Metallic plates shall be fastened with rivets or equivalent.

1.1.5. Labels shall be tamper evident, fraud resistant and self-destructive in case there is an attempt to remove the label.

1.2. Information to be mentioned on the manufacturer's statutory plate.

1.2.1. The following information shall be printed indelibly on the manufacturer's statutory plate in the order listed:

(a) the manufacturer's company name;

(b) the whole vehicle type-approval number;

(c) the stage of completion, in the case of second and subsequent stages of multi-stage built vehicles as referred to in point 4.2. of Annex IX to Regulation (EU) 2018/858;

(d) the vehicle identification number;

(e) the technically permissible maximum laden mass;

(f) the technically permissible maximum mass of the combination;

(g) the technically permissible maximum mass on each axle listed in order from front to rear.

1.2.2. The height of the characters referred to in point 1.2.1.(d) shall not be less than 4 mm.

1.2.3. The height of the characters of the information referred to in point 1.2.1., other than the vehicle identification number, shall not be less than 2 mm.

1.3. Specific provisions

1.3.1. Trailers

1.3.1.1. In the case of a trailer, the technically permissible maximum static vertical mass on the coupling point shall be mentioned.

1.3.1.2. The coupling point shall be considered as an axle. This axle shall be numbered '0'.

1.3.1.3. The first axle shall be numbered '1', the second '2' and so on, separated by a hyphen.

1.3.1.4. The mass of the combination referred to in point 1.2.1.(f) shall be omitted.

1.3.2. Heavy duty vehicles

1.3.2.1. With regard to vehicles of category N_3, O_3 or O_4, the technically permissible maximum mass on an axle group shall be mentioned. The entry corresponding to "Axle group" shall be identified by the letter 'T', followed by a hyphen.

1.3.2.2. With respect to vehicles of category M_3, N_3, O_3 or O_4, the manufacturer may mention on the manufacturer's statutory plate the intended registration/in-service maximum permissible laden mass.

1.3.2.2.1. The part of the manufacturer's statutory plate where the masses are mentioned shall be subdivided in two columns: the intended registration/in-service maximum permissible masses shall be mentioned in the left column and the technically permissible maximum laden masses in the right column.

1.3.2.2.2. The two-letter code of the country where the vehicle is intended to be registered shall be indicated as header of the left column. The code shall be in accordance with Standard ISO 3166-1:2006.

1.3.2.3. The requirements of point 1.3.2.1. shall not apply where:

(a) the technically permissible maximum mass on an axle group is the sum of the technically permissible maximum mass on the axles which are part of that axle group;

(b) the letter "T" is added as suffix to the maximum mass on each axle which is part of that axle group; and

(c) where the requirements of point 1.3.2.2. are applied, the registration/in-service maximum permissible mass on the group of axles is the sum of the registration/in-service maximum permissible mass on the axles which are part of that axle group.

1.4. Additional information

1.4.1. The manufacturer may provide additional information below or alongside the prescribed inscriptions, outside a clearly marked rectangle which shall enclose only the information referred to in points 1.2. and 1.3.

1.5. Models of the manufacturer's statutory plate

1.5.1. Examples of the various possible models of the manufacturer's statutory plate are given in Section B.

1.5.2. The data given on the models are fictitious.

1.6. Requirements for location on vehicle

1.6.1. The manufacturer's statutory plate shall be firmly attached in a conspicuous and readily accessible position.

1.6.2. The location shall be chosen so that the part on which it is affixed is not subject to replacement in use.

2. Vehicle identification number (VIN)

2.1. The VIN shall consist of the following three sections and a check digit:

(a) the world manufacturer identifier (WMI);

(b) the vehicle descriptor section (VDS);

(c) the vehicle indicator section (VIS).

2.2. The WMI shall consist of a code assigned to the vehicle manufacturer which enables that manufacturer to be identified.

2.2.1. The code shall comprise three alphanumeric characters, capital roman letters or Arabic numerals, which shall be assigned by the competent authority in the country where the principal place of business of the manufacturer is situated.

2.2.2. The competent authority shall act in accordance with the international organisation referred to in Standard ISO 3780:2009 on "Road vehicles – World manufacturer identifier (WMI) code".

2.2.3. Where the manufacturer's global production is less than 500 vehicles per year, the third character shall always be '9'. In order to identify such manufacturers, the competent authority referred to in point 2.2. shall assign the third, the fourth and the fifth character of the VIS.

2.3. The VDS shall consist of five alphanumeric characters, capital roman letters or Arabic numerals, which shall serve to indicate the general characteristics of the vehicle. Where the manufacturer does not use one or more of the five characters, the unused spaces shall be filled in with alphanumeric characters at the manufacturer's discretion so that the total number of characters is five.

2.4. The ninth position of the VIN shall be a check digit that is mathematically correct in accordance with the formula specified in Section C.

2.5. The VIS shall consist of eight alphanumeric characters, capital Roman letters or Arabic numerals, of which the last four shall consist of digits only.

The VIS shall provide, in conjunction with the WMI and the VDS, clear identification of a particular vehicle. Any unused space shall be filled in with the digit '0' so that the total number of characters is eight.

2.6. The height of the characters of the VIN marked on the chassis shall be no less than 7 mm.

2.7. There shall be no space between the characters.

2.8. The use of the letters 'I', 'O' or 'Q' shall not be permitted.

2.9. The beginning and the end of the VIN shall be limited by one symbol at the choice of the manufacturer. That symbol should neither be a Roman capital letter nor an Arabic numeral.

2.9.1. The requirement under point 2.9. may be waived where the VIN is marked on a single line.

2.9.2. Where the VIN is marked on two lines, the requirement under point 2.9. shall apply to each line.

2.10. Requirements for location of the VIN on a vehicle

2.10.1. The VIN shall be marked on a single line.

2.10.1.1. Where, for technical reasons such as lack of space, the VIN cannot be marked on a single line, the national authority may, at the request of the manufacturer, allow the VIN to be marked on two lines. In such case, the sections referred to in point 2.1. may not be interrupted.

2.10.2. The VIN shall be marked by stamping or mechanical hammering on the chassis, frame or other similar structure.

2.10.3. Techniques that are proven to offer the same level of inalterability against tampering or forgery as mechanical hammering may be used instead of that technique.

2.10.4. The VIN shall be marked in a clearly visible and easily accessible location, in a way that the marking cannot be obliterated or deteriorate.

2.10.5. The VIN shall be located on the right-hand side of the vehicle.

Section B

Model of statutory plate

1. MODEL A

for vehicles of category M_1 and N_1

JERMY CLARKFILS AUTOMOBILES S.A.
e2*2018/858*11460
VRZUA5FX29J276031
1 850 kg
3 290 kg
1 - 1 100 kg
2 - 880 kg

Example of a manufacturer's statutory plate for a vehicle of category M_1 type-approved in France.

2. MODEL B

for vehicles of category M_2, M_3, N_2 and N_3

DEMURO VEICOLI COMMERCIALI S.P.A. e3*2018/858*52288 ZCFC35A3405850414	
(IT) 17 990 kg 40 000 kg 1 - 7 100 kg 2 - 11 500 kg T - kg	17 990 kg 44 000 kg 1 - 7 100 kg 2 - 11 500 kg T - kg

Example of a manufacturer's statutory plate for a vehicle of category N_3 type-approved in Italy.

Note: the column on the left side is optional

3. MODEL C

for vehicles of category O_1 and O_2

KAPITÅN SLØW e5*2018/858*11460 YSXFB56VX71134031 1 500 kg 0 - 100 kg 1 - 1 100 kg 2 - 880 kg

Example of a manufacturer's statutory plate for a vehicle of category O_2 type-approved in Sweden.

4. MODEL D

for vehicles of category O_3 and O_4

Jalo Pnik CO. TD e8*2018/858*10036 2T0YX646XX7472266	
(CZ) 34 000 kg 0 - 8 000 kg 1 - 9 000 kg 2 - 9 000 kg 3 - 9 000 kg T - 27 000 kg	37 000 kg 0 - 8 000 kg 1 - 10 000 kg 2 - 10 000 kg 3 - 10 000 kg T - 30 000 kg

Example of a manufacturer's statutory plate for a vehicle of category O_4 type-approved in the Czech Republic.

Note: the column on the left side is optional

5. MODEL E

additional plate for vehicles built in multiple stages (in accordance with point 4.2. of Annex IX to Regulation (EU) 2018/858)

HaMsTeR conversions LLP
e49*2018/858*01912
Stage 3
VRZUA5FX29J276031
1 900 kg
kg
1 - 1 200 kg
2 - kg

Example of a manufacturer's statutory plate for a multi-stage vehicle of category N_1 type-approved in Cyprus. The technically permissible mass is mentioned on this plate, meaning that it has been changed in the current stage of approval. The technically permissible maximum mass of the combination is not mentioned on this plate, meaning that it has not been changed in the current stage of approval. In addition, the entry '0' is not mentioned meaning that the vehicle is permitted to tow a trailer. The technically permissible maximum mass on the first axle is mentioned on this plate, meaning that it has been changed in the current stage of approval. The technically permissible maximum mass on the second axle is not mentioned on this plate, meaning that it has not been changed in the current stage of approval.

Section C

Check digit

1. The check digit shall be calculated by carrying out the mathematical computation specified in points 1.1. to 1.4.

1.1. Assign to each number in the VIN its actual mathematical value and assign to each letter the value specified below:

A = 1	J = 1	S = 2
B = 2	K = 2	T = 3
C = 3	L = 3	U = 4
D = 4	M = 4	V = 5
E = 5	N = 5	W = 6
F = 6	P = 7	X = 7
G = 7	R = 9	Y = 8
H = 8		Z = 9

1.2. Multiply the assigned value for each character in the VIN by the position weight factor specified below:

1^{st} = 8	10^{th} = 9
2^{nd} = 7	11^{th} = 8
3^{rd} = 6	12^{th} = 7
4^{th} = 5	13^{th} = 6

5^{th} = 4

6^{th} = 3

7^{th} = 2

8^{th} = 10

9^{th} = check digit

14^{th} = 5

15^{th} = 4

16^{th} = 3

17^{th} = 2

1.3. Add the resulting products and divide the total by 11.

1.4. The check digit (number 0 to 9 or letter X) is based on either the fractional remainder or the decimal equivalent remainder (rounded to the nearest thousandth) as listed in the table below.

Check digit	Fractional remainder	Decimal equivalent remainder
0	0	0
1	1/11	0,091
2	2/11	0,182
3	3/11	0,273
4	4/11	0,364
5	5/11	0,455
6	6/11	0,545
7	7/11	0,634
8	8/11	0,727
9	9/11	0,818
X	10/11	0,909

PART 3

EU TYPE-APPROVAL CERTIFICATE (VEHICLE SYSTEM)

Communication concerning *granting* / *extension* / *refusal* / *withdrawal* ([1]) of type-approval of a type of vehicle with regard to the statutory plate and the vehicle identification number, in accordance with the requirements laid down in Annex II to Regulation (EU) 2021/535, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension* / *refusal* / *withdrawal* ([1]):

SECTION I

(To be completed in accordance with Section I of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

SECTION II

(To be completed in accordance with Section II of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

Addendum

to EU type-approval certificate number …

1. Additional information:

1.1. Brief description of the vehicle type as regards its structure, dimensions, lines and constituent materials:

2. Location of the vehicle identification number:

3. Location of the statutory plate:

4. Statutory plate for vehicle built in multi-stage: *yes* / *no* ([1])

5. Remarks:

([1]) Delete where not applicable.

ANNEX III

SPACE FOR MOUNTING AND FIXING OF FRONT AND REAR REGISTRATION PLATES

PART 1

Information document for EU type-approval of motor vehicles and their trailers with regard to the space for mounting and fixing of front and rear registration plates

MODEL

Information document No … relating to the EU type-approval of a motor vehicle or a trailer with regard to the space for mounting and the fixing of front and rear registration plates.

The following information shall be supplied in triplicate and include a list of contents. Any drawings or pictures shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

0.

0.1.

0.2.

0.2.1.

0.3.

0.3.1.

0.4.

0.5.

0.8.

0.9.

1.

1.1.

2.

2.4.

2.4.2.

2.4.2.3.

2.6.

9.

9.14.

9.14.1.

9.14.2.

9.14.3.

9.14.4.

9.14.5.

9.14.5.1.

9.14.5.2.

9.14.5.3.

9.14.5.4.

9.14.6.

9.14.7.

Explanatory notes:

This information document is based on the template laid down in Annex I to Commission Implementing Regulation (EU) 2020/683 and shall be completed with the relevant information under the point numbers listed above as defined in that template.

PART 2

TECHNICAL SPECIFICATIONS

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

1.1. '*virtually flat surface*' means a surface of solid material, which may also consist of patterned mesh or grille, with a radius of curvature of at least 3 000 mm;

1.2. '*surface of patterned mesh*' means a surface consisting of an evenly spread pattern of shapes such as round, oval, diamond, rectangular or square holes spread evenly at intervals not exceeding 15 mm;

1.3. '*surface of grille*' means a surface consisting of parallel bars which are spread evenly and have a mutual distance of not exceeding 15 mm;

1.4. '*nominal surface*' means the theoretical geometrically perfect surface without taking into account surface irregularities such as protrusions or indentations;

1.5. '*longitudinal median plane of the vehicle*' means the plane of symmetry of the vehicle or, if the vehicle is not symmetrical, the vertical longitudinal plane passing through the middle of the vehicle axles;

1.6. '*inclination*' means the degree of the angular deviation in relation to a vertical plane.

2. Technical requirements

2.1. Vehicles shall be equipped with a space for mounting and fixing of rear registration plates.

2.1.1. Motor vehicles of categories M and N shall in addition be equipped with a space for mounting and fixing of front registration plates.

2.1.2. Vehicles of category O_2, O_3 and O_4 shall be equipped with two separate spaces for mounting and fixing of rear registration plates (i.e. allowing for the optional identification of a towing vehicle where required by a national authority).

2.2. Shape and dimensions of the space for mounting a registration plate

2.2.1. The designated space for mounting shall comprise a rectangular area with the following minimum dimensions:

either ('wide plate')

width: 520 mm

height: 120 mm

or ('tall plate')

width: 340 mm

height: 240 mm.

2.3. Mounting and fixing of front and rear registration plates.

2.3.1. The space for mounting a front or rear registration plate shall comprise a flat or virtually flat rectangular surface.

2.3.1.1. An adapter plate or bracket may form the basis of the space for mounting a registration plate when provided as standard equipment. It may be designed in such a way that it is affixed to the vehicle only in combination with a registration plate.

2.3.1.2. The vehicle manufacturer may provide optional or alternative registration plate spaces on the vehicle provided that they also comply with the requirements.

2.3.2. The surface to be covered by a front or rear registration plate may have holes or gaps; however those holes or gaps shall be no more than 75 mm in height without taking into account their width.

2.3.3. The surface to be covered by a front or rear registration plate may have protrusions, provided that those protrusions do not project more than 5.0 mm from the nominal surface. Patches of very soft materials, such as foam or felt to stop the registration plate vibrating, shall not be taken into account.

2.3.4. The space for mounting a front or rear registration plate shall be such that, with a test plate, as defined in point 3.4., being fixed in accordance with the manufacturer's instructions, the following requirements are met:

2.3.4.1. Location of the space for mounting a front or rear registration plate:

2.3.4.1.1. The space for mounting a registration plate at the front of the vehicle shall be such that the plate can be positioned entirely within the two parallel longitudinal vertical planes passing through the outer extremities of the vehicle, not taking into account any devices for indirect vision. The designated space itself shall not form the widest point of the vehicle.

2.3.4.1.2. The space for mounting a registration plate at the rear of the vehicle shall be such that the plate can be positioned entirely within the two parallel longitudinal vertical planes passing through the outer extremities of the vehicle, not taking into account any devices for indirect vision. The designated space itself shall not form the widest point of the vehicle.

2.3.4.1.3. Front and rear registration plates shall be perpendicular (± 5°) to the longitudinal median plane of the vehicle, measured in the centre of the plate.

2.3.4.2. Position of the front and rear plate in relation to the vertical transverse plane:

2.3.4.2.1. The plate may be inclined to the vertical at not less than – 5° and not more than 30°, provided that the height of the upper edge of the plate is not more than 1 500 mm from the ground surface.

2.3.4.2.2. The plate may be inclined to the vertical at not less than – 15° and not more than 5°, provided that the height of the upper edge of the plate is more than 1 500 mm from the ground surface.

2.3.4.3. Height of the front and rear plate from the ground surface:

2.3.4.3.1. The lower edge of the front plate shall not be less than 100 mm from the ground surface.

2.3.4.3.2. The lower edge of the rear plate shall not be less than 200 mm from the ground surface.

2.3.4.3.3. The height of the upper edge of the front and rear plate from the ground surface shall not exceed 1 500 mm.

2.3.4.3.3.1. For special purpose vehicles, where it is not practicable to comply with the height provision for the front or rear registration plate space due to the construction of the vehicle, the maximum height may, by way of derogation from point 2.3.4.3.3., exceed 1 500 mm provided that it is as close to that limit as the constructional characteristics of the vehicle allow.

2.3.4.4. Geometrical visibility:

2.3.4.4.1. Front and rear plates shall be visible in the whole space within the following four planes:

(a) the two vertical planes touching the two lateral edges of the plate and forming an angle measured outwards to the left and to the right of the plate of 30° to the longitudinal median plane of the vehicle;

(b) the plane touching the upper edge of the plate and forming an angle measured upwards of 15° to the horizontal;

(c) the horizontal plane through the lower edge of the plate, in case the height of the upper edge of the plate from the ground surface does not exceed 1 500 mm;

(d) the plane touching the lower edge of the plate and forming an angle measured downwards of 15° with the horizontal, in case the height of the upper edge of the plate from the ground surface exceeds 1 500 mm.

The front plate shall be visible towards the front of the vehicle and the rear plate shall be visible towards the rear of the vehicle.

2.3.4.4.2. No structural element, even when fully transparent, shall be located within the space described above.

2.3.4.5. The gap between the edges of a mounted and fixed registration plate and the actual surface of the plate space shall not exceed 5.0 mm along the complete outline of the plate.

2.3.4.5.1. This gap may be exceeded if measured at a hole or gap in the surface of patterned mesh or between the parallel bars in the surface of a grille.

2.3.5. The actual position and shape of the mounted and fixed test plate as determined above, in particular its resulting radius of curvature, shall be taken into account for the purpose of rear registration plate lighting device requirements.

2.4. Other requirements

2.4.1. The presence of a registration plate shall not form the basis or part of the basis for attaching, mounting or clipping any other vehicle part, component or device onto it (e.g. lighting device supports may not be fixed onto a registration plate).

2.4.2. No vehicle part, adaptor plate, component or device shall become loosened or detached as a result of removal of a registration plate.

2.4.3. When a registration plate is fixed, its visibility shall not be reduced under normal conditions of use due, in particular, to vibrations and dynamic forces such as driving wind forces.

2.4.4. It is not permitted to provide a registration plate mounting location which can easily pivot up and/or down beyond the angles laid down in points 2.3.4.2.1. and 2.3.4.2.2. in relation to the vehicle structure in normal driving conditions (i.e. with doors or access panels closed).

2.4.5. Where it is declared by the vehicle manufacturer that a motor vehicle is suitable for towing loads (point 2.11.5. of the information document referred to in Article 24(1) of Regulation (EU) 2018/858) and any part of a suitable mechanical coupling device, whether fitted or not to the type of motor vehicle, could (partly) obscure the space for mounting and fixing the rear registration plate, the following shall apply:

(a) the motor-vehicle's user instructions (e.g. owner's manual, vehicle handbook) shall clearly specify that installation of a mechanical coupling device that cannot be easily removed or repositioned is not permitted,

(b) the instructions shall also clearly specify that, when fitted, a mechanical coupling device must always be removed or repositioned when it is not in use; and

(c) in the case of vehicle system type-approval in accordance with UN Regulation No 55 [1], it shall be ensured that the removal, repositioning and/or alternate location provisions are also fully complied with as regards lighting installation and space for mounting and fixing the rear registration plate.

3. Test procedure

3.1. Determination of the vertical inclination and height of the registration test plate from the ground surface.

3.1.1. The vehicle shall be placed on a smooth horizontal surface. The steered wheels shall be pointed in the straight-ahead position and the vehicle's mass shall be adjusted to that of the mass in running order, but without the driver, before the measurements are made.

3.1.2. Where the vehicle is equipped with hydro-pneumatic, hydraulic or pneumatic suspension or another device which can be adjusted in relation to load, it shall be tested with the suspension or device in the normal running condition, as specified by the manufacturer.

3.1.3. Where the primary and visible side of the registration test plate is facing downwards, the inclination measurement shall be expressed as a negative (minus) angle.

3.2. Projections shall be measured perpendicularly and directly towards the nominal surface to be covered by the registration plate.

3.3. The gap between the edge of the mounted and fixed registration test plate and the surface shall be measured perpendicularly and directly towards the actual surface to be covered by the plate.

3.4. The registration plate used for checking conformity shall have one of the two size as specified in point 2.2.1. and a thickness not exceeding 4.0 mm. The corners shall have a radius of 10 mm.

[1] Regulation No 55 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of mechanical coupling components of combinations of vehicles (OJ L 153, 15.6.2018, p. 179).

PART 3

EU TYPE-APPROVAL CERTIFICATE (VEHICLE SYSTEM)

Communication concerning *granting | extension | refusal | withdrawal* ([2]) of type-approval of a type of vehicle with regard to the registration plate spaces in accordance with the requirements laid down in Annex III to Regulation (EU) 2021/535, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension | refusal | withdrawal* ([2]):

SECTION I

(To be completed in accordance with Section I of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

SECTION II

(To be completed in accordance with Section II of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

Addendum

to EU type-approval certificate number …

1. Additional information:

1.1. Brief description of the vehicle type as regards its structure, dimensions, lines and constituent materials:

1.2. Description of the registration plate spaces (front and rear):

2. Registration plate space is suitable for fixing a registration plate size up to (mm):

2.1. Front: *520 × 120 | 340 × 240* ([2])

2.2. Rear: *520 × 120 | 340 × 240* ([2])

2.3. Second rear registration plate in case of vehicles of category O_2, O_3 and O_4: *520 × 120 | 340 × 240* ([2])

4. Rear registration plate space obscured when any mechanical coupling device is fitted: *yes | no* ([2])

5. Remarks:

([2]) Delete where not applicable.

ANNEX IV

WINDSCREEN WIPER AND WASHER SYSTEMS

PART 1

Section A

Information document for EU type-approval of motor vehicles with regard to their windscreen wiper and washer systems

MODEL

Information document No … relating to the EU type-approval of a motor vehicle with regard to its windscreen wiper and washer systems.

The following information shall be supplied in triplicate and include a list of contents. Any drawings or pictures shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

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0.1.

0.2.

0.2.1.

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0.3.1.

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3.2.

3.2.1.8.

3.2.5.

3.2.5.1.

3.2.5.2.

3.2.5.2.1.

3.2.5.2.2.

3.3.

3.3.1.1.

3.3.1.2.

3.3.2.

3.3.2.3.

3.4.

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9.10.3.5.

9.10.3.5.1.

9.10.3.6.

9.10.3.6.1.

Explanatory notes:

This information document is based on the template laid down in Annex I to Commission Implementing Regulation (EU) 2020/683 and shall be completed with the relevant information under the point numbers listed above as defined in that template.

Section B

Information document for EU type-approval of windscreen washer systems as separate technical units

MODEL

Information document No … relating to the EU type-approval as a separate technical unit of windscreen washer systems.

The following information shall be supplied in triplicate and include a list of contents. Any drawings shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

Where systems, components or separate technical units, referred to in this information document, have electronic controls, information concerning their performance shall be provided.

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Explanatory notes:

This information document is based on the template laid down in Annex I to Commission Implementing Regulation (EU) 2020/683 and shall be completed with the relevant information under the point numbers listed above as defined in that template.

PART 2

TECHNICAL SPECIFICATIONS

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

1.1. '*wiper field*' means the area(s) on the windscreen which is wiped by the wiper blade(s) when the wiper system is operating under normal conditions;

1.2. '*intermittent operation of the wiper system*' means an automatic non-continuous mode of operation of the wiper system, where after each full cycle there is a period during which the wipers are stationary in one specific designated halting position;

1.3. '*washer control*' means the device by which the washer system is manually activated and deactivated;

1.4. '*washer pump*' means a device for transferring fluid from the washer system storage reservoir to the outer face of the windscreen;

1.5. '*nozzle*' means a device which serves to direct fluid onto the windscreen;

1.6. '*fully primed system*' means a system which has been activated normally for a period of time and where fluid has been transferred through the pump, tubing and has exited the nozzle(s);

1.7. '*cleaned area*' means the previously soiled area which does not have any traces of drops and remaining dirt after it has dried completely;

1.8. '*vision area A*' means test area A as defined in paragraph 2.2. of Annex 21 to UN Regulation No 43 on uniform provisions concerning the approval of safety glazing materials and their installation on vehicles [1];

1.9. '*vision area B*' means reduced test area B as defined in paragraph 2.4. of Annex 21 to UN Regulation No 43, without the exclusion of the area defined in paragraph 2.4.1. (i.e. vision area A is included);

1.10. '*three-dimensional reference system*' means a reference grid as described in Annex 1 to the Consolidated Resolution on the Construction of Vehicles (R.E.3);

1.11. '*vehicle master control switch*' means the device by which the vehicle's on-board electronics system is brought from being switched off, as is the case when a vehicle is parked without the driver being present, to normal operation mode.

[1] Regulation No 43 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of safety glazing materials and their installation on vehicles (OJ L 42, 12.2.2014, p. 1).

2. Technical requirements

2.1. Windscreen wiper system.

2.1.1. Every vehicle that is fitted with a windscreen shall be equipped with a windscreen wiper system which is able to function when the vehicle master control switch has been activated, without any action by the driver other than switching the operating control, needed for starting and stopping the windscreen wiper system, to the on position.

2.1.1.1. The windscreen wiper system shall consist of one or more wiper arms which shall have wiper blades that are easily replaceable.

2.1.2. The windscreen wiper field shall cover at least 98 % of vision area A.

2.1.3. The windscreen wiper field shall cover at least 80 % of vision area B.

2.1.4. The windscreen wiper field shall meet the requirements of point 2.1.2. and 2.1.3. when the system is operating at a sweep frequency corresponding to point 2.1.5.1. and shall be tested under the conditions as set out in points 3.1.10. to 3.1.10.3.

2.1.5. The windscreen wiper system shall have at least two sweep frequency settings:

2.1.5.1. One frequency of not less than 10 and not more than 55 cycles per minute.

2.1.5.2. One frequency of not less than 45 complete cycles per minute.

2.1.5.3. The difference between the highest and a lower sweep frequency setting shall be at least 15 cycles per minute.

2.1.5.4. Intermittent operation of the windscreen wiper system may be used to comply with the requirements of points 2.1.5.1. to 2.1.5.3.

2.1.6. The frequencies referred to in points 2.1.5. to 2.1.5.3. shall be tested under the conditions as set out in points 3.1.1. to 3.1.6. and 3.1.8.

2.1.7. Where the windscreen wiper system is stopped as a result of switching the operating control to the off position, the wiper arm(s) and blade(s) shall return to their position of rest.

2.1.8. The windscreen wiper system shall be capable of withstanding stalling for at least 15 seconds. The use of automatic circuit protection devices is allowed, provided that for possible resetting no action is required other than operation of the windscreen wiper operating control.

2.1.9. The capability to withstand stalling of the windscreen wiper system referred to in point 2.1.8. shall be tested under the conditions as set out in point 3.1.7.

2.1.10. Where the position of rest of the windscreen wiper arm(s) or blade(s) is not outside of vision area B, it shall be possible to manually displace the wiper arm(s) in such a manner that the wiper blade(s) can be lifted from its/their position on the windscreen to allow that the windscreen is manually cleaned.

2.1.11. The windscreen wiper system shall be capable of operating for 120 seconds on a dry windscreen in an ambient temperature of – 18 °C, without degradation of performance.

2.1.12. The performance of the windscreen wiper system at – 18 °C shall be tested under the conditions as set out in point 3.1.11.

2.1.13. The windscreen wiper system shall continue to meet the requirements of point 2.1.2. without any degradation of efficiency, when it is operating at maximum frequency and when the vehicle is subjected to a relative air speed equal to 80 % of the vehicle's maximum design speed or 160 km/h, whichever is lower. Vision area A of the windshield shall be prepared in accordance with points 3.1.8. and 3.1.9. The aerodynamic effects associated with the size and shape of the windscreen, wiper arm(s) and wiper blade(s) shall be verified under these conditions, also taking into account point 3.1.9.1. During the test, the wiper blade(s) shall remain in contact with the windscreen and complete lift-off shall not be permitted. The wiper blade(s) shall stay in full contact with the windscreen in the area as established in point 2.1.2. for each complete cycle and any partial lift-off during upwards as well as downwards stroke shall not be permitted.

2.2. Windscreen washer system.

2.2.1. Every vehicle that is fitted with a windscreen shall be fitted with a windscreen washer system which is able to function when the vehicle master control switch has been activated, and which is capable of withstanding the loads and pressures resulting when the nozzles are plugged and the system is actuated in accordance with the procedure set out in points 3.2.1.1. to 3.2.1.1.2.

2.2.2. The performance of the windscreen washer system shall not be adversely affected by exposure to the temperature cycles in accordance with points 3.2.1. to 3.2.5.

2.2.3. The windscreen washer system shall have the ability to spray fluid onto the target area of the windscreen, without any trace of leakage, disconnection of any tubing and malfunctioning of any nozzle, at normal conditions when subjected to ambient temperatures between – 18 °C and 80 °C. In addition, when the nozzles are blocked, the system shall also show no signs of leakage and disconnection of any tubing.

2.2.4. The windscreen washer system shall be capable of delivering sufficient fluid to clear at least 60 % of vision area A, under the conditions as set out in points 3.2.6. to 3.2.6.4.

2.2.5. The windscreen washer system shall be capable of being manually activated by means of the washer control. In addition, activation and deactivation of the system may also be coordinated and combined with any other vehicle system.

2.2.6. The capacity of the reservoir containing the liquid shall be ≥ 1,0 litre.

3. Test procedure

3.1. Windscreen wiper system test conditions.

3.1.1. The tests described below shall be carried out under the conditions as stated in points 3.1.2. to 3.1.5. unless specified otherwise.

3.1.2. The ambient temperature shall be between 5 °C and 40 °C.

3.1.3. The windscreen shall be kept constantly wet.

3.1.4. In the case of an electric windscreen wiper system, the following additional conditions shall be met.

3.1.4.1. All batteries shall be fully charged at the start of the test.

3.1.4.2. The engine, if fitted, shall run at a speed not exceeding 30 % of the speed corresponding to its maximum power output. However, where this is proven not to be practicable due to specific engine control strategies, for instance in the case of electric hybrid vehicles, a realistic scenario taking into account the engine speeds, periodical absence or complete absence of a running engine during normal driving conditions, shall be determined. Where the windscreen wiper system can meet the requirements without a running engine, the engine does not have to run.

3.1.4.3. The passing beam headlamps shall be switched on.

3.1.4.4. All fitted heating, ventilation, defrosting and demisting systems (regardless of the location in the vehicle) shall be operating at maximum electrical consumption.

3.1.5. Compressed air or vacuum operated windscreen wiper systems shall be able to function continuously at the prescribed sweep frequencies whatever the engine speed and engine load or minimum and maximum battery charge levels specified by the manufacturer for normal operation.

3.1.6. The sweep frequencies of the windscreen wiper system shall comply with the requirements of points 2.1.5. to 2.1.5.3. after a preliminary operating time of 20 minutes on a wet windshield.

3.1.7. The requirements of point 2.1.8. shall be considered to be satisfied when the wiper arms are restrained in a position corresponding to half a cycle, for a period of 15 seconds with the windscreen wiper control set at the maximum sweep frequency.

3.1.8. The outer face of the windscreen shall be thoroughly degreased by means of methylated spirit or an equivalent degreasing agent. After drying, a solution of ammonia of not less than 3 % and not more than 10 % shall be applied. The surface shall be allowed to dry again and shall then be wiped with a dry cotton cloth.

3.1.9. A coating of the test mixture, in accordance with the specifications as laid down in point 4., shall be applied uniformly to the outer surface of the windscreen and allowed to dry.

3.1.9.1. Where the outer face of the windscreen has been prepared in accordance with points 3.1.8. and 3.1.9., the windscreen washer system may be used during the applicable tests.

3.1.10. The wiper field of the windscreen wiper system, as referred to in point 2.1.4., shall be determined as follows.

3.1.10.1. The outer face of the windscreen shall be treated in accordance with points 3.1.8. and 3.1.9.

3.1.10.2. In order to verify that the requirements of points 2.1.2. and 2.1.3. are met, the windscreen wiper system shall be activated, taking into account point 3.1.9.1., and a trace of the wiper field shall be made and compared to a trace of the vision areas A and B.

3.1.10.3. The technical service may agree to an alternative test procedure (e.g. virtual testing) to verify that the requirements of points 2.1.2. and 2.1.3.

3.1.11. The requirements of point 2.1.11. shall be met at an ambient temperature of – 18 ± 3 °C at which the vehicle has been stored for minimum four hours. The vehicle shall be prepared to operate under the conditions set out in points 3.1.4. and 3.1.5. During the test, the wiper system shall be operating normally, but at the maximum sweep frequency. The wiper field does not have to be observed.

3.2. Windscreen washer system test conditions.

3.2.1. Test No. 1

The windscreen washer system shall be filled with water, fully primed, and placed in an ambient temperature of 20 ± 2 °C for a minimum of four hours. The water shall be stabilized at that temperature.

3.2.1.1. All nozzle outlets shall be plugged at the location where the fluid exits those nozzles and the windscreen washer control shall be actuated six times in one minute, each time for at least three seconds.

3.2.1.1.1. Where the windscreen washer system is powered by the muscular energy of the driver, the force applied shall be 11,0 to 13,5 daN in case of a hand operated pump. The force applied shall be 40,0 to 44,5 daN in case of a foot operated pump.

3.2.1.1.2. In case of electric pumps, the test voltage shall not be less than the rated voltage and not more than the rated voltage plus 2 Volt.

3.2.1.2. The performance of the windscreen washer system at the end of the test shall be in compliance with point 2.2.3.

3.2.2. Test No. 2

The windscreen washer system shall be filled with water, fully primed, and placed in an ambient temperature of – 18 ± 3 °C for a minimum of four hours. The water does not have to be stabilized at this temperature.

3.2.2.1. The windscreen washer control shall be actuated six times in one minute, each time for at least three seconds, in accordance with points 3.2.1.1.1. and 3.2.1.1.2. The system shall then be placed in an ambient temperature of 20 ± 2 °C until the ice has completely thawed. The water does not have to be stabilized at this temperature. The performance of the windscreen washer system shall then be verified by actuating the system in accordance with points 3.2.1.1. and 3.2.1.2.

3.2.3. Test No. 3

Low temperature cycle exposure test

3.2.3.1. The windscreen washer system shall be filled with water, fully primed, and placed in an ambient temperature of – 18 ± 3 °C for a minimum of four hours so that the total mass of the water in the washer system is frozen. The system shall then be placed in an ambient temperature of 20 ± 2 °C until the ice has completely thawed, but in any case no longer than four hours. This freeze/thaw cycle shall be repeated six times. Finally, when the windscreen washer system is placed in the ambient temperature of 20 ± 2 °C and the ice has completely thawed, although the water does not have to be stabilized at this temperature, the performance of the windscreen washer system shall be verified by actuating the system in accordance with points 3.2.1.1. and 3.2.1.2.

3.2.3.2. The windscreen washer system shall be filled and fully primed with a low-temperature windscreen washer fluid consisting of a 50 % solution of methanol, or alternatively isopropyl alcohol, in water with a hardness not exceeding 205 mg/l (Ca). The system shall be placed in an ambient temperature of – 18 ± 3 °C for a minimum of four hours. The fluid does not have to be stabilized at this temperature. The performance of the windscreen washer system shall then be verified by actuating the system in accordance with points 3.2.1.1. and 3.2.1.2.

3.2.4. Test No. 4

High temperature cycle exposure test

3.2.4.1. If any part of the windscreen washer system is situated in the engine compartment, the system shall be filled with water, fully primed, and placed in an ambient temperature of 80 ± 3 °C for a minimum of eight hours. The water does not have to be stabilized at this temperature. The performance of the windscreen washer system shall then be verified by actuating the system in accordance with points 3.2.1.1. and 3.2.1.2.

3.2.4.2. If no part of the windscreen washer system is situated in the engine compartment, the system shall be filled with water, fully primed, and placed in an ambient temperature of 80 ± 3 °C for a minimum of eight hours. The water does not have to be stabilized at this temperature. Subsequently, the system is placed in an ambient temperature of 20 ± 2 °C. When the temperature of the water has stabilized, the performance of the windscreen washer system shall be verified by actuating the system in accordance with points 3.2.1.1. and 3.2.1.2. After this, the system shall be filled with water, fully primed, and placed in an ambient temperature of 60 ± 3 °C for a minimum of eight hours. The water does not have to be stabilized at this temperature. The performance of the windscreen washer system shall then be verified by actuating the system in accordance with points 3.2.1.1. and 3.2.1.2. Alternatively, the manufacturer may request that the windscreen washer system is tested under the conditions set out in point 3.2.4.1.

3.2.5. The windscreen washer tests as set out in points 3.2.1. to 3.2.4.2. shall be carried out in sequence on the same windscreen washer system. The system may be either tested as installed on the vehicle type for which EU type-approval is sought, or separately. In case EU type-approval is sought for a separate technical unit, the system shall be tested separately.

3.2.6. Test No. 5

Windscreen washer system capability test

3.2.6.1. The windscreen washer system shall be filled with water and fully primed. With the vehicle stationary and no significant wind effect, the nozzle(s) may be adjusted as to being pointed towards the target area on the outer face of the windscreen.

3.2.6.2. The outer face of the windscreen shall be treated as set out in points 3.1.8. and 3.1.9.

3.2.6.3. The windscreen washer system shall be actuated in accordance with the manufacturer's instructions, taking into account points 3.2.1.1.1. and 3.2.1.1.2. The total duration of the test shall not exceed 10 complete cycles of automatic operation of the windscreen wiper system operating at the maximum sweep frequency.

3.2.6.4. In order to verify that the requirements of point 2.2.4. are met, a trace of the relevant cleaned area shall be made and compared to a trace of vision area A. If it is obvious to the observer that the requirements are met, it is not required that the traces are prepared.

3.2.7. The test as set out in points 3.2.6. to 3.2.6.4. shall always be performed on the vehicle type for which EU type-approval is sought, even in the case when an approved separate technical unit is installed on the vehicle.

4. Specifications of the test mixture for testing the windscreen wiper and washer systems.

4.1. The test mixture referred to in point 3.1.9. shall consist of the following:

4.1.1. Water, with a hardness of less than 205 mg/l (Ca): 92,5 % by volume.

4.1.2. Aqueous saturated salt (sodium chloride), solution: 5,0 % by volume.

4.1.3. Dust, in accordance with the specifications of points 4.1.3.1. to 4.1.3.2.6. below: 2,5 % by volume.

4.1.3.1. Specifications of the test dust analysis

4.1.3.1.1. 68 ± 1 % SiO_2 by mass

4.1.3.1.2. 4 ± 1 % Fe_2O_3 by mass

4.1.3.1.3. 16 ± 1 % Al_2O_3 by mass

4.1.3.1.4. 3 ± 1 % CaO by mass

4.1.3.1.5. 1,0 ± 0,5 % MgO by mass

4.1.3.1.6. 4 ± 1 % Alkalis by mass

4.1.3.1.7. 2,5 ± 0,5 % Ignition loss by mass

4.1.3.2. Specifications of the particle-size distribution in course-grade dust

4.1.3.2.1. 12 ± 2 % of 0 to 5 μm particle-size

4.1.3.2.2. 12 ± 3 % of 5 to 10 μm particle-size

4.1.3.2.3. 14 ± 3 % of 10 to 20 μm particle-size

4.1.3.2.4. 23 ± 3 % of 20 to 40 μm particle-size

4.1.3.2.5. 30 ± 3 % of 40 to 80 μm particle-size

4.1.3.2.6. 9 ± 3 % of 80 to 200 μm particle-size

PART 3

Section A

EU TYPE-APPROVAL CERTIFICATE (VEHICLE SYSTEM)

Communication concerning *granting* / *extension* / *refusal* / *withdrawal* ([2]) of type-approval of a type of vehicle with regard to the windscreen wiper and washer systems, in accordance with the requirements laid down in Annex IV to Regulation (EU) 2021/535, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension* / *refusal* / *withdrawal* ([2]):

SECTION I

(To be completed in accordance with Section I of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

SECTION II

(To be completed in accordance with Section II of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

Addendum

to EU type-approval certificate number…

1. Additional information:

1.1. Brief description of the vehicle type as regards its structure, dimensions, lines and constituent materials:

1.2. Description of the method of operation of the wiper and washing systems:

1.3. Detailed description of the wiper system (i.e. number of blades, blade lengths, wiper arm dimensions, etc.):

1.4. Detailed description of the washer system (i.e. number of nozzles, number of outlet ports per nozzle, washer pump, fluid storage container, washer line hoses and their mounting to pump and nozzles, etc.)

1.5. Fluid storage capacity (litre):

1.6. Maximum vehicle design speed (km/h):

2. Hand of drive: left / right ([2])

3. Left hand drive and mirror-opposite right hand drive systems: yes / no ([2])

4. Aerodynamic spoiler fitted onto the wiper arm / wiper blade ([2]) at driver side / centre / passenger side / … ([2])

5. Remarks:

([2]) Delete where not applicable.

Section B

EU TYPE-APPROVAL CERTIFICATE (SEPARATE TECHNICAL UNIT)

Communication concerning *granting* / *extension* / *refusal* / *withdrawal* ([3]) of type-approval of a STU with regard to type of windscreen washer systems in accordance with the requirements laid down in Annex IV to Regulation (EU) 2021/535, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension* / *refusal* / *withdrawal* ([3]):

SECTION I

(To be completed in accordance with Section I of the template of Model C in Annex III to Commission Implementing Regulation (EU) 2020/683)

SECTION II

(To be completed in accordance with Section II of the template of Model C in Annex III to Commission Implementing Regulation (EU) 2020/683)

Addendum

to EU type-approval certificate number …

1. Additional information:

1.1. Brief description of the type of separate technical unit:

1.2. Detailed description of the washer system:

1.2.1. Number of nozzles:

1.2.2. Number of outlet ports per nozzle:

1.2.3. Description of washer line hoses and its mounting to pump and nozzles:

1.2.4. Description of washer pump:

1.2.5. Fluid storage capacity (litre):

2. Suitable for hand of drive: left / right ([3])

3. Any part of the system may be situated in the engine compartment: yes / no ([3])

4. Separate technical unit: universal / vehicle specific ([3])

5. Remarks:

6. List of vehicle types for which the separate technical unit has been approved (where applicable):

([3]) Delete where not applicable.

Section C

EU TYPE-APPROVAL MARK OF SEPARATE TECHNICAL UNIT

1. The EU type-approval mark for separate technical units referred to in Article 38(2) of Regulation (EU) 2018/858 shall consist of the following:

1.1. A rectangle surrounding the lower-case letter 'e', followed by the distinguishing number of the Member State which has granted the EU type-approval for the component or separate technical unit in accordance with the following:

1	for Germany	19	for Romania
2	for France	20	for Poland
3	for Italy	21	for Portugal
4	for the Netherlands	23	for Greece
5	for Sweden	24	for Ireland
6	for Belgium	25	for Croatia
7	for Hungary	26	for Slovenia
8	for the Czech Republic	27	for Slovakia
9	for Spain	29	for Estonia
		32	for Latvia
13	for Luxembourg	34	for Bulgaria
12	for Austria	36	for Lithuania
17	for Finland	49	for Cyprus
18	for Denmark	50	for Malta

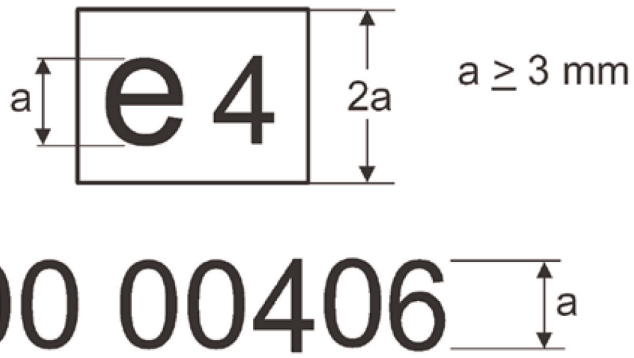
1.2. In the vicinity of the rectangle, two digits indicating the series of amendments laying down the requirements with which this separate technical units complies, '00' at present, followed by a space and the five-digit number referred to in point 2.4. of Annex IV of Regulation (EU) 2018/858.

2. The EU type-approval mark of the separate technical units shall be indelible and clearly legible.

3. An example of an EU separate technical unit type-approval mark is shown in Figure 1.

Figure 1

Example of EU separate technical unit type-approval mark



Explanatory note:

Legend The EU separate technical unit type-approval was issued by the Netherlands under number 00406. The first two digits '00' indicate that the separate technical unit was approved in accordance with this Regulation.

ANNEX V

WHEEL GUARDS

PART 1

Information document for EU type-approval of vehicles with regard to wheel guards

MODEL

Information document No … relating to the EU type-approval of a vehicle with regard to wheel guards.

The following information shall be supplied in triplicate and include a list of contents. Any drawings or pictures shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

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2.3.3.

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2.4.1.3.

2.4.2.

2.4.2.2.

2.4.2.3.

2.6.

6.

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6.6.1.

6.6.1.1.

6.6.1.1.1.

6.6.1.1.2.

etc.

6.6.4.

9.

9.16.

9.16.1.

9.16.2.

Explanatory notes:

This information document is based on the template laid down in Annex I to Commission Implementing Regulation (EU) 2020/683 and shall be completed with the relevant information under the point numbers listed above as defined in that template.

PART 2

Technical specifications

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

1.1. '*tyre envelope*' means the maximum section width and outer-diameter of a tyre, including tolerances, as permitted and specified according to its component approval;

1.2. '*snow traction device*' means a snow chain or other equivalent device providing traction in snow, which shall be able to be mounted onto the vehicle's tyre/wheel combination and which is not a snow tyre, winter tyre, all-season tyre or any other tyre by itself.

2. Technical requirements

2.1. General provisions

2.1.1. The vehicle shall be provided with a wheel guard for each wheel.

2.1.2. The wheel guard may consist of parts of the bodywork or separate mudguards and shall be so designed as to protect road users, as far as possible, against thrown-up stones, mud, ice, snow and water and to reduce the dangers due to contact with rotating wheels.

2.2. Specific requirements

2.2.1. The wheel guards shall meet the requirements from point 2.2.1.1. to 2.2.1.4. with the vehicle's mass adjusted to that of the manufacturer's declared mass in running order with one additional passenger on the first seating row, if applicable, and any steered wheels in the straight ahead position.

2.2.1.1. In the part formed by radial planes at an angle of 30° towards the front and 50° towards the rear of the centre of the wheels (see Figure 1), the overall width (q) of the wheel guard shall be at least sufficient to cover the total tyre width (b) taking into account the tyre envelope as well as the extremes of the tyre/wheel combination(s) as specified by the manufacturer. In the case of twin wheels, the tyre envelopes and total width over the two tyres (t) shall be taken into account.

2.2.1.1.1. For the purposes of determining the widths referred to in point 2.2.1.1., the labelling (marking) and decorations, protective bands or ribs on tyre walls shall not be taken into account.

2.2.1.2. The rear of the wheel guard shall not terminate above a horizontal plane 150 mm above the axis of rotation of the wheels, furthermore:

2.2.1.2.1. In case of single wheels, the intersection of the rear edge of the wheel guard with the horizontal plane as referred to in point 2.2.1.2. (see Figure 1, point A) shall lie outwards of the median longitudinal plane of the tyre.

2.2.1.2.2. In the case of twin wheels, the intersection of the rear edge of the wheel guard with the horizontal plane as referred to in point 2.2.1.2. (see Figure 1, point A) at the outside wheel shall lie outwards of the median longitudinal plane of the outermost tyre.

2.2.1.3. The contour and location of each wheel guard shall be such that they are as close to the tyres as possible. In particular within the part formed by the radial planes referred to in point 2.2.1.1., the following requirements shall be satisfied:

2.2.1.3.1. The depth (p) of the recess situated in the vertical plane of the tyre axis, measured from the outward and inward edges of the wheel guard at the vertical longitudinal plane passing through the centre of the tyre inside the wheel guard, shall be at least 30 mm. That depth (p) may be reduced progressively to zero towards the radial planes specified in point 2.2.1.1.

2.2.1.3.2. The distance (c) between the lower edges of the wheel guard and the axis passing through the centre of rotation of the wheels shall not exceed 2 × r, where the radius (r) is the static radius of the tyre.

2.2.1.4. In the case of vehicles having an adjustable suspension height, the requirements in points 2.2.1.3.1. and 2.2.1.3.2. shall be met when the vehicle is in the normal running position as specified by the vehicle manufacturer.

2.2.2. The wheel guards may consist of several components, provided that no gaps exist between or within the individual parts when assembled.

2.2.3. The wheel guards shall be firmly attached. However, it is allowed for them to be detachable either as a unit or in parts.

2.3. Use of snow traction devices

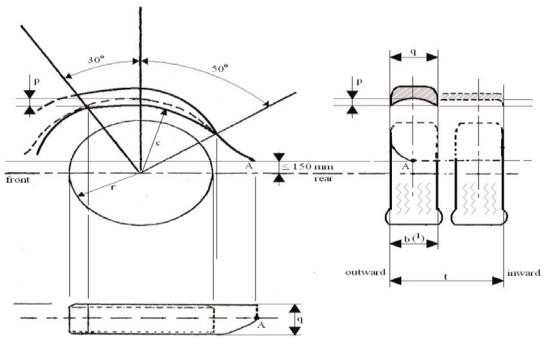
2.3.1. In the case of vehicles where only two wheels are driven, the manufacturer shall certify that the vehicle is so designed that at least one type of snow traction device can be used on at least one of the tyre and wheel combinations approved for the driven axle of the vehicle. The snow traction device and tyre/wheel combination(s) suitable for the vehicle type shall be specified by the manufacturer under item 6.6.4. of the information document.

2.3.2. In the case of vehicles where all wheels are driven, including vehicles where drive axles can be disengaged either manually or automatically, the manufacturer shall certify that the vehicle is so designed that at least one type of snow traction device can be used on at least one of the tyre and wheel combinations approved for the driven axle, which cannot be disengaged, of the vehicle. The snow traction device and tyre/wheel combination(s) suitable for the vehicle type shall be specified by the manufacturer under item 6.6.4. of the information document.

2.3.3. The vehicle manufacturer shall include relevant instructions regarding the correct use of the specified snow traction devices in the motor vehicle's user instructions (e.g. owner's manual, vehicle handbook).

Figure 1

Diagram of wheel guard



Explanatory note:

([1]) The tyre width (b) is determined at the top part of the tyre (tyre section width between the radial planes as referred to in point 2.2.1.1.).

PART 3

EU TYPE-APPROVAL CERTIFICATE (VEHICLE SYSTEM)

Communication concerning *granting | extension | refusal | withdrawal* [1] of type-approval of a type of vehicle with regard to the wheel guards in accordance with the requirements laid down in Annex V to Regulation (EU) 2021/535, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension | refusal | withdrawal* [1]:

SECTION I

(To be completed in accordance with Section I of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

SECTION II

(To be completed in accordance with Section II of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

Addendum

to EU type-approval certificate number …

1. Additional information:

1.1. Brief description of the vehicle type as regards its structure, dimensions, lines and constituent materials:

1.2. Description of the wheel guards:

1.3. Tyre/wheel combination(s) (including tyre size, rim size and wheel off-set):

1.4. Description of the type of snow traction device(s) which may be used:

1.5. Tyre/wheel combination(s) (including tyre size, rim size and wheel off-set) to be used with the snow traction device(s):

2. Permanently driven axle(s): *axle 1 | axle 2 | …* [1]

3. Suspension height adjustable: *yes | no* [1]

4. Wheel guards *detachable | not detachable* [1] *as a unit | in parts* [1]

5. Remarks:

[1] Delete where not applicable.

ANNEX VI

WINDSCREEN DEFROSTING AND DEMISTING SYSTEMS

PART 1

Information document for EU type-approval of motor vehicles with regard to windscreen defrosting and demisting systems

MODEL

Information document No … relating to the EU type-approval of a motor vehicle with regard to windscreen defrosting and demisting systems.

The following information shall be supplied in triplicate and include a list of contents. Any drawings or pictures shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

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Explanatory notes:

This information document is based on the template laid down in Annex I to Commission Implementing Regulation (EU) 2020/683 and shall be completed with the relevant information under the point numbers listed above as defined in that template.

PART 2

Technical specifications

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

1.1. '*defrosted area*' means the area of the windscreen having a dry outside surface or an outside surface covered with melted or partially melted wet frost which can be removed by the vehicle's windscreen wiper system;

1.2. '*mist*' means a film of condensate on the inside face of the glazed surface of the windscreen;

1.3. '*demisted area*' means the area of the windscreen having a dry inside surface, without any drops or traces of water, after previously being covered by mist;

1.4. '*vision area A*' means test area A as defined in paragraph 2.2. of Annex 21 to UN Regulation 43;

1.5. '*vision area B*' means reduced test area B as defined in paragraph 2.4. of Annex 21 to UN Regulation 43, without the exclusion of the area defined in paragraph 2.4.1. (i.e. vision area A is included);

1.6. '*vehicle master control switch*' means the device by which the vehicle's on-board electronics system is brought from being switched off, as is the case when a vehicle is parked without the driver being present, to normal operation mode;

2. Technical requirements

2.1. Windscreen defrosting

2.1.1. Every vehicle that is fitted with a windscreen shall be equipped with a system for removing frost and ice from the exterior glazed surface of the windscreen. The windscreen defrosting system shall be effective enough to ensure adequate visibility through the windscreen in cold weather.

2.1.2. The efficiency of the system shall be verified by determining the defrosted area of the windscreen periodically after starting, the vehicle having been kept in a cold chamber for a certain amount of time.

2.1.3. The requirements of points 2.1.1. and 2.1.2. shall be checked using the method set out in point 3.1.

2.1.4. The following requirements shall be satisfied:

2.1.4.1. 20 minutes after the start of the test period, vision area A shall be 80 % defrosted;

2.1.4.2. 25 minutes after the start of the test period, the defrosted area of the windscreen on the passenger side shall be comparable to the area referred to in point 2.1.4.1. for the driver's side;

2.1.4.3. 40 minutes after the start of the test period, vision area B shall be 95 % defrosted.

2.2. Windscreen demisting

2.2.1. Every vehicle that is fitted with a windscreen shall be equipped with a system for removing mist from the interior glazed surface of the windscreen.

2.2.2. The demisting system shall be effective enough to restore visibility through the windscreen in case it is fogged up with mist. Its efficiency shall be verified in accordance with the procedure described in point 3.2.

2.2.3. The following requirements shall be satisfied:

2.2.3.1. Vision area A shall be 90 % demisted in 10 minutes;

2.2.3.2. Vision area B shall be 80 % demisted in 10 minutes.

3. Test procedures

3.1. Windscreen defrosting

3.1.1. The test shall be carried out at a temperature of − 8 ± 2 °C or − 18 ± 3 °C, as selected by the manufacturer.

3.1.1.1. The test shall be carried out in a cold chamber large enough to contain the complete vehicle and equipped to maintain one of the temperatures mentioned in point 3.1.1. in the chamber throughout the test and to circulate cold air. The cold chamber shall be maintained at or below the specified test temperature for not less than 24 hours before the start of the period during which the vehicle is exposed to cold.

3.1.2. Before the test, the inner and outer surfaces of the windscreen shall be thoroughly degreased by means of methylated spirit or an equivalent degreasing agent. After drying, a solution of ammonia of not less than 3 % and not more than 10 % shall be applied. The surface shall be allowed to dry again and then be wiped with a dry cotton cloth.

3.1.3. The vehicle shall be switched off and shall be kept at the test temperature for not less than 10 hours prior to commencement of the test.

3.1.3.1. Where it is possible to check whether the vehicle's engine coolant and lubricant are stabilized at the test temperature, the period referred to in point 3.1.3. may be shortened.

3.1.4. Following the exposure period prescribed in point 3.1.3., an even layer of ice of 0,044 g/cm^2 shall be applied over the entire outside surface of the windscreen by means of a water spray gun working at 3,5 ± 0,2 bar operating pressure.

3.1.4.1. The spray nozzle, adjusted to full fan pattern and maximum flow, shall be held perpendicular to and at a distance of between 200 and 250 mm from the glazed surface, and so directed as to form an even layer of ice right across the windscreen from one side to the other.

3.1.4.1.1. A spray gun having a nozzle of 1,7 mm diameter and a liquid flow rate of 0,395 l/min, and capable of producing a fan pattern of 300 mm diameter on the glazed surface at a distance 200 mm from that surface, may be used to satisfy the requirements of point 3.1.5. Any other device by which the requirements can be satisfied shall also be permitted.

3.1.5. After the ice has been formed on the windscreen, the vehicle shall be kept in the cold chamber for an additional period of not less than 30 minutes and not more than 40 minutes.

3.1.6. After the period referred to in point 3.1.5. has elapsed, one or two observers shall enter the vehicle, subsequently the vehicle master operation control may be switched to the on position and any engine can be started, if necessary by some external means. The test period shall commence as soon as the vehicle master control switch has been activated.

3.1.6.1. If the vehicle is fitted with an engine, the engine speeds may be adjusted in accordance with the manufacturer's specification recommended for warming up when starting in cold weather, during the first five minutes of the test period.

3.1.6.2. During the final 35 minutes of the test period (or during the entire test period if the five-minute warming-up procedure is not followed) the following shall apply:

3.1.6.2.1. The engine, if fitted, shall run at a speed not exceeding 50% of the speed corresponding to its maximum power output. However, if this is proven not to be practicable due to specific engine control strategies, for instance in the case of electric hybrid vehicles, a realistic worst case scenario shall be determined. The scenario shall take into account the engine speeds, periodical absence or complete absence of a running engine during normal driving conditions at an ambient temperature of − 8 °C or − 18 °C, whichever has been selected by the manufacturer as the designated test temperature. If the system can meet the defrosting requirements without a running engine, the engine does not have to run at all.

3.1.6.3. All batteries shall be fully charged at the start of the test. However, high voltage batteries of vehicles with an electric powertrain shall be charged > 60 %.

3.1.6.4. During the test, the voltage at the terminals of the defrosting device may be not more than 20 % above the nominal rating of the system.

3.1.6.5. The temperature in the test chamber shall be measured at the level of the centre of the windscreen, at a point not significantly affected by heat from the vehicle under test.

3.1.6.6. The horizontal component of the speed of the air cooling the chamber, measured immediately prior to the test, in the median plane of the vehicle at a point 300 mm forward of the base of the windscreen and at a level half-way between the base and the top of the windscreen, shall be as low as possible and in any event less than 8 km/h.

3.1.6.7. If fitted, the engine bonnet, roof, all doors, windows and vents, except the intakes and outlets of the heating and ventilating system, shall be closed; one or two windows may be opened for a total vertical distance of 25 mm if the vehicle manufacturer so requests.

3.1.7.8. The vehicle's defrosting system controls shall be set as recommended by the vehicle manufacturer for the test temperature.

3.1.6.9. The windscreen wipers may be used during the test, but this shall be done without any manual assistance apart from the operation of any controls in the interior of the vehicle.

3.1.7. The observer(s) shall outline the defrosted area on the inside surface of the windscreen, at five-minute intervals from the start of the test period.

3.1.8. On completion of the test, the pattern of the defrosted area outlined on the inner face of the windscreen as required by point 3.1.7. shall be noted and marked to identify windscreen vision areas A and B.

3.2. Windscreen demisting

3.2.1. Before the test, the inside and outer surfaces of the windscreen shall be thoroughly degreased by means of methylated spirit, or an equivalent degreasing agent. After drying, a solution of ammonia of not less than 3 % and not more than 10 % shall be applied. The surface shall be allowed to dry again and then be wiped with a dry cotton cloth.

3.2.2. The test shall be carried out in an environmental chamber large enough to take the complete vehicle and capable of producing and maintaining a test temperature of – 3 ± 1 °C throughout the test period.

3.2.2.1. The temperature in the test chamber shall be measured at the level of the centre of the windscreen, at a point not significantly affected by heat from the vehicle under test.

3.2.2.2. The horizontal component of the speed of the air cooling the chamber, measured immediately prior to the test, in the median plane of the vehicle at a point 300 mm forward of the base of the windscreen and at a level half-way between the base and the top of the windscreen, shall be as low as possible and in any event less than 8 km/h.

3.2.2.3. If fitted, the engine bonnet, roof, all doors, windows and vents, except the intakes and outlets of the heating and ventilation system, shall be closed; one or two windows may be opened from the beginning of the demisting test for a total vertical distance of 25 mm if the vehicle manufacturer so requests.

3.2.3. The mist shall be produced by means of the steam generator described in point 4. The generator shall contain enough water to generate at least 70 ± 5 g/h of steam for each seating position designated by the manufacturer, in an ambient temperature of – 3 °C.

3.2.4. The inside surface of the windscreen shall be cleaned as set out in point 3.2.1. once the vehicle is placed in the environmental chamber. The ambient air temperature shall then be lowered and stabilized at – 3 ± 1 °C. The vehicle shall be switched off and shall be kept at the test temperature for not less than 10 hours prior to commencement of the test. If it is possible to check whether the vehicle's engine coolant and lubricant are stabilized at the test temperature, that period may be shortened.

3.2.5. The steam generator shall be placed with its outlets in the median longitudinal plane of the vehicle at a height of 580 ± 80 mm above the R-point or seating reference point of the driver's seat (i.e. the design point defined by the vehicle manufacturer with respect to the three-dimensional reference system defined in point 1.10. in Part 2 of Annex IV). It shall normally be placed behind the front seats, however, where the design of the vehicle precludes this, the generator may be placed in the nearest convenient forward position to that mentioned above.

3.2.6. After the generator has been operating for five minutes inside the vehicle, one or two observers shall quickly enter the vehicle, opening any access doors for a total duration not exceeding 8 seconds, and be seated on the front seating position(s), the output of the generator being then reduced by 70 ± 5 g/h for each observer.

3.2.7. One minute after the observer(s) have entered the vehicle, the vehicle master operation control may be switched to the on position and any engine can be started, if necessary by some external means. The test period shall commence as soon as the vehicle master control switch has been activated.

3.2.7.1. Where the vehicle is fitted with an engine, it shall run at a speed not exceeding 50% of the speed corresponding to its maximum power output. However, if this is proven not to be practicable due to specific engine control strategies, for instance in the case of electric hybrid vehicles, a realistic worst case scenario shall be determined. The scenario shall take into account the engine speeds, periodical absence or complete absence of a running engine during normal driving conditions at an ambient temperature of – 1 °C. If the system can meet the demisting requirements without a running engine, the engine does not have to run at all.

3.2.7.2. The vehicle's demisting system controls shall be set as recommended by the vehicle manufacturer for the test temperature.

3.2.7.3. All batteries shall be fully charged at the start of the test. However, high voltage batteries of vehicles with an electric powertrain shall be charged > 60 %.

3.2.7.4. The voltage at the terminals of the demisting device may be not more than 20 % above the nominal rating of the system.

3.2.8. At the end of the test, the demist pattern shall be recorded, noted and marked to identify windscreen vision areas A and B.

4. Characteristics of the steam generator.

4.1. The steam generator used for the test shall have the following general characteristics:

4.1.1. The water container shall have a capacity of at least 2,25 litres.

4.1.2. The heat loss at boiling point shall not exceed 75 W in an ambient temperature of – 3 ± 1 °C.

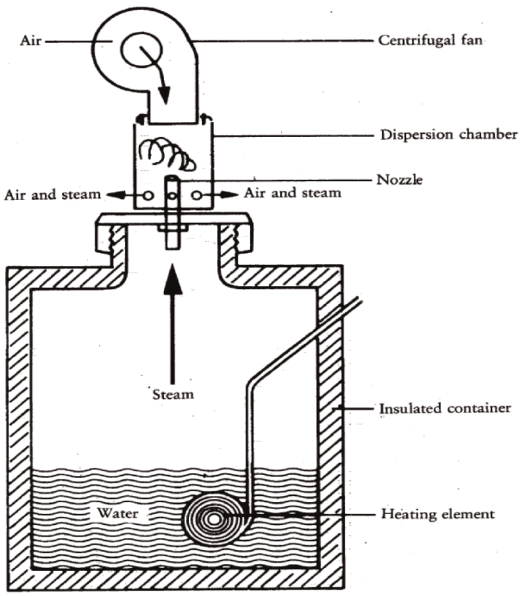
4.1.3. The fan shall have a capacity of 0,07 to 0,10 m^3/min at 0,5 mbar static pressure.

4.1.4. Six steam outlet holes shall be positioned at the top of the generator, around the perimeter spaced at equal distances (see Figure 1)

4.1.5. The generator shall be calibrated at – 3 ± 1 °C to give reading for each 70 ± 5 g/h output up to a maximum of *n* times this figure, where *n* is the maximum number of seating positions designated by the manufacturer.

Figure 1

Diagram of steam generator



4.2. The specified parts shall have the following dimensional and material characteristics:

4.2.1. Nozzle

4.2.1.1. Dimensions:

4.2.1.1.1. Length 100 mm.

4.2.1.1.2. Inside diameter 15 mm.

4.2.1.2. Material:

4.2.1.2.1. Brass.

4.2.2. Dispersion chamber

4.2.2.1. Dimensions:

4.2.2.1.1. Pipe outside diameter 75 mm.

4.2.2.1.2. Wall thickness 0,38 mm.

4.2.2.1.3. Length 115 mm.

4.2.2.1.4. Six evenly spaced holes of 6,3 mm in diameter, 25 mm above the bottom of the dispersion chamber.

4.2.2.2. Material:

4.2.2.2.1. Brass.

PART 3

EU TYPE-APPROVAL CERTIFICATE (VEHICLE SYSTEM)

Communication concerning *granting* / *extension* / *refusal* / *withdrawal* ([1]) of type-approval of a type of vehicle with regard to the windscreen defrosting and demisting system in accordance with the requirements laid down in Annex VI to Regulation (EU) 2021/535, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension* / *refusal* / *withdrawal* ([1]):

SECTION I

(To be completed in accordance with Section I of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

SECTION II

(To be completed in accordance with Section II of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

Addendum

to the EU type-approval certificate number …

1. Additional information:

1.1. Brief description of the vehicle type as regards its structure, dimensions, lines and constituent materials:

1.2. Description of the defrosting and demisting systems:

1.3. Description of the interior arrangements or fittings that might affect the tests:

1.4. Maximum number of seating positions:

1.5. Characteristics of the windscreen:

thickness of component parts (mm):

1.6. Rated voltage of the electrical installation (V):

2. Hand of drive: *left* / *right* ([1])

3. Power plant: positive ignition / compression ignition / electric / hybrid electric / ([1])

4. Defrost test temperature: *– 8 °C* / *– 18 °C* ([1])

5. Remarks:

([1]) Delete where not applicable.

ANNEX VII

TOWING DEVICES

PART 1

Information document for EU type-approval of motor vehicles with regard to towing devices

MODEL

Information document No … relating to the EU type-approval of a motor vehicle with regard to towing devices.

The following information shall be supplied in triplicate and include a list of contents. Any drawings or pictures shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

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0.2.1.

0.3.

0.3.1.

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2.11.5.

12.

12.3.

12.3.1.

12.3.2.

12.3.3.

Explanatory notes:

This information document is based on the template laid down in Annex I to Commission Implementing Regulation (EU) 2020/683 and shall be completed with the relevant information under the point numbers listed above as defined in that template.

PART 2

Technical specifications

1. Technical requirements

1.1. Minimum number of devices.

1.1.1. All motor vehicles shall have a towing device fitted at the front.

1.1.2. Vehicles in category M_1, as defined in Part A of Annex I to Regulation (EU) 2018/858, except for those vehicles not suitable for towing any load, shall also be fitted with a towing device at the rear.

1.1.3. A rear towing device may be substituted by a mechanical coupling device, as set out in UN Regulation No 55, provided that the requirements in point 1.2.1. are met.

1.2. Load and stability

1.2.1. Each towing device fitted to the vehicle shall be able to withstand a tractive and compressive static force equivalent to the force of gravity acting on at least half the technically permissible maximum laden mass of the vehicle.

2. Test procedure

2.1. Both tractive and compressive test loads shall be applied on each separate towing device fitted to the vehicle.

2.2. The test loads shall be applied in horizontal longitudinal direction, in relation to the vehicle.

PART 3

EU TYPE-APPROVAL CERTIFICATE (VEHICLE SYSTEM)

Communication concerning *granting* / *extension* / *refusal* / *withdrawal* ([1]) of type-approval of a type of vehicle with regard to the towing devices in accordance with the requirements laid down in Annex VII to Regulation (EU) 2021/535, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension* / *refusal* / *withdrawal* ([1]):

SECTION I

(To be completed in accordance with Section I of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

SECTION II

(To be completed in accordance with Section II of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

Addendum

to EU type-approval certificate Number…

1. Additional information:

1.1. Brief description of the vehicle type as regards its structure, dimensions, lines and constituent materials:

1.2. Total number and location of towing device(s):

1.3. Method of attachment to the vehicle:

1.4. Technically permissible maximum laden mass of the vehicle (kg):

2. Front towing device(s): *removable* / *not removable* ([1]) *hook* / *eye* / *other* ([1])

3. Rear towing device(s): *removable* / *not removable* ([1]) *hook* / *eye* / *other* / *none* ([1])

4. Vehicle *is* / *is not* ([1]) suitable for towing loads

5. Remarks:

([1]) Delete where not applicable.

ANNEX VIII

SPRAY SUPPRESSION SYSTEMS

PART 1

Section A

Information document for EU type-approval of vehicles with regard to spray suppression systems

MODEL

Information document No … relating to the EU type-approval of a vehicle with regard to its spray suppression systems.

The following information shall be supplied in triplicate and include a list of contents. Any drawings or pictures shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

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9.20.0.

9.20.1.

9.20.2.

9.20.3.

Explanatory notes:

This information document is based on the template laid down in Annex I to Commission Implementing Regulation (EU) 2020/683 and shall be completed with the relevant information under the point numbers listed above as defined in that template.

Section B

Information document for EU type-approval of a type of separate technical unit with regard to spray suppression systems

MODEL

Information document No … relating to the EU separate technical unit type-approval of a spray suppression system.

The following information shall be supplied in triplicate and include a list of contents. Any drawings or pictures shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

Where systems, components or separate technical units, referred to in this information document, have electronic controls, information concerning their performance shall be provided.

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Explanatory notes:

This information document is based on the template laid down in Annex I to Commission Implementing Regulation (EU) 2020/683 and shall be completed with the relevant information under the point numbers listed above as defined in that template.

PART 2

Technical specifications

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

1.1. '*mudguard*' means a rigid or semi-rigid component intended to trap the water thrown up by tyres in motion and to direct it towards the ground and which may entirely or partially form an integral part of the vehicle bodywork or other parts of the vehicle such as the lower part of the load platform;

1.2. '*rain flap*' means a flexible component mounted vertically behind the wheel, on the lower part of the chassis or the loading surface, or on the mudguard and which reduces the risk of small objects, in particular pebbles, being picked up from the ground by the tyres and thrown upwards or sideward towards other road users;

1.3. '*air/water separator*' means a component forming part of the valance and/or of the rain flap through which air can pass whilst reducing pulverized water emissions;

1.4. '*energy absorber*' means a component forming part of the mudguard and/or valance and/ or rain flap which absorbs the energy of water spray, thus reducing pulverized water spray;

1.5. '*outer valance*' means a component located approximately within a vertical plane that is parallel to the longitudinal plane of the vehicle and which may form part of a mudguard or of the vehicle bodywork;

1.6. '*steered wheels*' means the wheels actuated by the vehicle's steering system;

1.7. '*self-tracking axle*' means an axle pivoted about a central point in such a way that it can describe a horizontal arc;

1.8. '*self-steered wheels*' means wheels not actuated by the vehicle's steering device, which may swivel through an angle not exceeding 20° owing to the friction exerted by the ground;

1.9. '*retractable axle*' means an axle as defined in Annex XIII, Part 2, Section A, point 1.9.;

1.10. '*unladen vehicle*' means a vehicle in running order as stated in Annex XIII, Part 2, Section A, point 1.3.;

1.11. '*tread*' is the part of the tyre as defined in paragraph 2.8. of UN Regulation No 30 ([1]) or UN Regulation No 54 ([2]) as appropriate;

2. Spray suppression devices

2.1. General provision

Spray suppression devices shall be constructed in such a way that they operate properly when used normally on wet roads. Moreover, those devices shall incorporate no structural or manufacturing defect detrimental to their proper functioning or behaviour.

2.2. Test to be carried out

Depending on their physical operating principle, spray suppression devices shall be subjected to the relevant tests as described in points 3.1. and 3.2. and shall deliver the results required in points 3.1.5. and 3.2.5.

2.3. The following shall be submitted to the technical service responsible for conducting the type-approval tests:

Three of the samples shall be used for tests and the fourth shall be kept by the test laboratory for any subsequent verification. The test laboratory may require further samples.

2.4. Markings

Each sample shall be clearly and indelibly marked with the trade name or mark and an indication of the type and include a space that is large enough for the EU component type-approval mark.

2.5. A symbol "A" for devices of the energy-absorption type or a symbol "S" for devices of the air/water separator type shall be added to the approval mark in accordance with Section C in Part 3.

3. Test procedures

Depending on their physical operating principle, spray suppression devices shall subjected to the tests described in points 3.1. and 3.2. and shall deliver the results required in those sections (points 3.1.5. and 3.2.5.).

3.1. **Tests on spray suppression devices of the energy-absorber type**

3.1.1. Principle

The aim of this test is to quantify the ability of a device to retain the water directed against it by a series of jets. The test assembly is intended to reproduce the conditions under which the device is to function when fitted to a vehicle as regards the volume and speed of the water thrown up from the ground by the tyre tread.

([1]) Regulation No 30 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of pneumatic tyres for motor vehicles and their trailers (OJ L 307, 23.11.2011, p. 1).

([2]) Regulation No 54 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of pneumatic tyres for commercial vehicles and their trailers (OJ L 183, 11.7.2008, p. 41).

3.1.2. Equipment

See Figure 8 in the Appendix for a description of the test assembly.

3.1.3. Test conditions

3.1.3.1. The tests shall be carried out in a closed room with a still-air environment.

3.1.3.2. The ambient temperature and the temperature of the test pieces shall be 21 (± 3) °C.

3.1.3.3. De-ionized water shall be used.

3.1.3.4. The test pieces shall be prepared for each test by wetting.

3.1.4. Procedure

3.1.4.1. A 500 (+ 0/– 5) mm wide 750 mm high sample of the equipment to be tested shall be secured to the vertical plate of the testing equipment, making sure that the sample lies well within the limits of the collector, and that no obstacle is able to deflect the water, either before or after its impact.

3.1.4.2. The water flow rate shall be set at 0,675 (+/– 0,01) l/s and direct at least 90 l, at most 120 l, on to the sample from a horizontal distance of 500 (+/– 2) mm (Figure 8 in the Appendix).

3.1.4.3. The water shall be allowed to trickle from the sample into the collector. The percentage of water collected in relation to the quantity of water sprayed shall be calculated.

3.1.4.4. The test shall be carried out five times on the sample in accordance with points 3.1.4.2. and 3.1.4.3. The average percentage of the series of five tests shall be calculated.

3.1.5. Results

3.1.5.1. The average percentage calculated in point 3.1.4.4. shall be 70 % or higher.

3.1.5.2. Where, within a series of five tests, the highest and lowest percentages of water collected depart from the average percentage by more than 5 %, the series of five tests shall be repeated.

Where, within a second series of five tests, the highest and lowest percentages of water recovered again depart from the average percentage by more than 5 % and if the lower value does not satisfy the requirements of point 3.1.5.1., type-approval shall be refused.

3.1.5.3. It shall be verified whether the vertical position of the device influences the results obtained. Where that is the case, the procedure described in points 3.1.4.1. to 3.1.4.4. shall be repeated in the positions giving the highest and lowest percentage of water collected; the requirements of point 3.1.5.2. shall apply.

The mean of the individual results shall then be taken to give the average percentage. That average percentage shall be 70 or higher.

3.2. Test on spray suppression devices of the air/water separator type

3.2.1. Principle

This test is intended to determine the effectiveness of a porous material intended to retain the water with which it has been sprayed by means of a pressurized air/water pulveriser.

The equipment used for the test shall simulate the conditions to which the material would be submitted, with regard to the volume and speed of the water sprays produced by the tyres, if it were fitted to a vehicle.

3.2.2. Equipment

See Figure 9 in the Appendix for a description of the test assembly.

3.2.3. Test conditions

3.2.3.1. The tests shall be carried out in a closed room with a still-air environment.

3.2.3.2. The ambient temperature and the temperature of the test pieces shall be 21 (± 3)°C.

3.2.3.3. De-ionized water shall be used.

3.2.3.4. The test pieces shall be prepared for each test by wetting.

3.2.4. Procedure

3.2.4.1. A 305 × 100 mm sample shall be secured vertically in the test assembly. It shall be verified that there is no space between the sample and the upper curved plate and that the tray is properly in position. The pulveriser tank shall be filled with 1 ± 0,005 litres of water and placed as described in the diagram.

3.2.4.2. The pulveriser shall be regulated as follows:

(a) pressure (at pulveriser): 5 bar + 10 % / – 0 %

(b) flowrate: 1 litre/minute ± 5 seconds

(c) pulverisation: circular, 50 ± 5 mm in diameter at 200 ± 5 mm from the sample, nozzle 5 ± 0,1 mm in diameter.

3.2.4.3. The water shall be pulverised until there is no more water mist and the time taken shall be noted. The water shall be allowed to flow out of the sample on to the tray for 60 seconds and the volume of water collected shall be measured. The quantity of water left in the pulveriser tank shall be measured. The percentage of the volume of water collected in relation to the volume of water pulverised shall be calculated.

3.2.4.4. The test shall be carried out five times and the average percentage of the quantity collected shall be calculated. It shall be verified before each test that the tray, pulveriser tank and measuring vessel are dry.

3.2.5. Results

3.2.5.1. The average percentage calculated in accordance with point 3.2.4.4. shall be 85 % or higher.

3.2.5.2. Where, within a series of five tests, the highest and lowest percentages of water collected depart from the average percentage by more than 5 %, the series of five tests shall be repeated. Where, within a second series of five tests, the highest and lowest percentages of water recovered again depart from the average percentage by more than 5 %, and where the lower value does not satisfy the requirements of point 3.2.5.1., type-approval shall be refused.

3.2.5.3. Where the vertical position of the device influences the results obtained, the procedure described in points 3.2.4.1. to 3.2.4.4. shall be repeated in the positions giving the highest and lowest percentages of water collected; the requirements of point 3.2.5.2. shall apply.

The requirement of point 3.2.5.1. apply in order to give the results of each test.

4. Requirements for vehicle type-approval with regard to their spray suppression systems

4.1. Category N and O vehicles, with the exception of off-road vehicles as defined in Annex I to Regulation (EU) 2018/858, shall be constructed and/or fitted with spray suppression systems in such a way as to meet the requirements laid down in this Annex. In the case of chassis/cab vehicles, these requirements may only be applied to the wheels covered by the cab.

At the manufacturer's discretion, for vehicles of category N_1, N_2 with a permissible maximum laden mass not exceeding 7,5 tonnes, and O_1 and O_2, the requirements of Part 2 of Annex V as set out for vehicle category M_1 may be applied instead of the requirements of this Annex. In such a case, the information document shall include all the particulars relevant to wheel guards as laid down in Part 1 of Annex V.

4.2. The requirements of this Annex relating to spray suppression devices, as defined in Article 2(19), are not mandatory for categories N, O_1 and O_2 vehicles with a permissible maximum laden mass not exceeding 7,5 tonnes, chassis/cab vehicles, unbodied vehicles or vehicles on which the presence of spray suppression devices would be incompatible with their use. However, where such devices are fitted to those vehicles, they shall fulfil the requirements set out in this Regulation.

4.3. A vehicle representative of the vehicle type to be approved, fitted with its spray suppression system, shall be submitted to the technical service conducting the approval tests.

General requirements

4.4. Axles

4.4.1. *Retractable* axles

Where a vehicle is fitted with one or more retractable axles, the spray suppression system shall cover all the wheels when the axle is lowered and the wheels in contact with the ground when the axle is raised.

4.4.2. *Self-tracking axles*

For the purpose of this Regulation, a self-tracking axle of the 'pivot steering' type is considered to be, and treated as, an axle fitted with steered wheels.

Where a vehicle is fitted with a self-tracking axle, the spray suppression system shall satisfy the conditions applicable to non-steered wheels where mounted on the pivoting part. Where not mounted on that part it shall satisfy the conditions are applicable to steered wheels.

4.5. **Position of outer valance**

The distance 'c' between the longitudinal plane tangential to the outer tyre wall, apart from any tyre bulge near the ground, and the inner edge of the valance shall not exceed 100 mm (Figures 1a and 1b in the Appendix).

4.6. **State of the vehicle**

When verifying compliance with this Regulation, the vehicle shall be unladen and with the wheels in the straight-ahead position and the tyres shall be inflated to their normal pressure.

In the case of semi-trailers, the loading surfaces shall be horizontal and the tyres shall be inflated to their normal pressure.

4.7. **Spray suppression systems**

4.7.1. The spray suppression system shall meet the specifications set out in point 4.8. or point 4.10.

4.7.2. The spray suppression system for non-steered or self-steered wheels that are covered by the bodywork floor, or by the lower part of the load platform, shall meet either the specifications set out in point 4.8. or point 4.10. or the specifications set out in point 4.9.

Specific requirements

4.8. **Requirements concerning energy-absorption spray suppression systems for axles fitted with steered or self-steering or non-steered wheels**

4.8.1. Mudguards

4.8.1.1. The mudguards shall cover the zone immediately above, ahead and behind the tyre or tyres in the following manner:

(a) in the case of a single or multiple axle, the forward edge (C) shall extend forwards to reach a line O-Z where ϑ (theta) is no more than 45° above the horizontal.

The rearmost edge (Figure 2 in the Appendix) shall extend downwards in such a way as not to be more than 100 mm above a horizontal line passing through the centre of the wheel;

(b) in the case of multiple axles the angle ϑ relates only to the foremost axle and the requirement relating to the height of the rearmost edge shall apply only to the rearmost axle;

(c) the mudguard shall possess a total width 'q' (Figure 1a in the Appendix) at least adequate to cover the width of the tyre 'b' or the entire width of two tyres 't' in the case of twin wheels, account being taken of the extremes for the tyre/wheel unit specified by the manufacturer. Dimensions 'b' and 't' shall be measured at hub height, excluding any markings, ribs, protective bands, etc., on the tyre walls.

4.8.1.2. The front side of the rear part of the mudguard shall be fitted with a spray-reduction device complying with the specifications set out in point 3.1. This material shall cover the inside of the mudguard up to a height determined by a straight line running from the centre of the wheel and forming an angle of at least 30° with the horizontal (Figure 3 in the Appendix).

4.8.1.3. Where the mudguards are made up of several components, when fitted, they shall not incorporate any aperture enabling spray to exit while the vehicle is in motion. That requirement shall be deemed to be met where (the vehicle being either laden or unladen) any radial jet running outwards from the wheel centre over the entire width of the tyre running surface and within the range covered by the mudguard always strikes against a part of the spray suppression system.

4.8.2. Outer Valances

4.8.2.1. In the case of single axles, the lower edge of the outer valance may not be situated beyond the following distances and radii, as measured from the centre of the wheel, except at the lowest extremities, which may be rounded (Figure 2 in the Appendix).

Air suspension:	
(a) Axles fitted with steered wheels or self-steering wheels: From the front edge (towards the front of the vehicle) (tip C) — To the rear edge (towards the rear of the vehicle) (tip A)	$R_v \leq 1{,}5\ R$
(b) Axles fitted with non-steered wheels: — From the front edge (tip C) — To the rear edge (tip A)	$R_v \leq 1{,}25\ R$

Mechanical suspension

(a) general case } $Rv \leq 1{,}8\ R$

(b) non-steered wheels for vehicles with a technically permissible laden mass more than 7.5 t } $Rv \leq 1{,}5\ R$

where R is the radius of the tyre fitted to the vehicle, and Rv the distance, expressed as a radius, at which the lower edge of the outer valence is situated.

4.8.2.2. In the case of multiple axles the requirements laid down in point 4.8.2.1. shall not apply between the vertical transversal planes passing through the centre of the first and the last axles where the outer valance may be straight in order to ensure the continuity of the spray suppression system. (Figure 4 in the Appendix).

4.8.2.3. The distance between the uppermost and the lowermost points of the spray suppression system (mudguard and outer valance) measured in any cross section perpendicular to the mudguard (see Figures 1b and 2 in the Appendix) shall extend to not less than 45 mm at all points behind a vertical line passing through the centre of the wheel or the first wheel in the case of multiple axles. This dimension may be gradually reduced in front of that vertical line.

4.8.2.4. Openings enabling spray to emerge when the vehicle is moving shall not be allowed in the outer valances or between the outer valances and the other parts of the mudguards.

4.8.2.5. The requirements of points 4.8.2.3. and 4.8.2.4. may not be respected locally when the valance is composed by different elements with relative movement.

4.8.2.6. Tractors for semi-trailers with a low chassis, namely those which may have a height of coupling face (defined in point 6.20. of standard ISO 612:1978) equal to or less than 1 100 mm, may be designed in such a way as to be exempted from the requirements of points 4.8.1.1 (a), 4.8.1.3 and 4.8.2.4. In that regard, mudguards and valances shall not cover the area immediately above the tyres of the rear axles, where those tractors are coupled to a semi-trailer, in order to avoid the spray suppression system being destroyed. However, the mudguards and valances of those vehicles shall fulfill the requirements of points 4.8.1.1.(a), 4.8.1.3. and 4.8.2.4., in sectors more than 60º from the vertical line passing through the centre of the wheel, in front and behind these tyres.

The vehicles referred to in the first paragraph shall therefore be designed in such a way as to meet the requirements set out in that first paragraph when they are operated without a semi-trailer.

In order to be able to meet the requirements set out in the first paragraph, mudguards and valances may comprise a removable part.

4.8.3. Rain Flaps

4.8.3.1. The width of the flap shall fulfil the requirement for 'q' in point 4.8.1.1.(c), except for any part of the flap that is contained within the mudguards. In such cases this part of the flap shall be at least equal in width to the tread of the tyre.

The width of the part of the rain flaps positioned beneath the mudguard shall satisfy the condition laid down in the first paragraph with a tolerance of ± 10 mm at each side.

4.8.3.2. The orientation of the flap shall be basically vertical.

4.8.3.3. The maximum height of the bottom edge shall not exceed 200 mm (Figure 3 in the Appendix).

That distance shall be increased to 300 mm for the last axle where the radial distance of the lower edge of the outer valancing, Rv, does not exceed the dimensions of the radius of the tyres fitted to the wheels on that axle.

The maximum height of the bottom edge of the rain flap in relation to the ground, may be raised to 300 mm where the manufacturer deems it technically appropriate with regard to the suspension characteristics.

4.8.3.4. The rain flap shall not be more than 300 mm from the rearmost edge of the tyre, measured horizontally.

4.8.3.5. For multiple axles where distance 'd' between the tyres on adjacent axles is less than 250 mm, only the rear set of wheels shall be fitted with rain flaps. There shall be a rain flap behind each wheel when distance 'd' between the tyres on adjacent axles is at least 250 mm (Figure 4 in the Appendix).

4.8.3.6. Rain flaps shall not be deflected by more than 100 mm towards the rear under a force of 3 N per 100 mm of flap width, applied to a point located 50 mm above the lower edge of the flaps.

4.8.3.7. The whole of the front face of the part of the rain flap having the minimum dimensions required shall be fitted with a spray suppression device that meets the specifications set out in point 3.1.

4.8.3.8. Openings enabling spray to emerge shall not be allowed between the lower rear edge of the mudguard and the rain flaps.

4.8.3.9. Where the spray suppression device meets the specifications relating to rain flaps set out in point 4.8.3., no additional rain flap shall be required.

4.9. **Requirements relating to spray suppression systems fitted with energy-absorption spray suppression devices for certain axles that are fitted with non-steered or self-steering wheels (see point 5.2.)**

4.9.1. Mudguards

4.9.1.1. Mudguards shall cover the zone immediately above the tyre or tyres. Their front and rear extremities shall extend to at least the horizontal plane that is tangent to the upper edge of the tyre or tyres (Figure 5 in the Appendix). However, the rear extremity may be replaced by the rain flap, in which case the rain flap shall extend to the upper part of the mudguard (or equivalent component).

4.9.1.2. All of the inner rear part of the mudguard shall be fitted with a spray suppression device that meets the requirements set out in point 3.1.

4.9.2. Outer Valances

4.9.2.1. For single or multiple axles where the distance between the adjacent tyres is at least 250 mm, the outer valance shall cover the surface extending from the lower to the upper part of the mudguard up to a straight line formed by the tangent to the upper edge of the tyre or tyres and lying between the vertical plane formed by the tangent to the front of the tyre and the mudguard or rain flap located behind the wheel or wheels (Figure 5b in the Appendix).

For multiple axles an outer valance shall be located by each wheel.

4.9.2.2. Openings enabling spray to emerge shall not be allowed between the outer valance and the inner part of the mudguard.

4.9.2.3. Where rain flaps are not fitted behind each wheel (see point 4.8.3.5.), the outer valance shall be unbroken between the outer edge of the rain flap to the vertical plane that is tangent to the point furthest to the front of the tyre (Figure 5a in the Appendix) of the first axle.

4.9.2.4. The entire inner surface of the outer valance, the height of which shall not be less than 100 mm, shall be fitted with an energy-absorption spray suppression device complying with the requirements under point 3.1.

4.9.3. Those flaps shall extend to the lower part of the mudguard and comply with points 4.8.3.1. to 4.8.3.9.

4.10 **Requirements concerning spray suppression systems fitted with air/water separator spray suppression devices for axles with steered and non-steered wheels**

4.10.1. Mudguards

4.10.1.1. Mudguards shall comply with the requirements of point 4.8.1.1.(c).

4.10.1.2. Mudguards for single or multiple axles where the distance between the tyres on adjacent axles exceeds 300 mm shall, in addition, comply with point 4.8.1.1.(a).

4.10.1.3. For multiple axles where the distance between the tyres on adjacent axles does not exceed 300 mm the mudguards shall, in addition, comply with the model shown in Figure 7.

4.10.2. Outer Valances

4.10.2.1. The lower edges of the outer valances shall be fitted with air/water separator spray suppression devices complying with the requirements set out in this Annex.

4.10.2.2. For single or multiple axles where the distance between the tyres on adjacent axles exceeds 300 mm, the lower edge of the spray suppression device fitted to the outer valance shall have the following maximum dimensions and radii, starting from the centre of the wheel (Figures 6 and 7 in the Appendix):

(a) Axles fitted with steered wheels or self-steering wheels: from the front edge (towards the front of the vehicle) (tip C at 30°) to the rear edge (towards the rear of the vehicle) (tip A at 100mm)	$R_v \leq 1{,}05\ R$
(b) Axles fitted with non-steered wheels : from the front edge (tip C at 20°) to the rear edge (tip A at 100mm)	$R_v \leq 1{,}00\ R$

where

R = is the radius of tyre fitted to the vehicle;

R_v = the radial distance from the lowest edge of the outer valance to the centre of the wheel.

4.10.2.3. For multiple axles where the distance between the tyres on adjacent axles does not exceed 300 mm, the outer valances located in the inter-axle spaces shall follow the path specified in point 4.10.1.3., and shall extend downwards in such a way as to be not more than 100 mm above a horizontal straight line passing through the wheel centres (Figure 7 in the Appendix).

4.10.2.4. The depth of the outer valance shall extend to not less than 45 mm, at all points behind a vertical line passing through the centre of the wheel. That depth may be gradually reduced in front of that vertical line.

4.10.2.5. Openings enabling spray to emerge shall not be allowed in the outer valances or between the outer valances and the mudguards.

4.10.3. Rain Flaps

4.10.3.1. Rain flaps shall comply with either of the following sets of requirements:

(a) point 4.8.3. (Figure 3 in the Appendix);

(b) points 4.8.3.1., 4.8.3.2., 4.8.3.5., 4.8.3.8. and 4.10.3.2. (Figure 6 in the Appendix).

4.10.3.2. Spray suppression equipment complying with the specifications set out in point 4 of the Appendix, shall be fitted to the rain flaps referred to in point 4.10.3.1.(b), at least along the full edge.

4.10.3.2.1. The lower edge of the spray suppression device shall be not more than 200 mm from the ground. The maximum height of the bottom edge of the rain flap in relation to the ground may be raised to 300 mm where the manufacturer deems it technically appropriate with regard to the suspension characteristics.

4.10.3.2.2. The spray suppression device shall be at least 100 mm deep.

4.10.3.2.3. Apart from the lower part, which includes the spray suppression device, the rain flap as referred to in point 4.10.3.1.(b) shall not bend by more than 100 mm towards the rear under the effect of a force of 3 N per 100 mm of width of the rain flap measured at the intersection of the rain flap with the spray suppression device in its working position, applied at a distance of 50 mm above the lower edge of the rain flap.

4.10.3.3. The rain flap shall not be more than 200 mm from the rearmost edge of the tyre, measured horizontally.

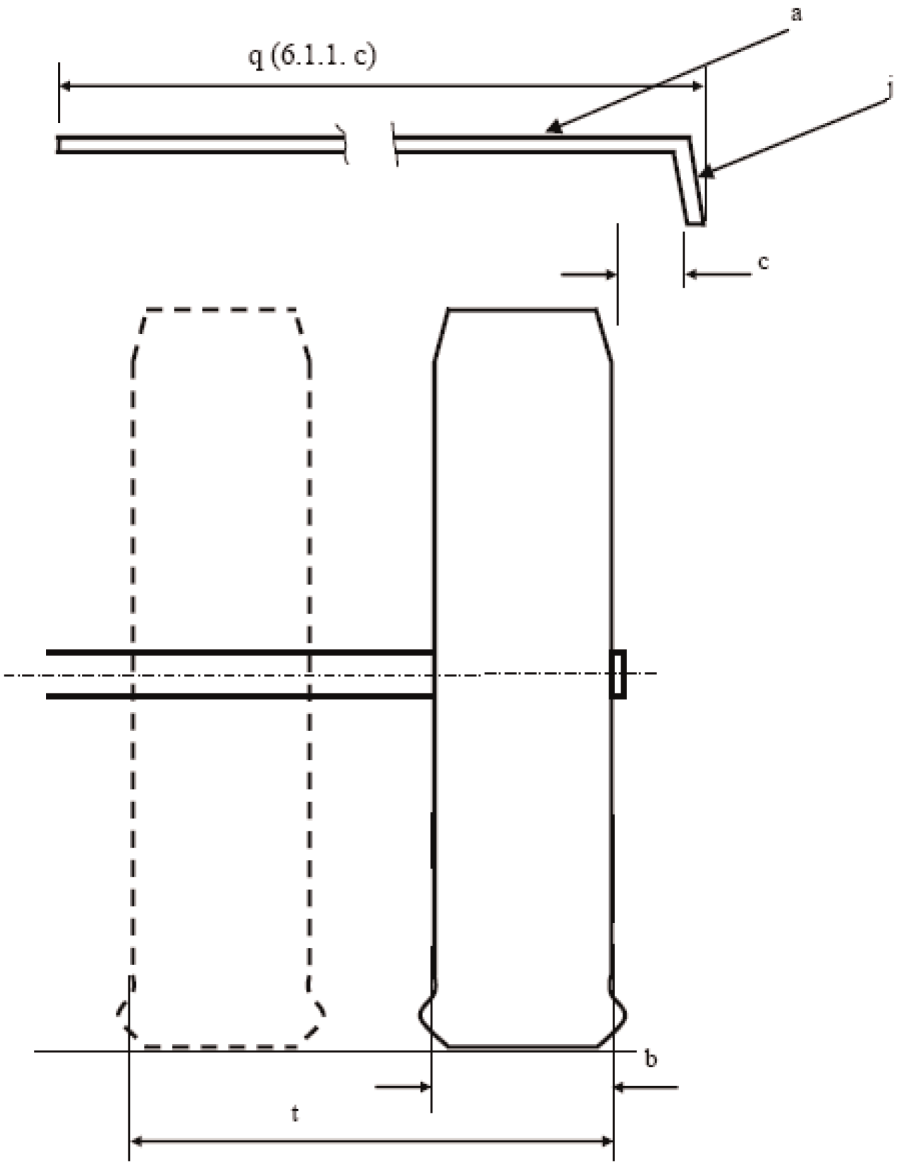
4.11. For multiple axles, it is not necessary that the spray suppression system of one axle, which shall not be the furthest back, covers the entire width of the tread of the tyre when there is, locally, the possibility of interference between the spray suppression system and the structure of the axles or of the suspension or of the undercarriage.

Appendix

Figures

Figure 1a

Width (q) of mudguard (a) and position of valance (j)



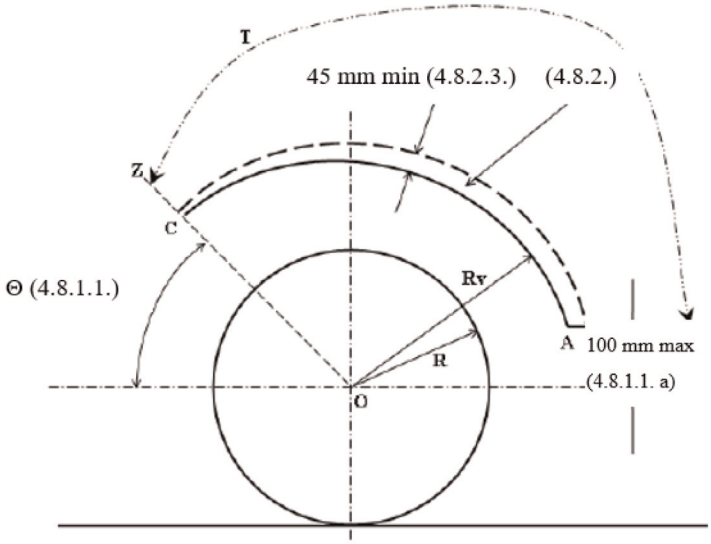
Note: The figures refer to the corresponding point 4.8.1.1.(c) of Part 2 of this Annex.

Figure 1b

Example of measurement of the outer valance

Figure 2

Dimensions of mudguard and outer valance

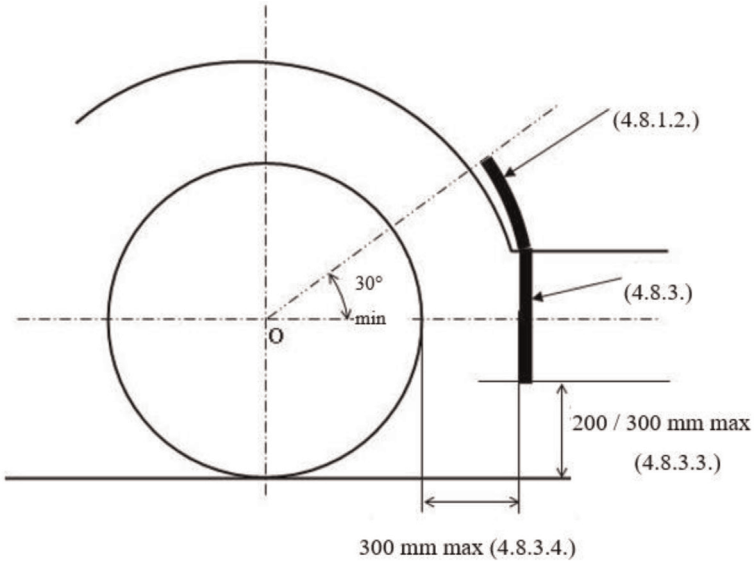


Note:

1. The figures quoted relate to points 4.8.2., 4.8.2.3., 4.8.1.1. and 4.8.1.1.(a) of Part 2 of this Annex.
2. T: extent of mudguard.

Figure 3

Position of mudguard and rain flap



Note: The figures quoted relate to points 4.8.1.2., 4.8.3. and 4.8.3.3. of Part 2 of this Annex

Figure 4

Diagram showing assembly of a spray suppression system (mudguard, rain flap, outer valance) incorporating spray suppression devices (energy absorbers) for multiple axles

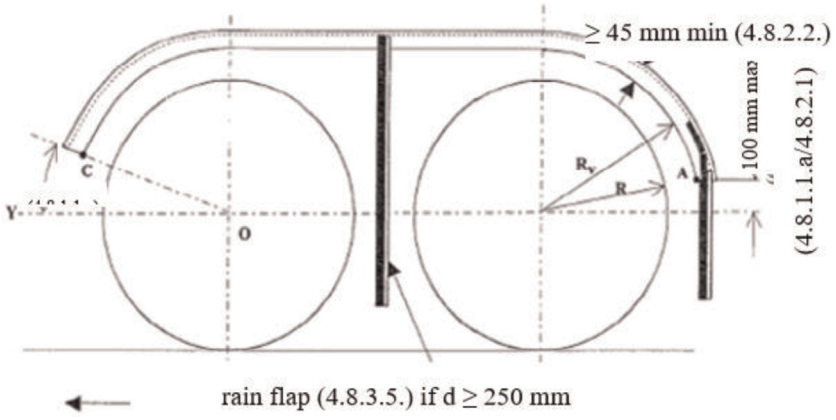
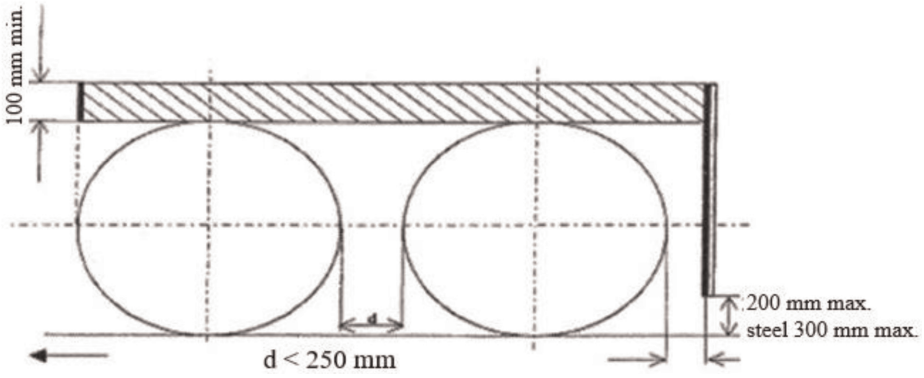


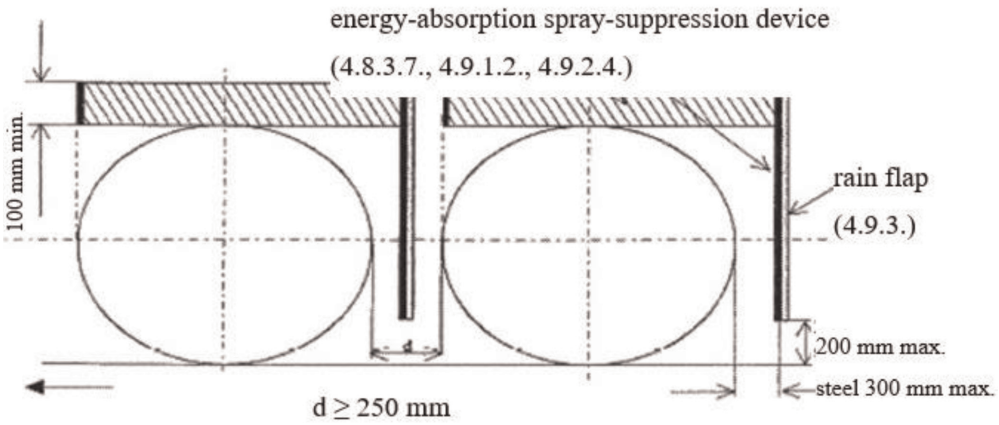
Figure 5

Diagram showing the assembly of a spray suppression system incorporating spray suppression devices (energy absorbers) for axles fitted with non-steered or self-steering wheels

(Points 4.7.2. and 4.9. of Part 2 of this Annex)



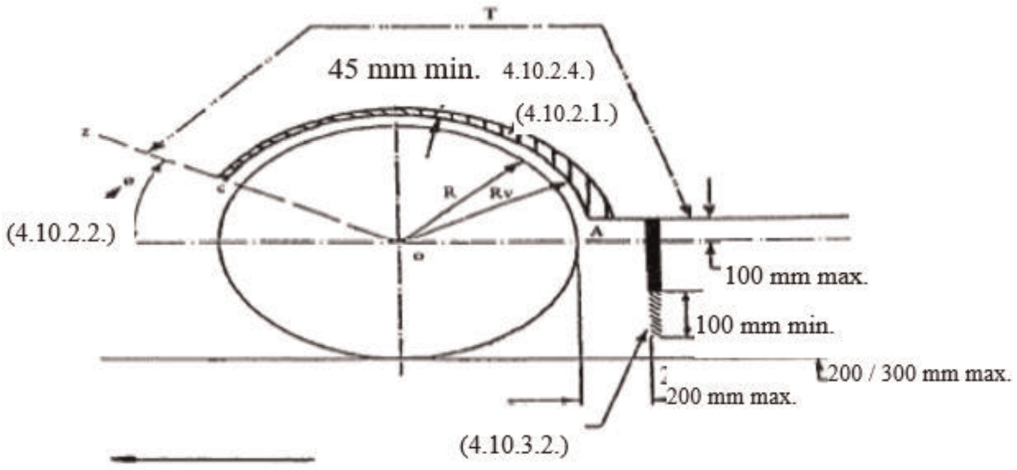
(a) Multiple axles where the distance between the tyres is less than 250 mm



(b) Single axles or multiple axles where the distance between the tyres is not less than 250 mm

Figure 6

Diagram showing the assembly of a spray suppression system incorporating spray suppression devices fitted with air/water separators for axles fitted with steered, self-steering or non-steered wheels



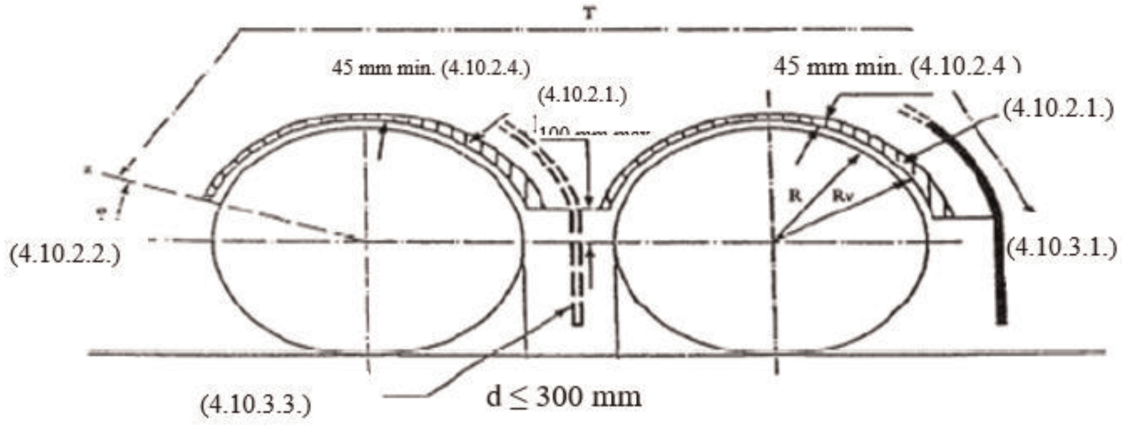
Note:

1. The figures relate to the corresponding points of Part 2 of this Annex.

2. T: extent of mudguard

Figure 7

Diagram showing assembly of a spray suppression system incorporating spray suppression devices (mudguard, rain flap, outer valance) for multiple axles where the distance between the tyres does not exceed 300 mm



Note:

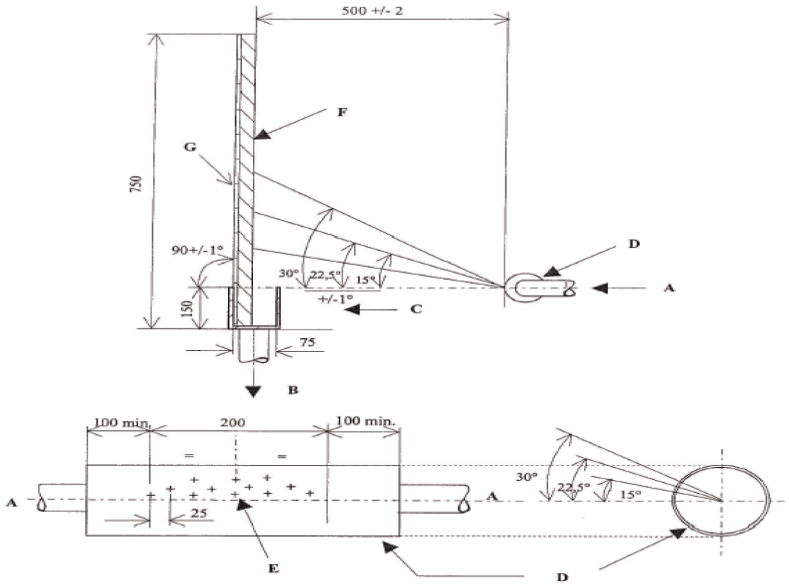
1. The figures relate to the corresponding points of Part 2 of this Annex.

2. T: extent of mudguard

Figure 8

Test assembly for energy absorption spray suppression devices

(point 3.1.2. of Part 2 of this Annex)



Note:

A = water supply from pump

B = flow towards collector tank

C = collector with inside dimension of 500 (+ 5/– 0) mm length and 75 (+ 2/– 0) mm width

D = stainless steel pipe, external diameter 54 mm, wall thickness 1,2 (+/– 0,12) mm, inside and outside surface roughness Ra between 0,4 and 0,8 µm

E = 12 cylindrical radially drilled holes with burr-free square edges. Their diameter, measured on the inside and on the outside of the tube, is 1,68 (+ 0,010/– 0) mm

F = 500 (+ 0/– 5) mm-wide sample to be tested

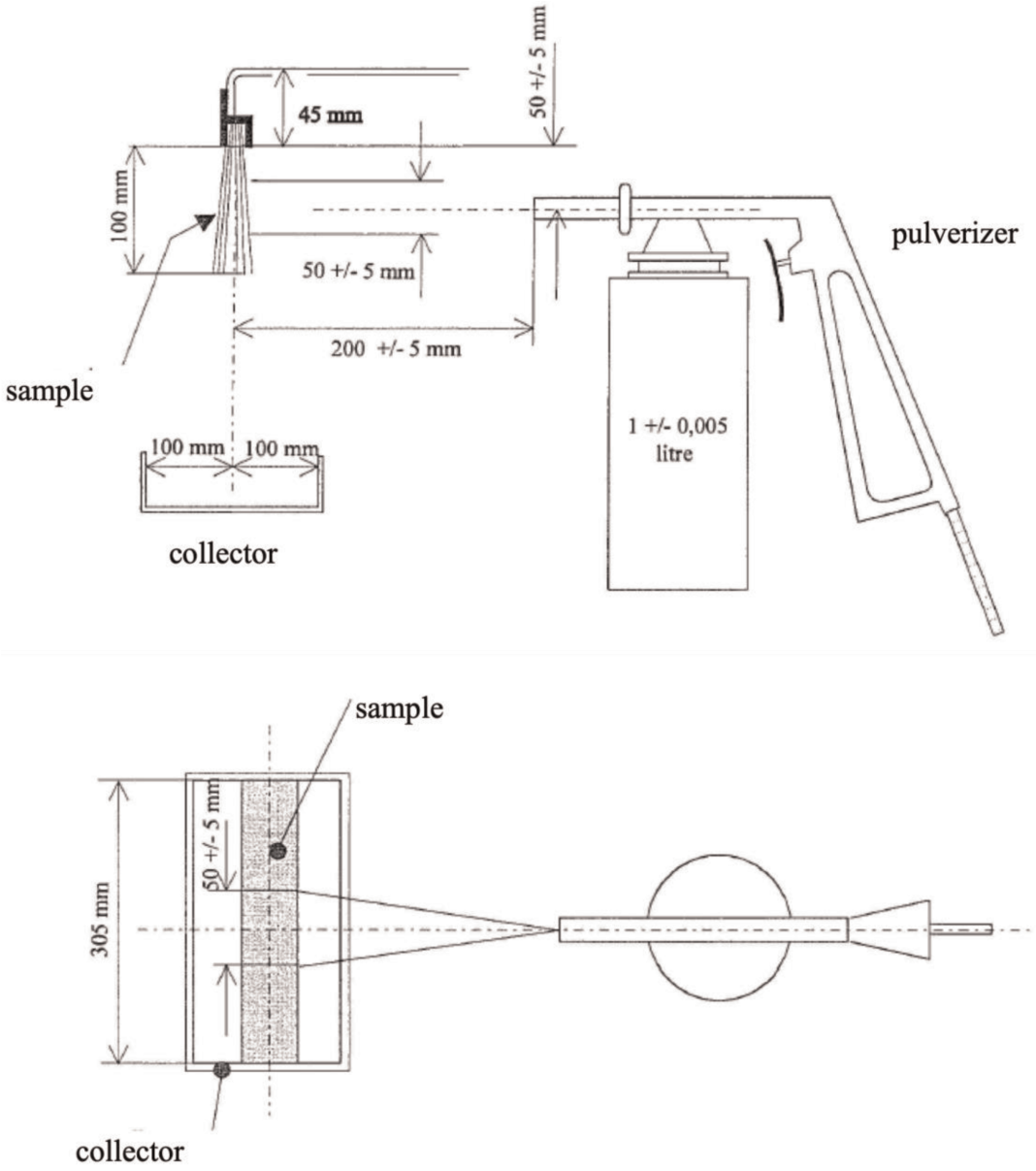
G = rigid flat plate

All linear dimensions are shown in millimetres.

Figure 9

Test assembly for air/water separator spray suppression devices

(point 3.2.2. of Part 2 of this Annex)



PART 3

Section A

EU TYPE-APPROVAL CERTIFICATE (VEHICLE SYSTEM)

Communication concerning *granting* / *extension* / *refusal* / *withdrawal* [1] of type-approval of a type of vehicle with regard to the spray suppression system in accordance with the requirements laid down in Annex VIII to Regulation (EU) 2021/535, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension* / *refusal* / *withdrawal* [1]:

SECTION I

(To be completed in accordance with Section I of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

SECTION II

(To be completed in accordance with Section II of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

Addendum

to EU type-approval certificate number …

1. Additional information

1.1. Characteristics of the spray suppression devices (type, brief description, trade mark or name, component type-approval number(s):

5. Remarks (if any):

[1] Delete where not applicable.

Section B

EU TYPE-APPROVAL CERTIFICATE (SEPARATE TECHNICAL UNIT)

Communication concerning *granting | extension | refusal | withdrawal* ([2]) of type-approval of a type of STU with regard to the spray suppression systems in accordance with the requirements laid down in Annex VIII to Regulation (EU) 2021/535, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension | refusal | withdrawal* ([2]):

SECTION I

(To be completed in accordance with Section I of the template of Model C in Annex III to Commission Implementing Regulation (EU) 2020/683)

SECTION II

(To be completed in accordance with Section II of the template of Model C in Annex III to Commission Implementing Regulation (EU) 2020/683)

Addendum

to EU type-approval certificate number …

1. Additional information

1.1. Operating principle of device: *energy-absorption | air | water separator* ([2]):

1.2. Characteristics of spray suppression devices (brief description, trademark or name, number(s):

5. Remarks (if any):

([2]) Delete where not applicable.

Section C

EU TYPE-APPROVAL MARK OF SEPARATE TECHNICAL UNITS AS REGARDS SPRAY SUPPRESSION SYSTEMS

1. The EU type-approval mark for separate technical units referred to in Article 38(2) of Regulation (EU) 2018/858 shall consist of the following:

1.1. A rectangle surrounding the lower-case letter 'e', followed by the distinguishing number of the Member State which has granted the EU type-approval for the component or separate technical unit in accordance with the following:

1	for Germany
2	for France
3	for Italy
4	for the Netherlands
5	for Sweden
6	for Belgium
7	for Hungary
8	for the Czech Republic
9	for Spain
12	for Austria
13	for Luxembourg
17	for Finland
18	for Denmark

19	for Romania
20	for Poland
21	for Portugal
23	for Greece
24	for Ireland
25	for Croatia
26	for Slovenia
27	for Slovakia
29	for Estonia
32	for Latvia
34	for Bulgaria
36	for Lithuania
49	for Cyprus
50	for Malta

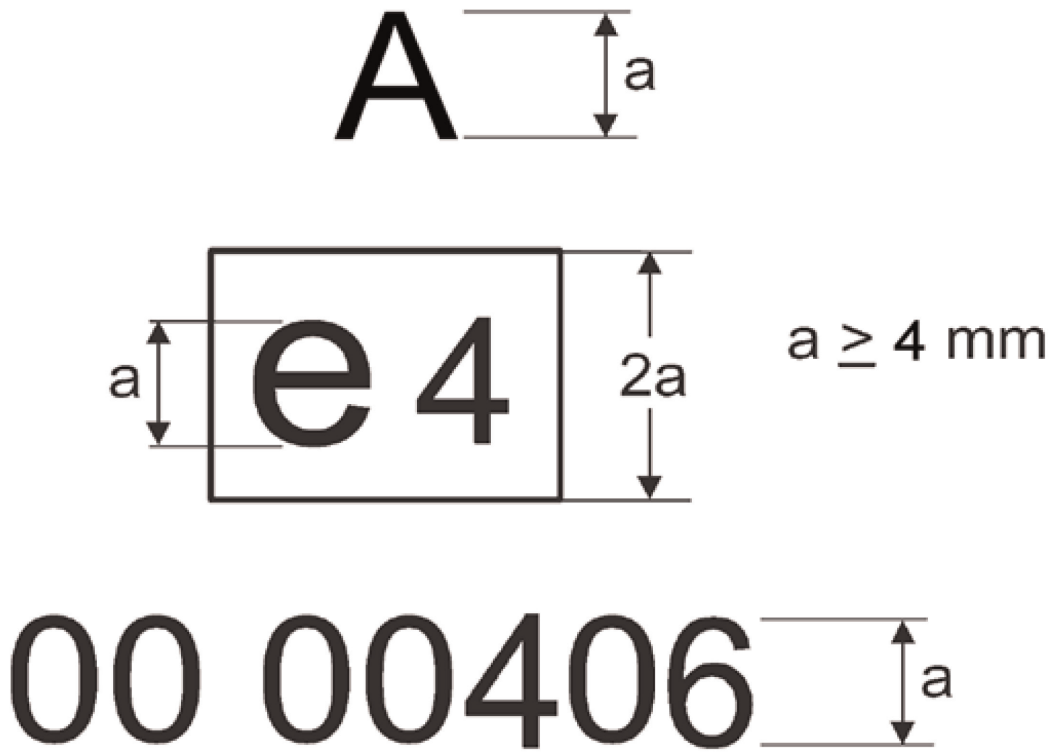
1.2. In the vicinity of the rectangle, two digits indicating the series of amendments laying down the requirements with which this separate technical units complies, '00' at present, followed by a space and the five-digit number referred to in point 2.4. of Annex IV of Regulation (EU) 2018/858.

2. The EU separate technical unit type-approval mark shall be affixed to the spray suppression device in such a way as to be indelible as well as clearly and easily legible even if the device is fitted to a vehicle.

3. An example of an EU separate technical unit type-approval mark is shown in Figure 1.

Figure 1

Example of EU separate technical unit type-approval mark



Explanatory note:

Legend The EU separate technical unit type-approval was issued by the Netherlands under number 00406. The first two digits '00' indicate that the separate technical unit was approved in accordance with this Regulation. The symbol 'A' indicates it is a device of the energy-absorption type.

ANNEX IX

GEAR SHIFT INDICATORS (GSI)

PART 1

Information document for EU type-approval of motor vehicles with regard to gear shift indicators (GSI)

MODEL

Information document No….relating to EU type-approval of a vehicle with regard to gear shift indicators.

The following information, if applicable, must be supplied in triplicate and include a list of contents. Any drawings or pictures must be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, must show sufficient detail.

Information set out in points 0, 3 and 4 of Appendix 3 to Annex I of Commission Regulation (EU) 2017/1151 [1]

0.

0.1.

0.2.

0.2.1.

0.3.

0.3.1.

0.4.

0.5.

0.8.

0.9.

4.

4.11.

4.11.1.

4.11.2.

4.11.3.

4.11.4.

4.11.5.

4.11.6.

Explanatory note:

This information document is based on the template laid down in Annex I to Commission Implementing Regulation (EU) 2020/683 and shall be completed with the relevant information under the point numbers listed above as defined in that template.

[1] OJ L 175, 7.7.2017, p. 1.

Appendix

MODEL

Manufacturer's certificate of compliance with the gear shift indicator's requirements

(Manufacturer):

(Address of the manufacturer):

Certifies that

The vehicle types listed in Annex to this Certificate are in compliance with the provisions of […]of [this Regulation] relating to gear shift indicators

Done at [……Place]

On […….Date]

[Signature] [Position]

Annexes:
— List of vehicle types to which this Certificate applies

PART 2

Technical specifications

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

1.1. '*manual gearbox*' means a gearbox that can be operated in a mode where the shift between all or some of the gears is always an immediate consequence of an action of the driver, regardless of its physical implementation; this does not cover systems where the driver can only preselect a certain gear shift strategy or limit the number of gears available for driving and where the actual gear shifts are initiated independently of the decision of the driver according to certain driving patterns;

1.2. '*operational mode of the vehicle*' means a state of the vehicle, in which shifts between at least two forward gears may occur;

1.3. '*manual mode*' means an operational mode of the vehicle, where the shift between all or some of the gears is always an immediate consequence of an action of the driver;

1.4. '*tailpipe emissions*' means tailpipe emissions as defined in Article 3, paragraph (6), of Regulation (EC) No 715/2007 of the European Parliament and of the Council.

2. General provisions

2.1. The requirements set out in this Part apply to motor vehicles of category M_1, which comply with the following requirements:

(a) the vehicles are fitted with a manually operated gearbox;

(b) the vehicles have a reference mass not exceeding 2610 kg or type-approval is extended to the vehicles in accordance with Article 2(2) of Regulation (EC) No 715/2007.

2.2. The requirements referred to in point 2.1. shall not apply to 'vehicles designed to fulfil specific social needs' as defined in Article 3, point (2)(c) of Regulation (EC) No 715/2007.

2.3. When applying for an EU type-approval of a vehicle equipped with GSI, the manufacturer shall either:

(a) submit to the type-approval authority the GSI gear shift points determined analytically as provided for in the last paragraph of point 7.1.; or

(b) provide the technical service responsible for conducting the type-approval tests with a vehicle which is representative of the vehicle type to be approved for the purposes of the test described in point 7.

3. Assessment of manually operated gearbox

Any gearbox, having at least one manual mode, shall be considered as being manually operated when, in the respective mode, there are no automatic changes between gears, except where those changes only occur under extreme conditions to protect the powertrain at high engine revolutions or to avoid the stalling of the engine, and those changes do not occur to optimise the operation of the vehicle.

4. Characteristic of the GSI appearance

4.1. The shift recommendation shall be provided by means of a distinct visual indication, for example a clear indication to shift up or up/down or a symbol that identifies the gear into which the driver should shift. The visible indication may be complemented by other indications, including audible ones, provided that those indications do not compromise safety.

4.2. The GSI shall not interfere with or mask the identification of any tell-tale, control or indicator, which is mandated or supports the safe operation of the vehicle. Notwithstanding point 4.3., the signal shall be designed so that it does not distract the driver's attention and so that it does not interfere with proper and safe vehicle operation.

4.3. The GSI shall be located in compliance with paragraph 5.1.2. of UN Regulation No 121 ([1]). The GSI shall be designed in such a way that it cannot be confused with any other tell-tale, control or indicator that the vehicle is equipped with.

4.4. An information display device may be used to display GSI indications provided that they are sufficiently different from other indications so as to be clearly visible and identifiable by the driver.

4.5. Temporarily, the GSI indication may be automatically overridden or deactivated in exceptional situations. Such exceptional situations are those that may compromise the safe operation or integrity of the vehicle, including activation of traction or stability control systems, temporary displays from driver assistance systems or events relating to vehicle malfunctioning. The GSI shall, within 10 seconds or, where justified by specific technical or behavioural reasons, within more than 10 seconds, resume normal operation after the exceptional situation has ceased to exist.

5. Functional requirements for GSI (applicable to all manual modes)

5.1. The GSI shall suggest changing gear when the fuel consumption with the suggested gear is estimated to be lower than the one being used, taking into account the requirements laid down in points 5.2. and 5.3.

5.2. The GSI shall be designed to encourage an optimised fuel efficient driving style under driving conditions that are reasonably foreseeable. The GSI's main purpose shall be to minimise fuel consumption of the vehicle when the driver follows its indications. However, regulated tailpipe emissions shall not disproportionately increase with respect to the initial state when following the indication of the GSI. In addition, following the GSI strategy shall facilitate the timely functioning of pollution control devices, such as catalysts, after a cold start, minimising their heat up time. For that purpose, vehicle manufacturers shall provide technical documentation to the type-approval authority, which shall describe the impact of the GSI strategy on the vehicle's regulated tailpipe emissions, under at least steady vehicle speed, and the shortening of after treatment heat up at cold start.

5.3. Following the indication of the GSI shall not compromise the safe operation of the vehicle, e.g. prevent stalling of the engine, insufficient engine braking or insufficient engine torque in the case of high power demand.

6. Information to be provided

6.1. The manufacturer shall provide the information to the type-approval authority in the following two parts:

(a) the "formal documentation package" that may be made available to interested parties upon request;

(b) the "extended documentation package" that shall remain strictly confidential.

([1]) UN Regulation No 121 of the Economic Commission for Europe of the United Nations (UN/ECE) – Uniform provisions concerning the approval of vehicles with regard to the location and identification of hand controls, tell-tales and indicators (OJ L 5, 8.1.2016, p. 9).

6.1.1. The formal documentation package shall contain the following information:

(a) a description of the complete set of appearances of the GSIs which are fitted on vehicles being part of the vehicle type with regard to GSI, and evidence of their compliance with the requirements of point 5;

(b) evidence in the form of data or engineering evaluations (for example modelling data, emission or fuel consumption maps, emission tests), which adequately demonstrate that the GSI is effective in providing timely and meaningful shift recommendations to the driver in order to comply with the requirements of point 5.

(c) an explanation of the purpose, use and functions of the GSI in a 'GSI section' of the user manual accompanying the vehicle.

6.1.2. The extended documentation package shall contain the design strategy of the GSI, in particular its functional characteristics.

6.1.3. Notwithstanding the provision of Article 13 of this Regulation, the extended documentation package shall remain strictly confidential between the type-approval authority and the manufacturer. It may be kept by the type-approval authority, or, at the discretion of the type-approval authority, retained by the manufacturer. In case the manufacturer retains the extended documentation package, that package shall be identified and dated by the type-approval authority once reviewed and approved. It shall be made available for inspection by the approval authority at the time of approval or at any time during the validity of the approval.

7. The fuel economy impact of GSI recommended gear shift points shall be determined in accordance with the procedure set out in points 7.1. to 7.5.

7.1. Determination of vehicle speeds at which GSI recommends shifting up gears.

The test to determine the vehicle speeds at which GSI recommends shifting up gears shall be performed on a warmed up vehicle on a chassis dynamometer in accordance with the speed profile described in point 8. The advice of the GSI shall be followed for shifting up gears and the vehicle speeds, at which the GSI recommends shifting shall be recorded. The test shall be repeated three times.

V^{n}_{GSI} shall denote the average speed at which the GSI recommends shifting up from gear n (n = 1, 2, …, #g) into gear n+1, determined from the 3 tests, where #g shall denote the vehicle's number of forward gears. For that purpose, only GSI shift instructions in the phase before the maximum speed is reached shall be taken into account and any GSI instruction during the deceleration shall be ignored.

For the purposes of the following calculations V^{0}_{GSI} shall be set to 0 km/h and $V^{\#g}_{GSI}$ shall be set to 140 km/h or the maximum vehicle speed, whichever is smaller. Where the vehicle cannot attain 140 km/h, the vehicle shall be driven at its maximum speed until it rejoins the speed profile in Figure I.1.

Alternatively, the recommended GSI shift speeds may be analytically determined by the manufacturer, based on the GSI algorithm contained in the extended documentation package provided in accordance with point 6.1.

7.2. Standard gear shift points.

V^{n}_{std} shall denote the speed at which a typical driver is assumed to shift up from gear n into gear n+1 without GSI recommendation. Based on the gear shift points determined in the type 1 emission test ([2]), the following standard gear shift speeds shall be defined:

V^{0}_{std} = 0 km/h;

V^{1}_{std} = 15 km/h;

V^{2}_{std} = 35 km/h;

V^{3}_{std} = 50 km/h;

V^{4}_{std} = 70 km/h;

V^{5}_{std} = 90 km/h;

V^{6}_{std} = 110 km/h;

V^{7}_{std} = 130 km/h;

$V^{8}_{std} = V^{\#g}_{GSI}$;

V^{n}_{min} shall denote the minimum vehicle speed the vehicle can be driven in the gear n without stalling of the engine and V^{n}_{max} the maximum vehicle speed the vehicle can be driven in the gear n without creating damage to the engine.

If V^{n}_{std} derived from this list is smaller than V^{n+1}_{min}, then V^{n}_{std} shall be set to V^{n+1}_{min}. If V^{n}_{std} derived from this list is greater than V^{n}_{max}, then V^{n}_{std} shall be set to V^{n}_{max} (n = 1, 2,…, #g-1).

If $V^{\#g}_{std}$ determined by this procedure is smaller than $V^{\#g}_{GSI}$, then $V^{\#g}_{std}$ shall be set to $V^{\#g}_{GSI.}$

7.3. Fuel consumption speed curves.

The manufacturer shall supply the type-approval authority with the functional dependence of the vehicle's fuel consumption on the steady vehicle speed when driving with gear n according to the following rules.

FC^{n}_{i} shall denote the fuel consumption in terms of kg/h (kilograms per hour) where the vehicle is driven with the constant vehicle speed v_i = i * 5 km/h – 2,5 km/h (where i is a positive integer number) in the gear n. These data shall be provided by the manufacturer for each gear n (n = 1, 2, …, #g) and $v^{n}_{min} \leq v_i \leq v^{n}_{max}$. These fuel consumption values shall be determined under identical ambient conditions corresponding to a realistic driving situation that may be defined by the vehicle manufacturer, either by a physical test or by an appropriate calculation model agreed between the type-approval authority and the manufacturer.

([2]) As defined in Annex 4a of UN Regulation No 83.

7.4. Vehicle speed distribution.

The following distribution shall be used for the probability P_i that the vehicle drives with a speed v, where $v_i - 2{,}5$ km/h $< v \leq v_i + 2{,}5$ km/h (i = 1, …, 28):

i	P_i
1	4,610535879
2	5,083909299
3	4,86818148
4	5,128313511
5	5,233189418
6	5,548597362
7	5,768706442
8	5,881761847
9	6,105763476
10	6,098904359
11	5,533164348
12	4,761325003
13	4,077325232
14	3,533825909
15	2,968643201
16	2,61326375
17	2,275220718
18	2,014651418
19	1,873070659
20	1,838715054
21	1,982122053
22	2,124757402
23	2,226658166
24	2,137249569
25	1,76902642
26	1,665033625
27	1,671035353
28	0,607049046

Where the maximum speed of the vehicle corresponds to step i and i < 28, the values of P_{i+1} to P_{28} shall be added to P_i.

7.5. Determination of the model fuel consumption

FC_{GSI} shall denote the fuel consumption of the vehicle when the driver follows the advice of the GSI:

$FC^{GSI}{}_i = FC^n{}_i$, where $V^{n-1}{}_{GSI} \leq v_i < V^n{}_{GSI}$ (for n = 1, …, #g) and $FC^{GSI}{}_i = 0$ if $v_i \geq V^{\#g}{}_{GSI}$

$FC_{GSI} = \sum_{i=1}^{28} P_i * FC^{GSI_i}/100$

FC_{std} shall denote the fuel consumption of the vehicle when standard gear shift points are used:

$FC^{std}{}_i = FC^n{}_i$, where $V^{n-1}{}_{std} \leq v_i < V^n{}_{std}$ (for n = 1, …, #g) and $FC^{std}{}_i = 0$ if $v_i \geq V^{\#g}{}_{GSI}$

$FC_{std} = \sum_{i=1}^{28} P_i * FC^{std_i}/100$

The relative saving of fuel consumption by following the advice of the GSI of the model is calculated as:

$$FC_{rel.\ Save} = (1 - FC_{GSI} / FC_{std}) * 100\ \%$$

7.6. Data records

The following information shall be recorded:

(a) the values of $V^n{}_{GSI}$ as determined pursuant to point 7.1.

(b) the values FCni of the fuel consumption speed curve as communicated by the manufacturer pursuant to point 7.3.

(c) the values FC_{GSI}, FC_{std} and $FC_{rel.\ Save}$ as calculated pursuant to point 7.5.

8. Description of the vehicle speed profile referred to in point 7.1.

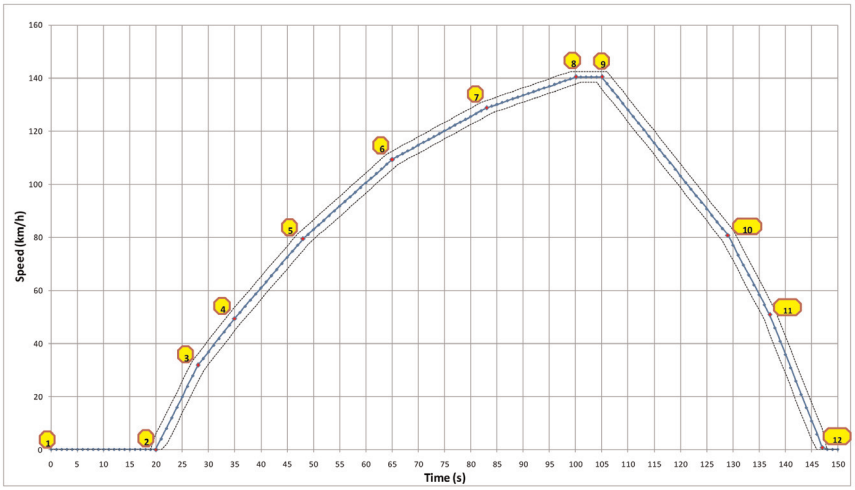
No. of	Operation	Acceleration	Speed	Cumulative time
operation		(m/s^2)	(km/h)	(s)
1	Idling	0	0	20
2	Acceleration	1,1	0 – 31,68	28
3		0,7	31,68 – 49,32	35
4		0,64	49,32 – 79,27	48
5		0,49	79,27 – 109,26	65
6		0,3	109,26 – 128,70	83
7		0,19	128,70 – 140,33	100

No. of	Operation	Acceleration	Speed	Cumulative time
operation		(m/s^2)	(km/h)	(s)
8	Steady state	0	140,33	105
9	Deceleration	– 0,69	140,33 – 80,71	129
10		– 1,04	80,71 – 50,76	137
11		– 1,39	50,76 – 0	147
12	Idling	0	0	150

The tolerances for deviation from this speed profile are set out in point 6.1.3.4. of Annex 4a to UN Regulation No 83 ([3]).

Figure I.1

Graphical representation of the speed profile referred to in point 7.1.; solid line: speed profile; dashed lines: tolerances for deviation from this speed profile



The following table provides a second by second description of the speed profile. Where the vehicle is unable to attain 140 km/h, it shall be driven at its maximum speed until it rejoins the above speed profile.

([3]) UN Regulation No 83 of the Economic Commission for Europe of the United Nations (UN/ECE) – Uniform provisions concerning the approval of vehicles with regard to the emission of pollutants according to engine fuel requirements [2015/1038] (OJ L 172, 3.7.2015, p. 1).

Time (s)	Speed (km/h)	Time (s)	Speed (km/h)
0	0,00	31	39,24
1	0,00	32	41,76
2	0,00	33	44,28
3	0,00	34	46,80
4	0,00	35	49,32
5	0,00	36	51,62
6	0,00	37	53,93
7	0,00	38	56,23
8	0,00	39	58,54
9	0,00	40	60,84
10	0,00	41	63,14
11	0,00	42	65,45
12	0,00	43	67,75
13	0,00	44	70,06
14	0,00	45	72,36
15	0,00	46	74,66
16	0,00	47	76,97
17	0,00	48	79,27
18	0,00	49	81,04
19	0,00	50	82,80
20	0,00	51	84,56
21	3,96	52	86,33
22	7,92	53	88,09
23	11,88	54	89,86
24	15,84	55	91,62
25	19,80	56	93,38
26	23,76	57	95,15
27	27,72	58	96,91
28	31,68	59	98,68
29	34,20	60	100,44
30	36,72	61	102,20
		62	103,97
		63	105,73
		64	107,50
		65	109,26
		66	110,34
		67	111,42
		68	112,50
		69	113,58
		70	114,66
		71	115,74
		72	116,82
		73	117,90
		74	118,98
		75	120,06
		76	121,14
		77	122,22
		78	123,30
		79	124,38
		80	125,46
		81	126,54
		82	127,62
		83	128,70
		84	129,38
		85	130,07
		86	130,75
		87	131,44
		88	132,12
		89	132,80
		90	133,49
		91	134,17
		92	134,86
		93	135,54
		94	136,22
		95	136,91
		96	137,59
		97	138,28
		98	138,96
		99	139,64
		100	140,33

Time (s)	Speed (km/h)	Time (s)	Speed (km/h)
101	140,33	118	108,04
102	140,33	119	105,55
103	140,33	120	103,07
104	140,33	121	100,58
105	140,33	122	98,10
106	137,84	123	95,62
107	135,36	124	93,13
108	132,88	125	90,65
109	130,39	126	88,16
110	127,91	127	85,68
111	125,42	128	83,20
112	122,94	129	80,71
113	120,46	130	76,97
114	117,97	131	73,22
115	115,49	132	69,48
116	113,00	133	65,74
117	110,52	134	61,99

Time (s)	Speed (km/h)	Time (s)	Speed (km/h)
135	58,25		
136	54,50		
137	50,76		
138	45,76		
139	40,75		
140	35,75		
141	30,74		
142	25,74		
143	20,74		
144	15,73		
145	10,73		
146	5,72		
147	0,72		
148	0,00		
149	0,00		
150	0,00		

PART 3

EU TYPE-APPROVAL CERTIFICATE (VEHICLE SYSTEM)

Communication concerning *granting* / *extension* / *refusal* / *withdrawal* ([4]) of type-approval of a type of vehicle with regard to the the gear shift indicator in accordance with the requirements laid down in Annex IX to Regulation (EU) 2021/535, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension* / *refusal* / *withdrawal* ([4]):

SECTION I

(To be completed in accordance with Section I of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

SECTION II

(To be completed in accordance with Section II of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

Addendum

to EU type-approval certificate number …

1. Additional information

1.1. Brief description of the vehicle type as regards its structure, dimensions, lines and constituent materials:

2. Vehicle fitted with a manual conventional gearbox: *yes* / *no* ([4])

3. Vehicle fitted with a robotised conventional gearbox with manual mode: *yes* / *no* ([4])

4. Vehicle fitted with an automatic gearbox with manual mode: *yes* / *no* ([4])

5. Remarks (if any):

([4]) Delete where not applicable.

ANNEX X

VEHICLE ACCESS

PART 1

Information document for EU type-approval of motor vehicles with regard to vehicle access

MODEL

Information document No ... relating to the EU type-approval of a vehicle type with regard to vehicle access.

The following information, if applicable, shall be supplied in triplicate and include a list of contents. Any drawings or pictures shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

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0.2.1.

0.3.

0.3.1.

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2.6.

9.

9.3.

9.3.1.

9.3.4.

Explanatory note:

This information document is based on the template laid down in Annex I to Commission Implementing Regulation (EU) 2020/683 and shall be completed with the relevant information under the point numbers listed above as defined in that template.

PART 2

Technical specifications

1. For the purposes of this Annex, the following definition apply:

1.1. '*floor entrance*' means the lowest point of the door aperture or other structure whichever of the two is higher, which a person has to clear in terms of height in order to enter the passenger compartment.

2. General provision

2.1. The design characteristics of the vehicle type shall permit entry to and exit from the passenger compartment in complete safety and entrances to the passenger compartment shall be constructed in such a way that they can be used easily and without any danger.

3. Running boards and access steps

3.1. The wheel hub, rims and other parts of the wheel shall not be deemed to be running boards or access steps for the purpose of this Regulation, except where reasons relating to construction or use preclude the fitting of running boards or access steps elsewhere on the vehicle.

3.2. The height of the floor entrance shall be determined either directly from the ground surface or from the horizontal plane passing through the middle, in relation to the longitudinal direction, of the step immediately below.

4. Requirements concerning the access to and exit from the doors of the passenger compartment of vehicles of category N_2 having a maximum mass exceeding 7,5 tonnes and of category N_3

4.1. Access steps to the passenger compartment (Figure 1).

4.1.1. The distance (A) from the ground surface to the upper surface of the lowest step, measured with the vehicle in running order on a horizontal and flat surface, shall not be more than 600 mm.

4.1.1.1. However, for off-road vehicles (ORV) the distance (A) may be increased up to 700 mm.

4.1.2. The distance (B) between the upper surfaces of the steps shall be not more than 400 mm. The vertical distance between two subsequent steps shall not vary by more than 50 mm. However, the requirement concerning the vertical distance shall not apply to the distance between the uppermost step and the floor entrance of the passenger compartment.

4.1.2.1. For off-road vehicles (ORV), the allowed variation of the vertical distance as indicated in point 4.1.2. may be increased up to 100 mm.

4.1.3. In addition, the following minimum geometrical specifications shall be fulfilled:

(a) step depth (D): 80 mm;

(b) step clearance (E) (include step depth): 150 mm;

(c) step width (F): 300 mm;

(d) width of the lowest step (G): 200 mm;

(e) step height (S): 120 mm;

(f) transversal offset between steps (H): 0 mm;

(g) longitudinal overlap (J) between two subsequent steps in the same flight, or between the uppermost step and the cab floor entrance height: 200 mm.

4.1.3.1. For off-road vehicles (ORV), the value (F) set out in point 4.1.3.(c) may be reduced to 200 mm.

4.1.4. For off-road vehicles (ORV), the lowest step may be designed as a rung where that is necessary for reasons relating to construction or use. In such a case the rung depth (R) shall be at least 20 mm.

4.1.4.1. Rungs with a round cross-section shall not be permitted.

4.1.5. The position of the uppermost step shall be easily recognisable when getting down from the passenger compartment.

4.1.6. All access steps shall be constructed in such a way as to preclude the risk of slipping. In addition, access steps exposed to the weather and dirt during driving shall have adequate run-off or a draining surface.

4.2. Access to handholds to the passenger compartment (as shown in Figure 1).

4.2.1. One or more suitable handrail(s), handhold(s) or other equivalent holding device(s) shall be provided for access to the passenger compartment.

4.2.1.1. All handrails, handholds or equivalent holding devices shall be positioned in such a way that they can be easily grasped and do not obstruct access to the passenger compartment.

4.2.1.2. A maximum discontinuity of 100 mm in the handhold area of the handrails, handholds or equivalent holding devices shall be allowed.

4.2.1.3. For passenger compartment access with more than two steps, the handrails, handholds or equivalent holding devices shall be located in such a way that a person can support himself or herself at the same time with two hands and one foot or with two feet and one hand.

4.2.1.4. Except in the case of a stairway, the design and positioning of the handrails, handholds and equivalent holding devices shall be such that operators are encouraged to descend facing the passenger compartment.

4.2.1.5. The steering wheel may be considered as a handhold.

4.2.2. The height (N) of the lower edge of at least one handrail, handhold or equivalent holding device, measured from the ground surface with the vehicle in running order on a horizontal and flat surface, shall not exceed 1 850 mm.

4.2.2.1. For off-road vehicles (ORV), the height (N) referred to in point 4.2.2. may be increased up to 1 950 mm.

4.2.2.2. Where the floor entrance height of the passenger compartment measured from the ground surface is greater than 'N', that height shall be assumed as 'N'.

4.2.2.3. In addition, the minimum distance (P) of the upper edge of the handrails or handholds or equivalent holding devices from the floor entrance height of the passenger compartment shall be:

(a) for handrails, handholds or equivalent holding devices (U): 650 mm;

(b) for handrails, handholds or equivalent holding devices (V): 550 mm.

4.2.3. The following geometrical specifications shall be fulfilled:

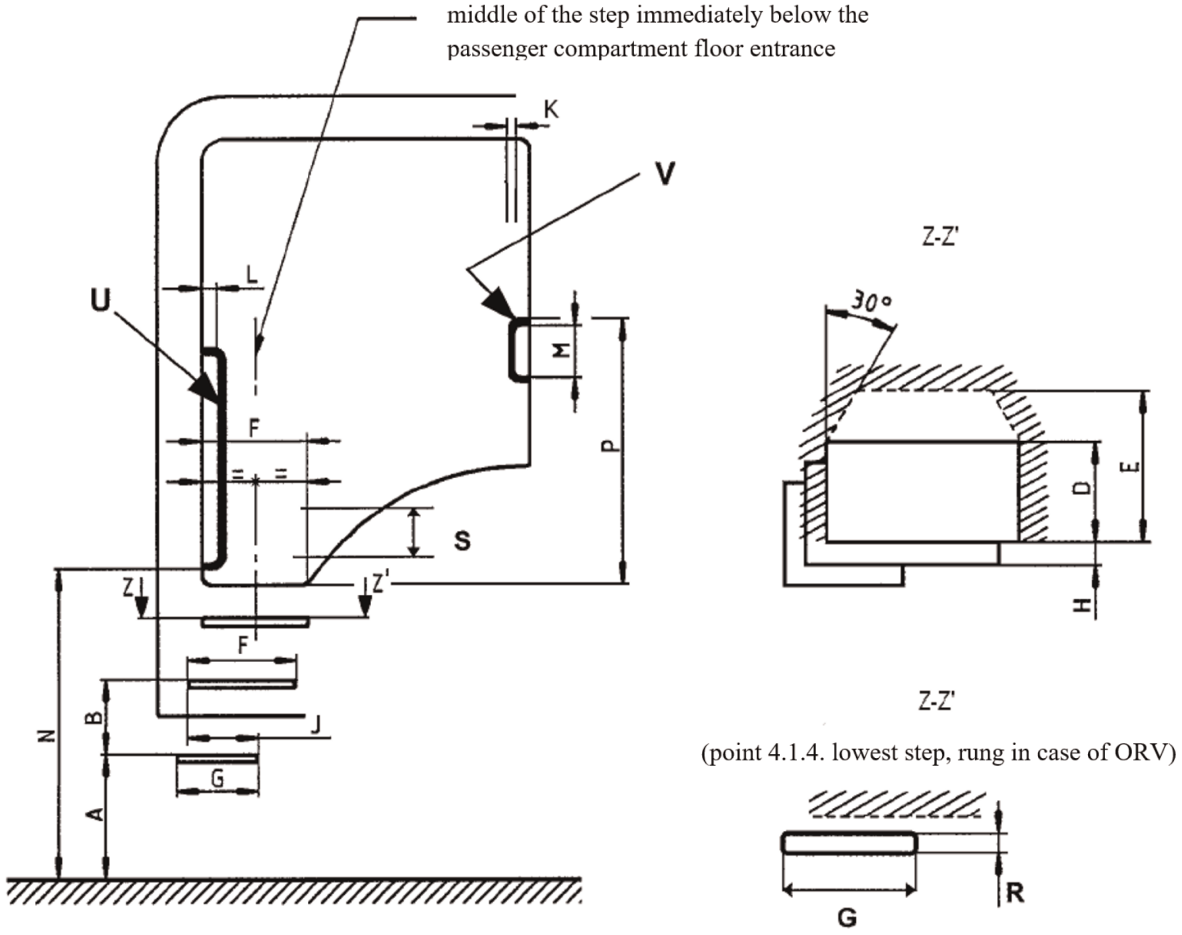
(a) gripping dimension (K): 16 mm minimum 38 mm maximum;

(b) length (M): 150 mm minimum;

(c) clearance to vehicle components (L): 40 mm minimum with open door.

Figure 1

Access steps and handholds to the passenger compartment



5. Requirements concerning the access to and exit from the doors of the passenger compartment of vehicles of categories other than N_2 having a maximum mass exceeding 7,5 tonnes or category N_3

5.1. Running boards and access steps

5.1.1. Vehicles of categories M_1 and N_1 as well as N_2 with a maximum mass not exceeding 7,5 tonnes, shall have one or more running board(s) or access step(s) where the floor entrance height of the passenger compartment is higher than 600 mm above the ground measured with the vehicle in running order on a horizontal and flat surface.

5.1.1.1. For off-road vehicles (ORV), the height of the passenger compartment specified in point 5.1.1. may be increased up to 700 mm.

5.1.1.2. All running boards and access steps shall be constructed in such a way as to preclude the risk of slipping. In addition, running boards and access steps exposed to the weather and dirt during driving shall have adequate run-off or a draining surface.

PART 3

EU TYPE-APPROVAL CERTIFICATE (VEHICLE SYSTEM)

Communication *concerning granting / extension / refusal / withdrawal* ([1]) of type-approval of a type of vehicle with regard to vehicle access in accordance with the requirements laid down in Annex X to Regulation (EU) 2021/535, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension / refusal / withdrawal* ([1]):

SECTION I

(To be completed in accordance with Section I of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

SECTION II

(To be completed in accordance with Section II of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

Addendum

to the EU type-approval certificate number…

1. Additional information:

1.1. Brief description of the vehicle type as regards its structure, dimensions, lines and constituent materials

1.2. Vehicle type of category M_1 / N_1 / N_2 *with a maximum mass not exceeding 7,5 tonnes* ([1]) *is / is not* ([1]) fitted with running boards or access steps.

1.3. Off-road vehicle (ORV) *yes / no* ([1])

5. Remarks:

([1]) Delete where not applicable.

ANNEX XI

REVERSING MOTION

PART 1

Information document for EU type-approval of motor vehicles with regard to reversing motion

MODEL

Information document No … relating to the EU type-approval of a vehicle with regard to reversing motion.

The following information, if applicable, shall be supplied in triplicate and include a list of contents. Any drawings or pictures shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

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Explanatory note:

This information document is based on the template laid down in Annex I to Commission Implementing Regulation (EU) 2020/683 and shall be completed with the relevant information under the point numbers listed above as defined in that template.

PART 2

Technical specifications

1. General provisions

1.1. All motor vehicles shall be equipped with a device for reversing which can be easily operated from the driver's position.

1.2. A brief delay between the moment the reversing mode is selected and the moment it is actually engaged is allowed.

PART 3

EU TYPE-APPROVAL CERTIFICATE (VEHICLE SYSTEM)

Communication concerning *granting* / *extension* / *refusal* / *withdrawal* ([1]) of type-approval of a type of vehicle with regard to reversing motion in accordance with the requirements laid down in Annex XI to Regulation (EU) 2021/535, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension* / *refusal* / *withdrawal* ([1]):

SECTION I

(To be completed in accordance with Section I of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

SECTION II

(To be completed in accordance with Section II of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

Addendum

to EU type-approval certificate number…

1. Additional information:

1.1. Brief description of the vehicle type as regards its structure, dimensions, lines and constituent materials

1.2. Device for reversing: *gearbox* / *other means* ([1])

1.3. Brief description of the device for reversing where this is not a function of the gearbox:

5. Remarks:

([1]) Delete where not applicable.

ANNEX XII

FRONTAL PROTECTION SYSTEMS FOR M1 AND N1 VEHICLES

PART 1

Information document for EU type-approval of separate technical unit with regard to frontal protection systems

MODEL

Information document No … relating to the EU separate technical unit type-approval of a frontal protection system.

The following information, if applicable, shall be supplied in triplicate and include a list of contents. Any drawings or pictures shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

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Explanatory note:

This information document is based on the template laid down in Annex I to Commission Implementing Regulation (EU) 2020/683 and shall be completed with the relevant information under the point numbers listed above as defined in that template.

PART 2

Section A

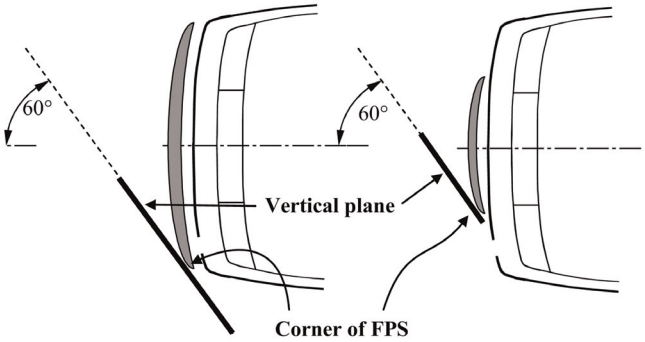
General provisions and requirements

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

1.1. 'corner of frontal protection system' means the frontal protection system's point of contact with a vertical plane, which makes an angle of 60° with the vertical longitudinal plane of the vehicle and is tangential to the outer surface of the frontal protection system (see Figure 1);

Figure 1

Determination of Corner of Frontal Protection System



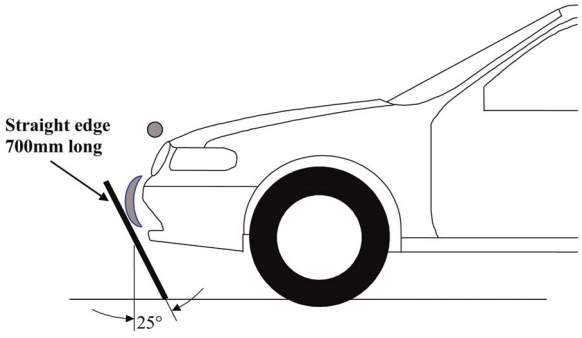
1.2. '*essential outer front end dimensions*' means solid points in space on the test frame, representing all points of the actual intended vehicle type where the frontal protection system would be liable to impact on the vehicle during testing;

1.3. '*lower frontal protection system height*' means, at any transverse position, the vertical distance between the ground and the lower frontal protection system reference line, with the vehicle positioned in its normal ride attitude;

1.4. '*lower frontal protection system reference line*' means a line which identifies the lower limit to significant points of pedestrian contact with the frontal protection system. The line is the geometric trace of the lowermost points of contact between a straight edge 700 mm long and the frontal protection system, when the straight edge, held parallel to the vertical longitudinal plane of the vehicle and inclined forwards by 25°, is traversed across the front of the vehicle, while maintaining contact with the ground and with the surface of the frontal protection system (see Figure 2);

Figure 2

Determination of Lower Frontal Protection System Reference Line



1.5. '*third of the frontal protection system*' means the geometric trace between each corner of the frontal protection system, measured with a flexible tape following the outer horizontal contour of the frontal protection system, divided into three equal parts;

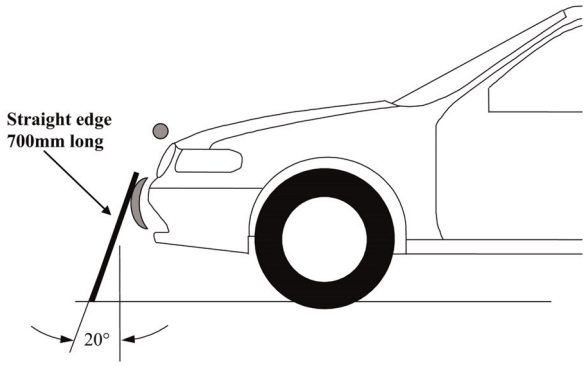
1.6. '*upper frontal protection system height*' means, at any transverse position, the vertical distance between the ground and the upper frontal protection system reference line, with the vehicle positioned in its normal ride attitude;

1.7. '*upper frontal protection system reference line*' means a line which identifies the upper limit to significant points of pedestrian contact with the frontal protection system. The line is the geometric trace of the upper most points of contact between a straight edge 700 mm long and the frontal protection system, when the straight edge, held parallel to the vertical longitudinal plane of the vehicle and inclined rearwards by 20°, is traversed across the front of the vehicle, while maintaining contact with the ground and with the surface of the frontal protection system (see Figure 3).

Where necessary the straight edge shall be shortened to avoid any contact with structures above the frontal protection system;

Figure 3

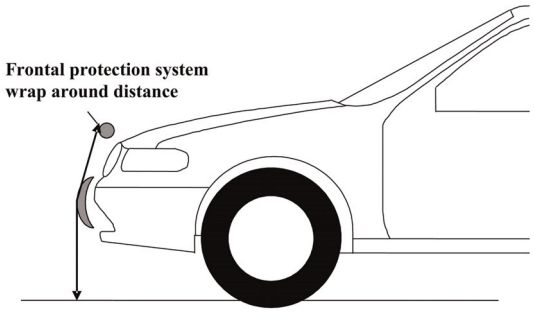
Determination of Upper Frontal Protection System Reference Line



1.8. '*wrap around distance*' means the geometric trace described on the frontal upper surface or the frontal protection system by one end of a flexible tape, when it is held in a vertical longitudinal plane of the vehicle and traversed across the frontal upper surface or frontal protection system. The tape is held taut throughout the operation with one end in contact with ground reference level, vertically below the front face of the bumper or frontal protection system and the other end is held in contact with the frontal upper surface or frontal protection system (see Figure 4, for example). The vehicle is positioned in the normal ride attitude.

Figure 4

Frontal protection system wrap around distance



2. General provisions:

2.1. The manufacturer shall submit to the technical service responsible for conducting the type-approval tests one sample of the type of frontal protection system to be approved. Where that technical service considers it necessary, it may request further samples. The sample(s) shall be clearly and indelibly marked with the applicant's trade name or mark and the type designation. The manufacturer shall make provision for the subsequent compulsory display of the EU type-approval mark.

2.2. Where the frontal protection system to be tested has been designed for use on more than one vehicle type of categories M_1 or N_1, that system shall be type-approved separately for every vehicle type for which it is intended.

However, the technical service shall have the discretion to waive additional tests where the intended vehicle types or the frontal protection system types are considered to be sufficiently similar.

2.3. The test may be carried out either with the frontal protection system mounted on a vehicle of the type for which it is intended or on a test frame closely representing the essential outer front end dimensions of the intended vehicle type. If, when using a test frame, the frontal protection system makes contact with the frame during testing, the test shall be repeated with the frontal protection system mounted on the actual vehicle type for which it is intended. In the case of testing carried out when the frontal protection system is mounted on a vehicle, the conditions of Section C shall apply.

2.4. Any modification of the vehicle types that are listed in the Appendix to the EU type-approval certificate of the frontal protection system, forward of their A-pillars or of the frontal protection system itself, which affects either the structure, the main dimensions, the materials of the outer surfaces of the vehicle or the frontal protection system, the fixing methods or the external or internal component arrangement, and which may have a significant influence on the results of the tests, shall be regarded as an amendment pursuant to Article 33 of Regulation (EU) 2018/858 and thus require a new EU type-approval with regard to the frontal protection system.

2.5. If the relevant requirements set out in Part 2 of Annex XII to this Regulation are met, the following shall apply for the purposes of Section 3 of the type-approval number and in particular concerning the letters that shall be used:

— 'A' if the frontal protection system is approved for fitting to vehicles of categories M_1 or N_1 that comply with the requirements of Section 2 of Annex I to Regulation (EC) No 78/2009 or point 3.1. of Annex I to Directive 2003/102/EC;

— 'B' if the frontal protection system is approved for fitting to vehicles of categories M_1 or N_1 that comply with the requirements of Section 3 of Annex I to Regulation (EC) No 78/2009, point 3.2. of Annex I to Directive 2003/102/EC or UN Regulation No 127 ([1]); or

— 'X' if the frontal protection system is approved for fitting only to vehicles of categories M_1 or N_1 which do not comply with either Regulation (EC) No 78/2009, Directive 2003/102/EC or UN Regulation No 127.

3. Specific requirements

3.1. The following requirements apply equally to frontal protection systems fitted to new vehicles of categories M_1 or N_1 and to frontal protection systems to be supplied as separate technical units for fitting to specified vehicles of categories M_1 or N_1.

([1]) UN Regulation No 127 of the Economic Commission for Europe of the United Nations (UN/ECE) – Uniform provisions concerning the approval of motor vehicles with regard to their pedestrian safety performance [2020/638] (OJ L 154, 15.5.2020, p. 1).

3.1.1. The components of the frontal protection system shall be so designed that all rigid surfaces which can be contacted by a 100 mm sphere, have a radius of curvature ≥ 5,0 mm.

3.1.2. The total mass of the frontal protection system, including all brackets and fixings, shall not exceed 1,2 % of the maximum mass of the vehicle for which it is designed, subject to a maximum of 18 kg.

3.1.3. The height of the frontal protection system, when fitted to a vehicle, shall be no more than 50 mm above the height of the bonnet leading edge reference line as defined in accordance with UN Regulation No 127.

3.1.4. The frontal protection system shall not increase the width of the vehicle to which it is fitted. If the overall width of the frontal protection system is more than 75 % of the width of the vehicle, the ends of the frontal protection system shall be turned in towards the external surface in order to minimise the risk of fouling. This requirement is considered to be satisfied if either the frontal protection system is recessed or integrated within the bodywork or the end of the frontal protection system is turned so that it is not contactable by a 100 mm sphere and the gap between the end of the frontal protection system and the surrounding bodywork does not exceed 20 mm.

3.1.5. Subject to point 3.1.4., the gap between the components of the frontal protection system and the underlying external surface shall not exceed 80 mm. Local discontinuities in the general contour of the underlying body (such as apertures in grilles, air intakes, etc.) shall be ignored.

3.1.6. At any lateral position across the vehicle, in order to preserve the benefits of the vehicle bumper, the longitudinal distance between the most forward part of the bumper and the most forward part of the frontal protection system shall not exceed 50 mm.

3.1.7. The frontal protection system shall not reduce significantly the effectiveness of the bumper. This requirement shall be considered to be satisfied if there are no more than two vertical components and no horizontal components of the frontal protection system overlapping the bumper.

3.1.8. The frontal protection system shall not be inclined forward of the vertical. The top parts of the frontal protection system shall not extend upwards or rearwards (towards the windscreen) more than 50 mm from the bonnet leading edge reference line of the vehicle with the frontal protection system removed.

3.1.9. Conformity with the requirements of the vehicle type-approval shall not be compromised by the fitting of a frontal protection system.

3.1.10. The type-approval authority may consider the requirements for any of the tests laid down in this Annex to be fulfilled by any equivalent testing carried out in accordance with UN Regulation No 127 (e.g. when tested as part of a type of vehicle when it can be optionally fitted with a frontal protection system, see point 1. and point 3.1. of Section C).

Section B

Vehicle test specifications

1. Complete vehicle

1.1. For testing on complete vehicles, the vehicles shall comply with the conditions laid down in points 1.1.1., 1.1.2. and 1.1.3.

1.1.1. The vehicle shall be in its normal ride attitude and shall be either securely mounted on raised supports or at rest on a flat surface with the hand brake on.

1.1.2. All devices designed to protect vulnerable road users shall be correctly activated before and/or be active during the appropriate test. It shall be the responsibility of the applicant for approval to show that the devices will act as intended in a pedestrian impact.

1.1.3. Any vehicle component which could change shape or position, other than active devices to protect pedestrians, and which have more than one fixed shape or position shall require the vehicle to comply with the components in each fixed shape or position.

2. Subsystem of vehicle

2.1. Where only a subsystem of the vehicle is supplied for tests, it shall comply with the conditions detailed in points 2.1.1., 2.1.2., 2.1.3. and 2.1.4.

2.1.1. All the parts of the vehicle structure, bonnet and under-bonnet components or behind windscreen components that may be involved in a frontal impact with a vulnerable road user shall be included in the test to demonstrate the performance and interactions of all the contributory vehicle components.

2.1.2. The vehicle subsystem shall be securely mounted in the vehicle normal ride attitude.

2.1.3. All devices designed to protect vulnerable road users shall be correctly activated before and/or be active during the appropriate test. It shall be the responsibility of the applicant for approval to show that the devices will act as intended in a pedestrian impact.

2.1.4. Any vehicle component which could change shape or position, other than active devices to protect pedestrians, and which have more than one fixed shape or position shall require the vehicle to comply with the components in each fixed shape or position.

Section C

Frontal protection systems test specifications

1. Frontal Protection System as original equipment fitted to a vehicle.

1.1. The frontal protection system mounted on the vehicle shall comply with the conditions laid down in points 3. to 3.1.10. of Section A.

1.2. The vehicle shall be in its normal ride attitude and either securely mounted on raised supports or at rest on a flat surface with the handbrake on. The vehicle shall be fitted with the frontal protection system to be tested. The fitting instructions from the manufacturer of the frontal protection system shall be followed and these shall include tightening torques for all fixings.

1.3. All devices designed to protect pedestrians and other vulnerable road users shall be correctly activated before and/or be active during the appropriate test. The applicant shall demonstrate that the devices will function as intended if the vehicle strikes a pedestrian or other vulnerable road user.

1.4. Any vehicle component that could change shape or position, such as 'pop-up' headlamps, other than devices to protect pedestrians and other vulnerable road users, shall be set to a shape or position that the technical services consider to be most appropriate for these tests.

2. Frontal Protection System as a separate technical unit.

2.1. Where only a frontal protection system is supplied for tests, it shall be possible to comply with the conditions laid down in points 3. to 3.1.10. of Section A when fitted to the vehicle type to which the specific separate technical unit type-approval relates.

2.2. The test may be carried out either with the frontal protection system mounted on a vehicle of the type for which it is intended or on a test frame closely representing the essential outer front end dimensions of the intended vehicle type. If, when using a test frame, the frontal protection system makes contact with the frame during testing, the test shall be repeated with the frontal protection system mounted on the actual vehicle type for which it is intended. In the case of testing carried out when the frontal protection system is mounted on a vehicle the conditions of point 1 shall apply.

3. Information to be provided.

3.1. All frontal protection systems, whether being part of the type-approval of a vehicle with regard to it being optionally fitted with a frontal protection system or being type-approved as a separate technical unit, shall be accompanied by information as to the vehicle or vehicles on which it has been approved for fitting.

3.2. All frontal protection systems type-approved as separate technical units shall be accompanied by detailed installation instructions giving sufficient information for a competent person to install it on the vehicle properly. The instructions shall be in the language or languages of the Member State in which the frontal protection system will be offered for sale.

Section D

Lower legform to frontal protection system test

1. Specific requirements

1.1. All the tests shall be performed at an impact speed of 40 km/h.

1.2. For a frontal protection system approved for fitting to vehicles that comply with the requirements of Section 2 of Annex I to Regulation (EC) No 78/2009 or point 3.1. of Annex I to Directive 2003/102/EC, the absolute value of the maximum dynamic medial collateral ligament elongation at the knee shall not exceed 40 mm, and the maximum dynamic anterior cruciate ligament and posterior cruciate ligament elongation shall not exceed 13 mm. The absolute value of dynamic bending moments at the tibia shall not exceed 380 Nm.

1.3. For a frontal protection system approved for fitting to vehicles that comply with the requirements of Section 3 of Annex I to Regulation (EC) No 78/2009, point 3.2. of Annex I to Directive 2003/102/EC or UN Regulation No 127, the absolute value of the maximum dynamic medial collateral ligament elongation at the knee shall not exceed 22 mm, and the maximum dynamic anterior cruciate ligament and posterior cruciate ligament elongation shall not exceed 13 mm. The absolute value of dynamic bending moments at the tibia shall not exceed 340 Nm.

1.4. For a frontal protection system approved for fitting only to vehicles which do not comply with either Regulation (EC) No 78/2009, Directive 2003/102/EC or UN Regulation No 127, the test requirements set out in points 1.2. and 1.3. may be replaced by the following test requirements:

— The absolute value of the maximum dynamic medial collateral ligament elongation at the knee shall not exceed 40 mm, and the maximum dynamic anterior cruciate ligament and posterior cruciate ligament elongation shall not exceed 13 mm. The absolute value of dynamic bending moments at the tibia shall not exceed 380 Nm; or

— A pair of tests shall be performed on the vehicle, one with the frontal protection system fitted, and a second without the frontal protection system fitted and each pair of tests shall be performed in equivalent locations as agreed with the type-approval authority and technical service. The values for the maximum dynamic medial collateral ligament elongation at the knee, the maximum dynamic anterior cruciate ligament and posterior cruciate ligament elongations shall be recorded. In each case the value recorded for the vehicle fitted with the frontal protection system shall not exceed 90 % of the value recorded for the vehicle without the frontal protection system fitted.

2. General

2.1. The lower legform impactor for the frontal protection system tests shall be in 'free flight' at the moment of impact, in accordance with the provisions of paragraph 1.8. of Annex 5 to UN Regulation No 127. The impactor shall be released to free flight at such a distance that the test results are not influenced by any contact of the impactor with the propulsion system during rebound of the impactor.

2.2. In all cases the impactor may be propelled by an air, spring or hydraulic gun, or by other means that can be shown to give the same result. The lower legform impactor shall be certified pursuant to paragraph 1. of Annex 6 to UN Regulation No 127.

3. Specification of the test

3.1. A minimum of three lower legform to frontal protection system tests shall be carried out on test points between the upper and lower frontal protection system reference lines. The test points shall be at positions judged by the technical service to be the most likely to cause injury. Tests shall be carried out to different types of structure where they vary throughout the area to be assessed. The points tested by the technical service shall be recorded in the test report.

3.2. For vehicles with a lower frontal protection system reference line height of less than 425 mm the requirements of this Section shall be applied.

4. For vehicles with a lower frontal protection system reference line height which is equal to, or greater than, 425 mm and less than 500 mm the manufacturer may choose to apply either the tests set out in this Section or the tests set out in Section E.

4.1. The state of the vehicle or subsystem shall comply with the provisions in Section C. The stabilised temperature of the test apparatus and the vehicle or separate technical unit shall be 20 °C°± 4 °C.

4.2. The lower legform impactor is described in Annex 4 to UN Regulation No 127.

4.3. The test impactor shall be stored and handled in accordance with paragraphs 1.2. and 1.3. of Annex 5 to UN Regulation No 127 prior to the test.

4.4. The tests shall be carried out in accordance with paragraphs 1.6. to 1.14. of Annex 5 to UN Regulation No 127.

4.5. During contact between the impactor and the frontal protection system, the impactor shall not contact the ground or any object which is not part of the frontal protection system or the vehicle.

Section E

Upper legform to frontal protection system test

1. Specific requirements

1.1. All the tests shall be performed at an impact speed of 40 km/h.

1.2. The instantaneous sum of the impact forces with respect to time shall not exceed 7,5 kN and the bending moment on the test impactor shall not exceed 510 Nm.

1.3. For a frontal protection system approved for fitting only to vehicles which do not comply with either Regulation (EC) No 78/2009, Directive 2003/102/EC or UN Regulation No 127, the test requirements set out in point 1.2. may be replaced by the following test requirements:

— The instantaneous sum of the impact forces with respect to time shall not exceed 9,4 kN and the bending moment on the test impactor shall not exceed 640 Nm; or

— A pair of tests shall be performed on the vehicle, one with the frontal protection system fitted, and a second without the frontal protection system fitted. Each pair of tests shall be performed in equivalent locations as agreed with the type-approval authority and technical service. The values for the instantaneous sum of the impact forces and the bending moment on the test impactor shall be recorded. In each case the value recorded for the vehicle fitted with the frontal protection system shall not exceed 90 % of the value recorded for the vehicle without the frontal protection system fitted.

2. General

2.1. The upper legform impactor for tests to the frontal protection system shall be mounted to the propulsion system, by a torque limiting joint, to prevent large off-centre loads damaging the guidance system. The guidance system shall be fitted with low-friction guides, insensitive to off-axis loading, that allow the impactor to move only in the specified direction of impact, when in contact with the frontal protection system. The guides shall prevent motion in other directions including rotation about any other axis.

2.2. The upper legform impactor may be propelled by an air, spring or hydraulic gun, or by other means that can be shown to give the same result. The upper legform impactor shall be certified pursuant to paragraph 2. of Annex 6 to UN Regulation No 127.

3. Specification of the test

3.1. A minimum of three upper legform to frontal protection system tests shall be carried out on test points between the Upper and Lower Frontal protection System Reference Lines. The test points shall be at positions judged by the technical service to be the most likely to cause injury. Tests shall be carried out to different types of structure where they vary throughout the area to be assessed. The points tested by the technical service shall be recorded in the test report.

3.2. For vehicles with a lower frontal protection system reference line height equal to, or greater than, 500 mm the requirements of this Section shall apply.

4. For vehicles with a lower frontal protection system reference line height which is equal to, or greater than, 425 mm and less than 500 mm the manufacturer may choose to apply either this test or the test set out in Section D.

4.1. The state of the vehicle or subsystem shall comply with the provisions in Section C. The stabilised temperature of the test apparatus and the vehicle or separate technical unit shall be 20° ± 4 °C.

4.2. The upper legform impactor is described in Annex 4 to UN Regulation No 127.

4.3. The test impactor shall be stored and handled in accordance with paragraphs 2.2. and 2.3. of Annex 5 to UN Regulation No 127.

4.5. The tests shall be carried out in accordance with paragraphs 2.6. and 2.7. of Annex 5 to UN Regulation No 127.

Section F

Child/Small Adult headform to frontal protection system test

1. Specific requirements

1.1. All the tests shall be performed at an impact speed of 35 km/h using a 3,5 kg headform test impactor for the child/small adult. The HPC calculated from the resultant of the accelerometer time histories shall not exceed 1 000 in all cases.

2. General

2.1. The child/small adult headform impactor for the frontal protection system tests shall be in 'free flight' at the moment of impact. The impactor shall be released to free flight at such a distance from the frontal protection system that the test results are not influenced by any contact of the impactor with the propulsion system during rebound of the impactor.

2.2. In all cases the impactors may be propelled by an air, spring or hydraulic gun, or by other means that can be shown to give the same result. The headform impactor shall be certified pursuant to paragraph 3. of Annex 6 to UN Regulation No 127.

3. Specification of the test

3.1. A minimum of three headform impact tests shall be carried out at positions which are judged by the technical service to be the most likely to cause injury. Tests shall be to different types of structure, where these vary throughout the area to be assessed. Points tested by the technical service shall be recorded in the test report.

3.2. Test points for the child/small adult headform impactor shall be chosen on parts of the frontal protection system where the frontal protection system wrap around distance exceeds 900 mm with the vehicle in its normal ride attitude or with the frontal protection system mounted on a test frame representing the vehicle to which it is to be fitted as if in its' normal ride attitude.

4. Test procedure

4.1. The state of the vehicle or subsystem shall comply with the provisions in point 1 of Section C. The stabilised temperature of the test apparatus and the vehicle or separate technical unit shall be 20 °C ± 4 °C.

4.2. The child/small adult headform impactor is described in Annex 4 to UN Regulation No 127.

4.3. The impactor shall be mounted and propelled as specified in points 2.1. and 2.2.

4.4. The tests shall be carried out in accordance with paragraphs 3. to 3.3.1. and 4.4. to 4.7. of Annex 5 to UN Regulation No 127.

PART 3

Section A

EU TYPE-APPROVAL CERTIFICATE (SEPARATE TECHNICAL UNIT)

Communication *concerning granting | extension | refusal | withdrawal* [2] of type-approval of a type of separate technical unit with regard to frontal protection systems in accordance with the requirements laid down in Annex XII to Regulation (EU) 2021/535, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension | refusal | withdrawal* [2]:

SECTION I

(To be completed in accordance with Section I of the template of Model C in Annex III to Commission Implementing Regulation (EU) 2020/683)

SECTION II

(To be completed in accordance with Section II of the template of Model C in Annex III to Commission Implementing Regulation (EU) 2020/683)

Addendum

to EU type-approval certificate number …

1. Additional information:

1.1. Method of attachment:

1.2. Assembly and mounting instructions:

2. List of vehicles on which the frontal protection system may be fitted, any usage instructions and necessary conditions for fitting:

[…]

5. Remarks

[…]

6. Test results according to the requirements of Part 2 of Annex XII of Regulation (EU) 2021/535.

Test	Value recorded			Pass/Fail
Lower legform to frontal protection system — three test positions (where performed)	Bending angle	…	degrees	
	Shear displacement	…	mm	
	Acceleration at tibia	…	g	
Upper legform to frontal protection system — three test positions (where performed)	Sum of impact forces	…	kN	
	Bending moment	…	Nm	
Child/small adult headform (3,5 kg) to frontal protection system	HPC values (at least three values)			

[2] Delete where not applicable.

Section B

EU type-approval mark of separate technical unit

1. The EU type-approval mark for separate technical units referred to in Article 38(2) of Regulation (EU) 2018/858 shall consist of:

1.1. A rectangle surrounding the lower-case letter 'e', followed by the distinguishing number of the Member State which has granted the type-approval for the component or separate technical unit:

1	for Germany	20	for Poland
2	for France	21	for Portugal
3	for Italy	23	for Greece
4	for the Netherlands	24	for Ireland
5	for Sweden	25	for Croatia
6	for Belgium	26	for Slovenia
7	for Hungary	27	for Slovakia
8	for the Czech Republic	29	for Estonia
9	for Spain	32	for Latvia
		12	for Austria
13	for Luxembourg	34	for Bulgaria
17	for Finland	36	for Lithuania
18	for Denmark	49	for Cyprus
19	for Romania	50	for Malta

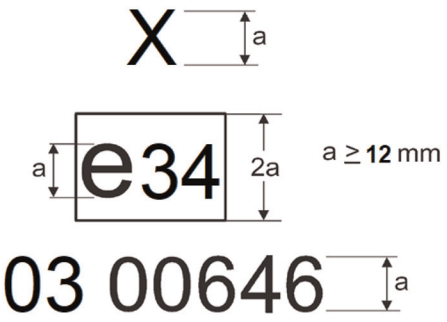
1.2. In the vicinity of the rectangle, two digits indicating the series of amendments laying down the requirements with which this separate technical units complies, '00' at present, followed by a space and the five-digit number referred to in point 2.4. of Annex IV of Regulation (EU) 2018/858.

2. The type-approval mark of the separate technical units shall be indelible and clearly legible.

3. An example of an EU separate technical unit type-approval mark is shown in Figure 1.

Figure 1

Example of EU separate technical unit type-approval mark



Explanatory note:

Legend The EU separate technical unit type-approval was issued by Bulgaria under number 00646. The first two digits "03" indicate that the separate technical unit was approved according to this Regulation. The letter 'X' means that the frontal protection system is intended for fitting only to vehicles of categories M_1 or N_1 which do not comply with either Regulation (EC) No 78/2009, Directive 2003/102/EC or UN Regulation No 127.

ANNEX XIII

MASSES AND DIMENSIONS

PART 1

Section A

Information document for EU type-approval of a motor vehicles and their trailers with regard to their masses and dimensions

MODEL

Information document No … relating to the EU type-approval of a motor vehicle or trailer with regard to the masses and dimensions.

The following information shall be supplied in triplicate and include a list of contents. Any drawings or pictures shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

0.

0.1.

0.2.

0.2.1.

0.4.

0.5.

0.8.

0.9.

1.

1.1.

1.2.

1.3.

1.3.1.

1.3.2.

1.3.3.

1.4.

1.7.

1.9.

1.10.

2.

2.1.

2.1.1.

2.1.2.

2.1.2.1.

2.1.2.2.

2.2.

2.2.1.

2.2.1.1.

2.2.1.2.

2.2.1.3.

2.2.2.

2.2.2.1.

2.3.

2.3.1.

2.3.2.

2.4.

2.4.1.

2.4.1.1.

2.4.1.1.1.

2.4.1.1.2.

2.4.1.1.3.

2.4.1.2.

2.4.1.2.1.

2.4.1.2.2.

2.4.1.3.

2.4.1.4.

2.4.1.4.1.

2.4.1.5.

2.4.1.5.1.

2.4.1.5.2.

2.4.1.6.

2.4.1.6.1.

2.4.1.6.2.

2.4.1.6.3.

2.4.1.8.

2.4.2.

2.4.2.1.

2.4.2.1.1.

2.4.2.1.3.

2.4.2.2.

2.4.2.2.1.

2.4.2.3.

2.4.2.4.

2.4.2.4.1.

2.4.2.5.

2.4.2.5.1.

2.4.2.5.2.

2.4.2.6.

2.4.2.6.1.

2.4.2.6.2.

2.4.2.6.3.

2.4.2.8.

2.4.3.

2.4.3.1.

2.4.3.2.

2.4.3.3.

2.5.

2.6.

2.6.1.

2.6.2.

2.6.4.

2.8.

2.8.1.

2.9.

2.10.

2.11.

2.11.1.

2.11.2.

2.11.3.

2.11.3.1.

2.11.4.

2.11.4.2.

2.11.5.

2.11.6.

2.12.

2.12.1.

2.12.2.

2.12.3.

2.16.

2.16.1.

2.16.2.

2.16.3.

2.16.4.

2.16.5.

3.

3.1.

3.2.

3.2.1.8.

3.3.

3.3.1.1.

3.4.

3.4.1.

3.4.5.4.

3.9.

4.

4.1.

5.

5.1.

5.2.

5.3.

5.4.

5.5.

6.

6.1.

6.2.

6.2.3.

6.2.3.1.

6.2.3.2.

6.2.4.

6.2.4.1.

6.2.4.2.

6.3.

9.

9.1.

9.10.3.

9.10.3.1.

9.10.3.1.1.

9.10.3.5.

9.10.3.5.1.

9.10.3.5.2.

9.25.

9.25.1.

9.26.

9.26.1.

9.26.2.

9.26.3.

9.27.3.1.

9.27.3.2.

9.27.3.3.

11.

11.1.

11.2.

13.

13.1.

13.2.

13.2.1.

13.2.2.

13.2.3.

13.2.4.

13.3.

13.3.1.

13.3.2.

13.3.3.

13.4.

13.4.1.

13.4.2.

13.4.3.

13.4.4.

13.7.

13.12.

Explanatory note:

This information document is based on the template laid down in Annex I to Commission Implementing Regulation (EU) 2020/683 and shall be completed with the relevant information under the point numbers listed above as defined in that template.

Section B

Information document for the EU type-approval of an aerodynamic device or equipment as a separate technical unit

MODEL

Information document No … relating to the EU type-approval of an aerodynamic device or equipment as a separate technical unit.

The following information shall be supplied in triplicate and include a list of contents. Any drawings shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

0.

0.1.

0.2.

0.3.

0.3.1.

0.5.

0.7.

0.8.

0.9.

9.26.

9.26.1.

9.26.2.

9.26.3.

9.26.3.1.

9.26.3.2.

9.26.3.3.

9.27.

9.27.1.

9.27.2.

9.27.3.

9.27.3.1.

9.27.3.2.

9.27.3.3.

Explanatory note:

This information document is based on the template laid down in Annex I to Commission Implementing Regulation (EU) 2020/683 and shall be completed with the relevant information under the point numbers listed above as defined in that template.

PART 2

TECHNICAL SPECIFICATIONS

Section A

Definitions and general provisions

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

1.1. '*standard equipment*' means the basic configuration of a vehicle which is equipped with all the features that are required under the regulatory acts referred to in Annex II to Regulation (EU) 2018/858, including all features that are fitted without giving rise to any further specifications on configuration or equipment level;

1.2. '*optional equipment*' means all the features not included in the standard equipment which are fitted to a vehicle under the responsibility of the manufacturer that can be ordered by the customer;

1.3. '*mass in running order*' means:

(a) in the case of a motor vehicle:

the mass of the vehicle, with its fuel tank(s) filled to at least 90 % of its or their capacity/ies, including the mass of the driver, of the fuel and liquids, fitted with the standard equipment in accordance with the manufacturer's specifications and, when they are fitted, the mass of the bodywork, the cabin, the coupling and the spare wheel(s) as well as the tools;

(b) in the case of a trailer:

the mass of the vehicle including the fuel and liquids, fitted with the standard equipment in accordance with the manufacturer's specifications, and, when they are fitted, the mass of the bodywork, additional coupling(s), the spare wheel(s) and the tools;

1.4. '*mass of the optional equipment*' means the maximum mass of the combinations of optional equipment which may be fitted to the vehicle in addition to the standard equipment, in accordance with the manufacturer's specifications;

1.5. '*actual mass of the vehicle*' means the mass in running order plus the mass of the optional equipment fitted to an individual vehicle;

1.6. '*technically permissible maximum laden mass (M)*' means the maximum mass allocated to a vehicle on the basis of its construction features and its design performances; the technically permissible laden mass of a trailer or of a semi-trailer includes the static mass transferred to the towing vehicle when coupled;

1.7. '*technically permissible maximum laden mass of the combination (MC)*' means the maximum mass allocated to the combination of a motor vehicle and one or more trailers on the basis of its construction features and its design performances or the maximum mass allocated to the combination of a tractor unit and a semi-trailer;

1.8. '*technically permissible maximum towable mass (TM)*' means the maximum mass of one or more trailers that may be towed by a towing vehicle which corresponds to the total load transmitted to the ground by the wheels of an axle or a group of axles on any trailer coupled to the towing vehicle;

1.9. '*axle*' means the common axis of rotation of two or more wheels whether power-driven or freely rotating, and whether in one or more segments located in the same plane perpendicular to the longitudinal centre-line of the vehicle;

1.10. '*group of axles*' means a number of axles having an axle spacing that is restricted to one of the axle spacing referred to as distance 'd' in Annex I to Directive 96/53/EC and which interact due to the specific design of the suspension;

1.11. '*solo axle*' means an axle that cannot be considered as part of a group of axles;

1.12. '*technically permissible maximum mass on the axle (m)*' means the mass corresponding to the maximum permissible static vertical load transmitted to the ground by the wheels of the axle, on the basis of the construction features of the axle and of the vehicle and their design performances;

1.13. '*technically permissible maximum mass on a group of axles (μ)*' means the mass corresponding to the maximum permissible static vertical load transmitted to the ground by the wheels of the group of axles, on the basis of the construction features of the group of axles and of the vehicle and their design performances;

1.14. '*coupling*' means a mechanical device including component items as defined in paragraphs 2.1. to 2.6. of Regulation No 55 of the Economic Commission for Europe of the United Nations (UN/ECE) ([1]) and a close-coupling device as defined in paragraph 2.1.1. of UN Regulation No 102 of the Economic Commission for Europe of the United Nations (UN/ECE) ([2]);

1.15. '*coupling point*' means the centre of engagement of the coupling fitted to a towed vehicle within the coupling fitted to a towing vehicle;

1.16. '*mass of the coupling*' means the mass of the coupling itself and of the parts necessary for the attachment of the coupling to the vehicle;

1.17. '*technically permissible maximum mass at the coupling point*' means:

(a) in the case of a towing vehicle, the mass, corresponding to the maximum permissible static vertical load on the coupling point ('S' or 'U' value) of a towing vehicle, on the basis of the construction features of the coupling and of the towing vehicle;

(b) in the case of a semi-trailer, a centre-axle trailer or a rigid drawbar trailer, the mass corresponding to the maximum permissible static vertical load ('S' or 'U' value) to be transferred by the trailer to the towing vehicle at the coupling point, on the basis of the construction features of the coupling and of the trailer;

([1]) Regulation No 55 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of mechanical coupling components of combinations of vehicles (OJ L 153, 15.6.2018, p.179).

([2]) Regulation No 102 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of I. A close-coupling device (CCD) II. Vehicles with regard to the fitting of an approved type of CCD (OJ L 351, 20.12.2008, p.44).

1.18. '*mass of the passengers*' means a rated mass depending on the vehicle category multiplied by the number of seating positions including, if any, the seating positions for crew members and the number of standees, but not including the driver;

1.19. '*mass of the driver*' means a mass rated at 75 kg located at the driver's seating reference point;

1.20. '*pay-mass*' means the difference between the technically permissible maximum laden mass and the mass in running order increased by the mass of the passengers and the mass of the optional equipment;

1.21. '*length*' means the dimension defined in points 6.1.1., 6.1.2. and 6.1.3. of Standard ISO 612:1978; this definition also applies to articulated vehicles made up of two or more sections;

1.22. '*width*' means the dimension defined in point 6.2. of Standard ISO 612:1978;

1.23. '*height*' means the dimension defined in point 6.3. of Standard ISO 612:1978;

1.24. '*wheelbase*' means the following:

(a) for motor vehicles and drawbar trailers, the horizontal distance between the centre of the first and the last axle;

(b) for centre-axle trailers, semi-trailers and rigid drawbar trailers, the distance between the vertical axis of the coupling and the centre of the last axle;

1.25. '*axle spacing*' means the distance between two consecutive axles; for centre-axle trailers, semi-trailers and rigid drawbar trailer, the first axle spacing is the horizontal distance between the vertical axis of the front coupling and the centre of the first axle;

1.26. '*track*' means the distance referred to in point 6.5. of Standard ISO 612:1978;

1.27. '*fifth wheel lead*' means the distance referred to in point 6.19.2. of Standard ISO 612:1978 in, taking into account the note referred to in point 6.19. of the same standard;

1.28. '*front fitting radius of semi-trailer*' means the horizontal distance from the axis of the kingpin to any point at the front of the semi-trailer;

1.29. '*front overhang*' means the horizontal distance between the vertical plane passing through the first axle or the kingpin axle in the case of a semi-trailer and the foremost point of the vehicle;

1.30. '*rear overhang*' means the horizontal distance between the vertical plane passing through the last rear axle and the rearmost point of the vehicle; where the vehicle is fitted with a coupling that is not removable, the rearmost point of the vehicle is the coupling point;

1.31. '*length of the loading area*' means the distance from the foremost internal point to the rearmost internal point of the cargo area, measured horizontally in the longitudinal plane of the vehicle;

1.32. '*rear swing-out*' means the distance between the initial point and the actual extreme point reached by the rear end of a vehicle when manoeuvring in the conditions specified in point 8 of Section B of Part 2 or in point 7 of Section C of Part 2 of this Annex;

1.33. '*axle-lift device*' means a mechanism fitted to a vehicle for the purpose of raising the axle clear off the ground and lowering it to the ground;

1.34. '*lift axle or retractable axle*' means an axle which can be raised from its normal position and re-lowered by an axle-lift device;

1.35. '*loadable axle*' means an axle the load on which can be varied without the axle being raised by the use of an axle-lift device;

1.36. '*air suspension*' means a suspension system on which at least 75 % of the spring effect is caused by the air spring;

1.37. '*class of a bus or of a coach*' means a set of vehicles as defined in paragraphs 2.1.1. and 2.1.2. of UN Regulation No 107– Uniform provisions concerning the approval of category M_2 or M_3 vehicles with regard to their general construction ([3]);

1.38. 'articulated vehicle' means a vehicle of category M_2 or M_3 as defined in paragraph 2.1.3. of UN Regulation No 107;

1.39. 'indivisible load' means a load that cannot, for the purposes of carriage by road, be divided into two or more loads without undue expense or risk of damage and which, owing to its mass or dimension, cannot be carried by a vehicle the masses and dimensions of which comply with the maximum authorised masses and dimensions applicable in a Member State.

2. General provisions

2.1. The following masses shall be determined by the manufacturer for each version within a vehicle type, irrespective of the state of completion of the vehicle:

(a) the technically permissible maximum laden mass;

(b) the technically permissible maximum laden mass of the combination;

(c) the technically permissible maximum towable mass;

(d) the technically permissible maximum mass on the axles or the technically permissible maximum mass on a group of axles;

(e) the technically permissible maximum masses at the coupling point(s), taking into account the technical features of the couplings that are fitted or can be fitted to the vehicle.

2.1.1. When determining the masses referred to in point 2.1, the manufacturer shall apply the best practices of good engineering and the best available technical knowledge in order to minimise the risks of mechanical failure, in particular those due to fatigue of materials, and to avoid damage to the road infrastructure.

2.1.2. When determining the masses referred to in point 2.1, the manufacturer shall apply the maximum speed by construction of the vehicle.

Where the vehicle is equipped by the manufacturer with a speed limitation device, the maximum speed by construction shall be the true speed permitted by the speed limitation device.

2.1.3. When determining the masses referred to in point 2.1., the manufacturer shall not impose restrictions on the use of the vehicle except those concerning the tyre capacities that can be adjusted to the speed by construction as is allowed under UN Regulation No 54.

([3]) OJ L 255, 29.09.2010, p. 1.

2.1.4. For incomplete vehicles, including chassis-cabin vehicles, that require a further stage of completion, the manufacturer shall provide all relevant information to the next stage manufacturers so that the requirements of this Regulation continue to be fulfilled.

For the purposes of the first paragraph, the manufacturer shall specify the position of the center of gravity of the mass corresponding to the sum of the load.

2.1.5. Incomplete vehicles of categories M_2, M_3, N_2 and N_3 not fitted with a bodywork shall be designed so as to allow the subsequent stage manufacturers to be able to fulfil the requirements of points 7 and 8 in Section C and points 6 and 7 in Section D.

3. For the purposes of mass distribution calculations, the manufacturer shall provide the type-approval authority, for each technical configuration within the vehicle type as determined by the set of values of the relevant points in the information document in accordance with Section A of Part 1 with the information necessary to identify the following masses:

(a) the technically permissible maximum laden mass;

(b) the technically permissible maximum mass on the axles or group of axles;

(c) the technically permissible maximum towable mass;

(d) the technically permissible maximum mass at the coupling point(s);

(e) the technically permissible maximum laden mass of the combination.

The information shall be provided in tabular or any other appropriate format, agreed to by the approval authority.

3.1. Where the optional equipment significantly affects the masses and dimensions of the vehicle, the manufacturer shall provide the technical service with the location, mass and geometrical position of the gravity centre with respect to the axles of the optional equipment that can be fitted to the vehicle.

However, where the optional equipment is made up of several parts located in various spaces in the vehicle, the manufacturer may instead provide the technical service with the distribution of the mass of the optional equipment on the axles only.

3.2. For groups of axles, the manufacturer shall indicate the load distribution among the axles of the total mass applied to the group of axles. Where necessary, the manufacturer shall state the distribution formulae or produce the relevant distribution graphs.

3.3. The manufacturer shall, upon a request by the type-approval authority or the technical service, make available for test purposes a vehicle representative of the type to be approved.

3.4. The vehicle manufacturer may submit an application for recognition of the equivalence of a suspension to air suspension to the type-approval authority.

3.4.1. The equivalence of a suspension to air suspension shall be recognised by the type-approval authority where the requirements set out in Section L are fulfilled.

3.4.2. Where the equivalence of a suspension to air suspension is recognised by the technical service, the latter shall issue a test report, which together with a technical description of the suspension shall be attached to the EU type-approval certificate.

4. Special provisions as regards registration/in-service maximum permissible masses

4.1. For the purposes of registration and entry into service of vehicles type-approved under this Regulation, national authorities may determine, for each variant and version within the type of vehicle, all of the following masses that are permitted for national traffic or for international traffic under Directive 96/53/EC:

(a) the registration/in-service maximum permissible laden mass;

(b) the registration/in-service maximum permissible mass on the axle(s);

(c) the registration/in-service maximum permissible mass on the group of axles;

(d) the registration/in-service maximum permissible towable mass;

(e) the registration/in-service maximum permissible laden mass of the combination.

4.2. National authorities shall establish the procedure for the determination of the registration/in service maximum permissible masses referred to in point 4.1. They shall designate the competent authority entrusted with the determination of those masses, and shall specify the information that must be provided to that competent authority.

4.3. The registration/in-service maximum permissible masses determined in accordance with the procedure referred to in point 4.1. shall not exceed the maximum masses referred to in point 2.1.

4.4. The manufacturer shall be consulted by the competent authority as regards the mass distribution on the axles or group of axles in order to ensure the proper functioning of the systems of the vehicle, in particular the brake- and steering system.

4.5. When determining the registration/in-service maximum permissible masses, national authorities shall ensure that the requirements of the regulatory acts listed in Parts I and II of Annex II to Regulation (EU) 2018/858 continue to be fulfilled.

4.6. Where national authorities conclude that the requirements of one of the regulatory acts listed in Parts I and II of Annex II to Regulation (EU) 2018/858, with the exception of this Regulation, are no longer fulfilled, they shall require that fresh tests are conducted and a new type-approval or an extension as the case may be, be granted by the type-approval authority that has granted the initial type-approval under the regulatory act in question.

Section B

Vehicles of category M_1 and N_1

1. Maximum authorised dimensions

1.1. The dimensions shall not exceed the following values:

1.1.1. Length: 12,00 m.

1.1.2. Width:

(a) M_1: 2,55 m;

(b) N_1: 2,55 m;

(c) N_1: 2,60 m for vehicles fitted with a bodywork with insulated walls of at least 45 mm thick, having bodywork code 04 or 05, as referred to in Appendix 2 to Annex I to Regulation (EU) 2018/858;

1.1.3. Height: 4,00 m.

1.2. For the purposes of measurement of the length, width and height, the vehicle shall be at its mass in running order, placed on a horizontal and flat surface with tyres inflated at the pressure recommended by the manufacturer.

1.3. The devices and equipment referred to in Section E shall not be taken into account for the determination of the length, width and height.

2. Mass distribution

2.1. The sum of the technically permissible maximum mass on the axles shall not be less than the technically permissible maximum laden mass of the vehicle.

2.2. The technically permissible maximum laden mass of the vehicle shall not be less than the mass of the vehicle in running order plus the mass of the passengers plus the mass of the optional equipment plus the mass of the coupling if not included in the mass in running order.

2.3. Where the vehicle is laden to the technically permissible maximum laden mass, the mass on each axle shall not exceed the technically permissible maximum mass on that axle.

2.4. Where the vehicle is laden to the technically permissible maximum laden mass, the mass on the front axle shall in no event be less than 30 % for M_1 vehicles, and no less than 20 % for N_1 vehicles of the technically permissible maximum laden mass of the vehicle.

2.5. Where the vehicle is laden to the technically permissible maximum laden mass plus the technically permissible maximum mass at the coupling point, the mass on the front axle shall in no event be less than 20 % of the technically permissible maximum laden mass of the vehicle.

2.6. Where a vehicle is equipped with removable seats, the verification procedure shall be limited to the condition with the maximum number of seating positions.

2.7. For the purposes of verifying the requirements laid down in points 2.2., 2.3. and 2.4.:

(a) The seats shall be adjusted as prescribed in point 2.7.1.;

(b) The masses of the passengers, the pay-mass and the mass of the optional equipment shall be distributed as prescribed in points 2.7.2. to 2.7.4.2.3.

2.7.1. Seat adjustment

2.7.1.1. The seats where adjustable shall be moved to their rearmost position.

2.7.1.2. Where there are other possibilities for adjusting the seat (vertical, angled, seat back, etc.) the adjusted positions shall be as specified by the vehicle manufacturer.

2.7.1.3. In the case of suspension seats, the seat shall be locked in the position specified by the manufacturer.

2.7.2. Distribution of the mass of passengers

2.7.2.1. The mass representing each passenger shall be 75 kg.

2.7.2.2. The mass for each passenger shall be located at the seating reference point (i.e. the 'R point' of the seat).

2.7.2.3. In the case of special purpose vehicle, the requirement of point 2.7.2.2 shall apply mutatis mutandis (for example, mass of an injured person lying on the stretcher in the case of an ambulance).

2.7.3. Distribution of the mass of the optional equipment

2.7.3.1. The mass of the optional equipment shall be distributed in accordance with the manufacturer's specifications.

2.7.4. Distribution of the pay-mass

2.7.4.1. M_1 vehicles

2.7.4.1.1. As regards M_1 vehicles, the pay-mass shall be distributed in accordance with the manufacturer's specifications in agreement with the technical service.

2.7.4.1.2. As regards motor caravans the minimum pay-mass (PM) shall meet the following requirement:

$$PM \text{ in kg} \geq 10 (n + L)$$

Where

'*n*' is the maximum number of passengers plus the driver and

'*L*' is the overall length of the vehicle in metre

2.7.4.2. N_1 vehicles

2.7.4.2.1. As regards vehicles with bodywork, the pay-mass shall be distributed uniformly on the cargo bed;

2.7.4.2.2. As regards vehicles without bodywork (e.g. chassis-cab), the manufacturer shall state the extreme permissible positions of the centre of gravity of the pay-mass increased by the mass of the equipment intended to accommodate goods (e.g. bodywork, tank, etc.) (for instance: from 0,50 m to 1,30 m in front of the first rear axle);

2.7.4.2.3. As regards vehicles intended to be fitted with a fifth wheel coupling, the manufacturer shall state the minimum and maximum fifth wheel lead.

2.8. Additional requirements where the vehicle is capable of towing a trailer

2.8.1. The requirements referred to in points 2.2., 2.3. and 2.4. shall apply taking into account the mass of the coupling and the technically permissible maximum mass at the coupling point.

2.8.2. Without prejudice to the requirements of point 2.4., the technically permissible maximum mass on the rear axle(s) may be exceeded by not more than 15 %.

2.8.2.1. Where the technically permissible maximum mass on the rear axle(s) is exceeded by not more than 15 %, the requirements of paragraph 5.2.4.1. of UN Regulation No 142 ([4]) shall apply.

2.8.2.2. In the Member States where the road traffic legislation allows it, the manufacturer may indicate in an appropriate supporting document, such as the owner's manual or the maintenance book that the technically permissible maximum laden mass of the vehicle may be exceeded by not more than 10 % or 100 kg, whichever value is lower.

([4]) UN Regulation No 142 – Uniform provisions concerning the approval of motor vehicles with regard to the installation of their tyres [2020/242] (OJ L 48,21.2.2020, p.60).

This allowance shall apply only when towing a trailer in the conditions specified in point 2.8.2.1. provided that the operating speed is restricted to 100 km/h or less.

3. Towable mass and mass at the coupling point

3.1. As regards the technically permissible maximum towable mass, the following requirements shall apply:

3.1.1. Trailer fitted with a service braking system

3.1.1.1. The technically permissible maximum towable mass of the vehicle shall be the lowest of the following values:

(a) the technically permissible maximum towable mass based on the construction features of the vehicle and the strength of the coupling;

(b) the technically permissible maximum laden mass of the towing vehicle;

(c) 1.5 times the technically permissible maximum laden mass of the towing vehicle in the case of an off-road vehicle as defined in Part A of Annex I to Regulation (EU) 2018/858.

3.1.1.2. However, the technically permissible maximum towable mass shall in no case exceed 3 500 kg.

3.1.2. Trailer without a service braking system

3.1.2.1. The permissible towable mass shall be the lowest of the following values:

(a) the technically permissible maximum towable mass based on the construction features of the vehicle and the strength of the coupling;

(b) half of the mass in running order of the towing vehicle.

3.1.2.2. The technically permissible maximum towable mass shall in no case exceed 750 kg.

3.2. The technically permissible maximum mass at the coupling point shall not be less than 4 % of the maximum permissible towable mass and not be less than 25 kg

3.3. The manufacturer shall specify in the owner's manual the technically permissible maximum mass at the coupling point, the mounting points of the coupling on the towing vehicle and the maximum permissible rear overhang for the coupling point.

3.4. The technically permissible maximum towable mass shall not be defined by reference to the number of passengers.

4. Mass of the combination

The technically permissible maximum laden mass of the combination shall not exceed the sum of the technically permissible maximum laden mass plus the technically permissible maximum towable mass.

5. Hill starting ability

5.1. The towing vehicle shall be able to start the vehicle combination five times on an uphill gradient of at least 12 % within five minutes.

5.2. In order to conduct the test described in point 5.1., the towing vehicle and the trailer shall be laden as to equal the technically permissible maximum laden mass of the combination.

Section C

Vehicles of category M_2 and M_3

1. Maximum authorised dimensions

1.1. The dimensions shall not exceed the following values:

1.1.1. Length

(a) Vehicle with two axles and one section: 13,50 m

(b) Vehicle with three or more axles and one section: 15,00 m

(c) Articulated vehicle: 18,75 m

1.1.2. Width: 2,55 m;

1.1.3. Height: 4,00 m

1.2. For the purposes of measurement of the length, width and height, the vehicle shall be at its mass in running order, placed on a horizontal and flat surface with tyres inflated at the pressure recommended by the manufacturer.

1.3. The devices and equipment referred to in Section E shall not be taken into account for the determination of the length, width and height.

1.3.1. Additional requirements for aerodynamic devices referred to in Section E

1.3.1.1. Aerodynamic devices and equipment not exceeding 500 mm in length in the in-use position shall not increase the overall usable cargo space. They shall be constructed in such a way as to make it possible to lock them in the retracted or folded and the in-use positions. Such devices and equipment shall furthermore be constructed so as to be retractable or foldable when the vehicle is at stand-still in such a way that the maximum authorised width of the vehicle referred to in point 1.1.2. is not exceeded by more than 25 mm on each side of the vehicle and the maximum authorised length of the vehicle referred to in point 1.1.1. is not exceeded by more than 200 mm as permitted only from a height above the ground of at least 1 050 mm so that they do not impair the capability of the vehicle to be used for intermodal transport. In addition, the requirements set out in points 1.3.1.1.1. and 1.3.1.1.3. shall be met.

1.3.1.1.1. The aerodynamic devices and equipment shall be type-approved in accordance with this Regulation.

1.3.1.1.2. It shall be possible for the operator to vary the position of the aerodynamic devices and equipment, and to retract or fold it, by applying a manual force not exceeding 40 daN. In addition, this may be done automatically as well.

1.3.1.1.3. It is not required for aerodynamic devices and equipment to be retractable or foldable if the maximum dimensional requirements are fully complied with under all conditions.

1.3.1.2. Aerodynamic devices and equipment exceeding 500 mm in length in the in-use position shall not increase the overall usable cargo space. They shall be constructed in such a way as to make it possible to lock them in both the retracted or folded and the in-use positions. Such devices and equipment shall furthermore be constructed so as to be retractable or foldable when the vehicle is at stand-still in such a way that the

maximum authorised width of the vehicle referred to in point 1.1.2. is not exceeded by more than 25 mm on each side of the vehicle and the maximum authorised length of the vehicle referred to in point 1.1.1. is not exceeded by more than 200 mm as permitted only from a height above the ground of at least 1 050 mm so that they do not impair the capability of the vehicle to be used for intermodal transport. In addition, the requirements set out in points 1.3.1.2.1. to 1.3.1.2.4. shall be met.

1.3.1.2.1. The aerodynamic devices and equipment shall be type-approved in accordance with this Regulation.

1.3.1.2.2. It shall be possible for the operator to vary the position of the aerodynamic devices and equipment, and to retract or fold it, by applying a manual force not exceeding 40 daN. In addition, this may be done automatically as well.

1.3.1.2.3. Each main vertical element or combination of elements and main horizontal element or combination of elements forming the aerodynamic devices and equipment shall, when installed on the vehicle and in the in-use position, withstand vertical and horizontal traction and push forces, applied sequentially in up, down, left and right direction, of 200 daN ± 10 % applied statically to the geometric centre of the relevant perpendicular projected surface, at a maximum pressure of 2,0 MPa. The aerodynamic devices and equipment may deform, but the system for adjustment and locking shall not release as a result of the applied forces. The deformation shall be limited to ensure that the maximum authorised width of the vehicle is not exceeded by more than 25 mm on each side of the vehicle, during and after the test.

1.3.1.2.4. Each main vertical element or combination of elements and main horizontal element or combination of elements forming the aerodynamic devices and equipment shall also, when in the retracted or folded position, withstand a horizontal traction force applied in longitudinal rearward direction, of 200 daN ± 10 % applied statically to the geometric centre of the relevant perpendicular projected surface, at a maximum pressure of 2,0 MPa. The aerodynamic devices and equipment may deform, but the system for adjustment and locking shall not release as a result of the applied forces. The deformation shall be limited to ensure that the maximum authorised width of the vehicle is not exceeded by more than 25 mm on each side of the vehicle and the maximum authorised length of the vehicle is not exceeded by more than 200 mm.

1.3.1.3. It shall be verified by the technical service, to the satisfaction of the type-approval authority that aerodynamic devices and equipment positioned in both, the in-use and the retracted or folded positions, do not significantly impair cooling and ventilation of the powertrain, exhaust system and passenger cabin. All other applicable requirements relating to the vehicle systems shall be fully complied with when the aerodynamic devices and equipment are placed in both their in-use and retracted or folded positions.

By way of derogation concerning the applicable requirements relating to rear underrun protection, the horizontal distances between the rear of the rear underrun protection device and the rear extremity of the vehicle as fitted with aerodynamic devices and equipment may be measured without taking the aerodynamic devices and equipment into account on condition that they exceed 200 mm in length, they are in the in-use condition and the fundamental sections of the elements placed at a height ≤ 2,0 m above the ground measured in unladen condition are made of material having a hardness of < 60 Shore (A). Narrow ribs, tubing and metal wire forming a frame or substrate to support the fundamental sections of the elements shall not be taken into account when determining the hardness. However, in order to eliminate the risk of injuries and penetration of other vehicles in the event of a collision, any ends of such ribs, tubing and metal wire shall not be directed rearward, with the aerodynamic devices and equipment both in the retracted or folded and the in-use positions.

As alternative to the derogation referred to in the previous paragraph, the horizontal distances between the rear of the rear underrun protection device and the rear extremity of the vehicle as fitted with aerodynamic devices and equipment may be measured without taking the aerodynamic devices and equipment into account provided that they exceed 200 mm in length, they are in the in-use condition and those devices or equipment comply with the test provisions set out in Section I.

The horizontal distances between the rear of the rear underrun protection device and the rear extremity of the vehicle shall however be measured with the aerodynamic devices and equipment positioned in the retracted or folded position or take into account the resulting projection length in accordance with point 1.6.1. of Section I, if this length exceeds that of the retracted or folded position.

2. Mass distribution for vehicles fitted with bodywork

2.1. Calculation procedure

Notations:

'M'		technically permissible maximum laden mass;
'TM'		technically permissible maximum towable mass;
'MC'		technically permissible maximum laden mass of the combination;
'm_i'		technically permissible maximum laden mass on the solo axle designated 'i', where 'i' varies from 1 to the total number of axles of the vehicle;
'm_c'		technically permissible maximum mass at the coupling point;
'μ_j'		the technically permissible maximum mass on the group of axles designated 'j', where j varies from 1 to the total number of groups of axles.

2.1.1. Suitable calculations shall be carried out in order to make sure that the following requirements are fulfilled for each technical configuration within the type.

2.1.2. In the case of vehicles fitted with loadable axles, the following calculations shall be carried out with the suspension of the axles loaded in the normal operating configuration.

2.1.3. In the case of alternatively fuelled or zero-emission motor vehicles:

2.1.3.1. The additional weight required for alternative fuel or zero-emission technology in accordance with points 2.3. and 2.4. of Annex I to Directive 96/53/EC shall be defined on the basis of the documentation provided by the manufacturer. The correctness of the declared information shall be verified by the Technical Service, to the satisfaction of the Type-Approval Authority.

2.1.3.2. The manufacturer shall indicate the following additional symbol as well as the value of the additional weight below or to the side of the mandatory inscriptions on the manufacturer's statutory plate, outside a clearly marked rectangle which shall enclose only the mandatory information.

'96/53/EC ARTICLE 10B COMPLIANT – XXXX KG'

The height of the symbol's characters and stated value shall not be less than 4 mm.

In addition, until the introduction of a dedicated entry in the Certificate of Conformity, the value of the additional weight shall be stated under 'remarks' in the Certificate of Conformity as to allow inclusion of this information in on-board vehicle registration papers.

2.2. General requirements

2.2.1. The sum of the technically permissible maximum mass on the solo axles plus the sum of the technically permissible maximum mass on the groups of axles shall not be less than the technically permissible maximum laden mass of the vehicle.

$$M \leq \sum [m_i + \mu_j]$$

2.2.2. The mass of the vehicle in running order, plus the mass of the optional equipment, the mass of the passengers, the masses 'WP' and 'B' referred to in point 2.2.3, plus the mass of the coupling if not included in the mass in running order, plus the technical permissible maximum mass at the coupling point shall not exceed the technically permissible maximum laden mass.

2.2.3. Load distribution

2.2.3.1. Notations

'P'		number of seating positions, not including the driver and crew member(s);
'Q'		mass of one passenger in kg;
'Qc'		mass of one crew member in kg;
'S_1'		area in m^2 for standing passengers;
'SP'		number of standing passengers stated by the manufacturer;
'Ssp'		rated space for one standing passenger in m^2;
'WP'		number of wheelchair spaces multiplied by 250 kg representing the mass of a wheelchair and user;
'V'		total volume of baggage compartments in m^3 including luggage compartments, racks and ski-box;
'B'		maximum permissible mass of the luggage in kg stated by the manufacturer, including the maximum permissible mass (B') that may be transported in the ski-box if any.

2.2.3.2. The mass Q and Q_c of the seated passengers shall be located at the seating reference points (i.e. the 'R point' of the seat).

2.2.3.3. The mass corresponding to the number SP of standing passengers of mass Q shall be uniformly distributed over the surface available for standing passenger S_1.

2.2.3.4. Where appropriate, the mass WP shall be uniformly distributed over each wheelchair space.

2.2.3.5. A mass equal to B (kg) shall be uniformly distributed in the luggage compartments.

2.2.3.6. A mass equal to B' (kg) shall be located at the centre of gravity of the ski-box.

2.2.3.7. The technically permissible maximum mass at the coupling point shall be located at the coupling point the rear overhang of which is stated by the vehicle manufacturer.

2.2.3.8. Values of Q and Ssp values

Vehicle class	Q (kg)	Ssp (m^2)
Class I and A	68	0,125 m^2
Class II	71	0,15 m^2
Class III and B	71	Not applicable

2.3. The assumed mass of each crew member shall be 75 kg.

2.3.1. The number of standing passengers shall not exceed the value S_1/Ssp, where Ssp is the rated space provided for one standing passenger as specified in the table in point 2.2.3.8.

2.3.1.1. The value of the maximum permissible mass of the luggage shall be not less than:

$$B = 100 \times V$$

2.3.2. Calculations

2.3.2.1. The requirements of point 2.2.2. shall be verified in all interior arrangement configurations.

2.3.2.2. In the conditions specified in point 2.2.3. the mass on each solo axle and on each group of axles shall not exceed the technically permissible maximum mass on that axle or group of axles.

2.3.2.3. In the case of a vehicle equipped with a variable seating capacity, with an area available for standing passengers (S_1) and equipped for the carriage of wheelchairs, compliance with the requirements of points 2.2.2. and 2.2.4.2. shall be verified for each of the following conditions as applicable:

(a) with all possible seats occupied followed by the remaining area for standing passengers (up to the standing capacity limit declared by the manufacturer, if reached) and, if space remains, any wheelchair spaces occupied;

(b) with all possible standing areas occupied (up to the standing capacity limit stated by the manufacturer) followed by the remaining seats available for seated passengers and, if space remains, any wheelchair spaces occupied;

(c) with all possible wheelchair spaces occupied followed by the remaining area for standing passengers (up to the standing capacity limit stated by the manufacturer, if reached) and then the remaining seats available for use occupied.

2.3.3. Where the vehicle is laden as specified in point 2.2.2. the mass corresponding to the load on the front steering axle(s) shall in no case be less than 20 % of the technically permissible maximum laden mass 'M'.

2.3.3.1. In the case of an articulated vehicle with at least 4 axles of class I having two steered axles, the mass corresponding to the load on the front steering axle(s) shall in no case be less than 15 % of the technically permissible maximum laden mass 'M'.

2.3.4. Where a vehicle is to be type-approved to more than one class, the requirements of Section 2 shall apply to each class.

3. Towing capacity

3.1. The technically permissible maximum laden mass of the combination shall not exceed the sum of the technically permissible maximum laden mass plus the technically permissible maximum towable mass.

$$MC \leq M + TM$$

3.2. The technically permissible maximum towable mass shall not exceed 3 500 kg.

4. Technically permissible maximum mass at the coupling point

4.1. The technically permissible maximum mass at the coupling point shall be at least equal to 4 % of its technically permissible maximum towable mass, or 25 kg, whichever is the greater.

4.2. The manufacturer shall specify in the owner's manual the conditions for the attachment of the coupling to the motor vehicle.

4.2.1. Where appropriate the conditions referred to in point 4.2. shall include the technically permissible maximum mass at the coupling point of the towing vehicle, the maximum permissible mass of the coupling device, the mounting points of the coupling and the maximum permissible rear overhang of the coupling.

5. Hill-starting ability

5.1. Vehicles designed to tow a trailer shall be capable of starting five times within five minutes at an up-hill gradient of at least 12 %.

5.2. For performing the test described in point 5.1., the towing vehicle and the trailer shall be laden so as to equal the technically permissible maximum laden mass of the combination.

6. Engine power

6.1. The engine shall provide a power output of at least 5 kW per tonne of the technically permissible maximum laden mass of the combination or of the technically permissible maximum laden mass of the solo vehicle where the vehicle is not designed to tow a trailer.

The requirements in this point shall not apply to the electric-only driving mode of hybrid electric vehicles.

6.2. The engine power shall be measured in accordance with UN Regulation No 85 ([5]).

7. Manoeuvrability

7.1. The vehicle shall be capable of manoeuvring on either side of a complete trajectory of 360° as shown in figure 1 in Section H without any of the vehicle's outermost points protruding beyond the outer circle or intruding inside the inner circle as the case may be.

([5]) UN Regulation No 85 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of internal combustion engines or electric drive trains intended for the propulsion of motor vehicles of categories M and N with regard to the measurement of net power and the maximum 30 minutes power of electric drive trains (OJ L 326, 24.11.2006, p. 55).

7.1.1. The test shall be conducted with the vehicle in both the unladen conditions (i.e. at its mass in running order) and loaded to its technically maximum permissible laden mass. If the vehicle is equipped with aerodynamic devices or equipment referred to in points 1.3.1.1. and 1.3.1.2., the devices and equipment shall be in the deployed and in-use position.

7.1.2. For the purposes of point 7.1, the parts permitted to protrude beyond the vehicle width referred to in Section F shall not be taken into account.

7.2. For vehicles fitted with a loadable axle, the requirement of point 7.1 shall also apply where the loadable axle(s) is in service.

7.3. The requirements of point 7.1. shall be verified as follows:

7.3.1. The vehicle shall manoeuvre inside a circular area defined by two concentric circles, the outer circle having a radius of 12,50 m and the inner circle having a radius of 5.30 m.

7.3.2. The outermost front point of the motor vehicle shall be guided along the contour of the outer circle (see figure 1 in Section H).

7.4. With the agreement of the Technical Service and the Type-Approval Authority, the manoeuvrability requirements may be proved by computer simulation in accordance with Annex VIII to Regulation (EU) 2018/858. In case of doubt, the Technical Service or Type-Approval Authority may require a physical full-scale test to be carried out.

8. Rear swing-out

8.1. Vehicle with one section

8.1.1. The vehicle shall be tested in accordance with the drive-in test method described in point 8.1.2. If the vehicle is equipped with aerodynamic devices or equipment referred to in points 1.3.1.1. and 1.3.1.2., the devices and equipment shall be in the deployed and in-use position.

8.1.2. Drive-in test method

The vehicle shall be stationary, a vertical plane tangential to the side of the vehicle and facing outwards from the circle shall be established by marking a line on the ground.

The vehicle shall be moved from a straight line approach into the circular area described Figure 1 with its front wheels turned such as the front outermost point follows the contour of the outer circle (see Figure 2a of Section H).

8.1.3. The vehicle shall be set to its mass in running order.

8.1.4. The maximum rear swing-out shall not exceed 0,60 m.

8.2. Vehicles with two or more sections

8.2.1. The requirements of point 8.1. shall apply *mutatis mutandis* as regards vehicles with two or more sections.

In such a case, the two or more rigid sections shall be aligned with the plane as shown in figure 2b of Section H.

8.3. With the agreement of the Technical Service and the Type-Approval Authority, the maximum rear swing-out requirements may be proved by computer simulation in accordance with Annex VIII to Regulation (EU) 2018/858. In case of doubt, the Technical Service or Type-Approval Authority may require a physical full-scale test to be carried out.

Section D

Vehicles of category N_2 and N_3

1. Maximum authorised dimensions

1.1. The dimensions shall not exceed the following values:

1.1.1. Length: 12,00 m.

1.1.2. Width:

(a) 2,55 m for any vehicle;

(b) 2,60 m for vehicles fitted with a bodywork with insulated walls of at least 45 mm thick, having bodywork code 04 or 05, as referred to in Appendix 2 of Part C of Annex I to Regulation (EU) 2018/858.

1.1.3. Height: 4,00 m

1.2. For the purposes of measurement of the length, width and height, the vehicle shall be at its mass in running order, placed on a horizontal and flat surface with tyres inflated at the pressure recommended by the manufacturer.

1.3. The devices and equipment referred to in Section F shall not be taken into account for the determination of the length, width and height.

1.3.1. Additional requirements for aerodynamic devices referred to in Section F

1.3.1.1. Aerodynamic devices and equipment not exceeding 500 mm in length in the in-use position shall not increase the usable length of the loading area. They shall be constructed in such a way as to make it possible to lock them in both the retracted or folded and the in-use positions. Such devices and equipment shall furthermore be constructed so as to be retractable or foldable when the vehicle is at stand-still in such a way that the maximum authorised width of the vehicle is not exceeded by more than 25 mm on each side of the vehicle and the maximum authorised length of the vehicle is not exceeded by more than 200 mm as permitted only from a height above the ground of at least 1 050 mm so that they do not impair the capability of the vehicle to be used for intermodal transport. In addition, the requirements set out in points 1.3.1.1.1. and 1.3.1.1.3. shall be met.

1.3.1.1.1. The devices and equipment shall be type-approved in accordance with this Regulation.

1.3.1.1.2. It shall be possible for the operator to vary the position of the aerodynamic devices and equipment, and to retract or fold it, by applying a manual force not exceeding 40 daN. In addition, this may be done automatically as well.

1.3.1.1.3. It is not required for devices and equipment to be retractable or foldable if the maximum dimensional requirements are fully complied with under all conditions.

1.3.1.2. Aerodynamic devices and equipment exceeding 500 mm in length in the in-use position shall not increase the usable length of the loading area. They shall be constructed in such a way as to make it possible to lock them in both the retracted or folded and in-use positions. Such devices and equipment shall furthermore be constructed so as to be retractable or foldable when the vehicle is at stand-still in such a way that the maximum authorised width of the vehicle is not exceeded by more than 25 mm on each side of the vehicle and the maximum authorised length of the vehicle is not exceeded by more than 200 mm as permitted only from a height above the ground of at least 1 050 mm so that they do not impair the capability of the vehicle to be used for intermodal transport. In addition, the requirements set out in points 1.3.1.2.1. to 1.3.1.2.4. below shall be met.

1.3.1.2.1. The devices and equipment shall be type-approved in accordance with this Regulation.

1.3.1.2.2. It shall be possible for the operator to vary the position of the aerodynamic devices and equipment, and retract or fold it, by applying a manual force not exceeding 40 daN. In addition, this may be done automatically as well.

1.3.1.2.3. Each main vertical element or combination of elements and main horizontal element or combination of elements forming the devices and equipment shall, when installed on the vehicle and in the in-use position, withstand vertical and horizontal traction and push forces, applied sequentially in up, down, left and right direction, of 200 daN ± 10 % applied statically to the geometric centre of the relevant perpendicular projected surface, at a maximum pressure of 2,0 MPa. The devices and equipment may deform, but the system for adjustment and locking shall not release as a result of the applied forces. The deformation shall be limited to ensure that the maximum authorised width of the vehicle is not exceeded by more than 25 mm on each side of the vehicle, during and after the test.

1.3.1.2.4. Each main vertical element or combination of elements and main horizontal element or combination of elements forming the devices and equipment shall also, when in the retracted or folded position, withstand a horizontal traction force applied in longitudinal rearward direction, of 200 daN ± 10 % applied statically to the geometric centre of the relevant perpendicular projected surface, at a maximum pressure of 2,0 MPa. The devices and equipment may deform, but the system for adjustment and locking shall not release as a result of the applied forces. The deformation shall be limited to ensure that the maximum authorised width of the vehicle is not exceeded by more than 25 mm on each side of the vehicle and the maximum authorised length of the vehicle is not exceeded by more than 200 mm.

1.3.1.3. Aerodynamic devices and equipment of cabs, both in the retracted or folded and in-use position, where applicable, shall be constructed in such a way that the maximum authorised width of the vehicle is not exceeded by more than 25 mm on each side of the vehicle and that they do not impair the capability of the vehicle to be used for intermodal transport. In addition, the requirements set out in points 1.3.1.3.1. to 1.3.1.3.4. below shall be met.

1.3.1.3.1. Aerodynamic devices and equipment for cabs shall be type-approved in accordance with this Regulation.

1.3.1.3.2. When installed on a vehicle and both in the retracted or folded and in-use positions, where applicable, no part of the aerodynamic devices and equipment shall be above the lower windscreen edge, unless it is not directly visible to the driver due to the instrument panel or other standard interior fittings.

1.3.1.3.3. The aerodynamic devices and equipment shall be covered with energy absorbing material. Alternatively, the devices and equipment shall consist of material having a hardness of < 60 Shore (A) in accordance with point 1.3.1.4.

1.3.1.3.4. The aerodynamic devices and equipment shall not be constructed of material that is prone to breakage into sharp fragments or jagged edges.

1.3.1.4. It shall be verified by the technical service, to the satisfaction of the type-approval authority that aerodynamic devices and equipment referred to in points 1.3.1.1., 1.3.1.2. and 1.3.1.3. positioned in both, the in-use and retracted or folded positions, do not impair the driver's forward field of vision and the windscreen wash and wipe functions, as well as do not significantly impair the cooling and ventilation of the powertrain, exhaust system, braking system, occupant cabin and loading area. All other applicable requirements relating to the vehicle systems shall be fully complied with when the devices and equipment are placed in both their in-use and retracted or folded positions.

By way of derogation concerning the applicable requirements relating to front underrun protection, the horizontal distances between the foremost part of the vehicle as fitted with aerodynamic devices and equipment and its front underrun protective device as well as the rear of the rear underrun protection device and the rear extremity of the vehicle as fitted with aerodynamic devices and equipment may be measured without taking the devices and equipment into account on condition that at the rear they exceed 200 mm in length, they are in the in-use condition and that at the front and rear the fundamental sections of the elements placed at a height ≤ 2,0 m above the ground measured in unladen condition are made of material having a hardness of < 60 Shore (A). Narrow ribs, tubing and metal wire forming a frame or substrate to support the fundamental sections of the elements shall not be taken into account when determining the hardness. However, in order to eliminate the risk of injuries and penetration of other vehicles in the event of a collision, any ends of such ribs, tubing and metal wire shall not be directed forward at the front and rearward at the rear of the vehicle, with the aerodynamic devices and equipment both in the retracted or folded and the in-use positions.

As alternative to the derogation concerning the rear underrun protection device referred to in the previous paragraph, the horizontal distances between the rear of the rear underrun protection device and the rear extremity of the vehicle as fitted with aerodynamic devices and equipment may be measured without taking the aerodynamic devices and equipment into account provided that they exceed 200 mm in length, they are in the in-use condition and those devices or equipment comply with the test provisions set out in Section I.

The horizontal distances between the rear of the rear underrun protection device and the rear extremity of the vehicle shall however be measured with the aerodynamic devices and equipment positioned in the retracted or folded position or take into account the resulting projection length in accordance with point 1.6.1. of Section I, if this length exceeds that of the retracted or folded position.

1.4. Elongated cabs

1.4.1. Where the front fascia of the motor vehicle's cab location, including all external projections of for example the chassis, bumper, wheel guards and wheels, fully conforms to parameters of the three-dimensional envelope as set out in Section I and the length of the loading area does not exceed 10,5 m, the vehicle may exceed the maximum authorised length set out in point 1.1.1.

1.4.2. In the case referred to in point 1.4.1., the manufacturer shall indicate the following additional symbol below or to the side of the mandatory inscriptions on the manufacturer's statutory plate, outside a clearly marked rectangle which shall enclose only the mandatory information.

'96/53/EC ARTICLE 9A COMPLIANT'

The height of the symbol's characters shall not be less than 4 mm. The text '96/53/EC ARTICLE 9A COMPLIANT' shall also be added to the 'remarks' in the Certificate of Conformity as to allow inclusion of this information in on-board vehicle registration papers.

2. Mass distribution for vehicles fitted with bodywork

2.1. Calculation procedure

Notations:

'M'		technically permissible maximum laden mass;
'TM'		technically permissible maximum towable mass;

'MC'		technically permissible maximum laden mass of the combination;
'm_i'		the technically permissible maximum mass on the solo axle designated 'i', where i varies from 1 to the total number of axles of the vehicle;
'm_c'		technically permissible maximum mass at the coupling point;
'μ_j'		the technically permissible maximum mass on the group of axles designated 'j', where j varies from 1 to the total number of groups of axles.

2.1.1. Suitable calculations shall be carried out in order to make sure that the requirements set out in points 2.2. and 2.3. are fulfilled for each technical configuration within the type.

2.1.2. In the case of vehicles fitted with loadable axles, the calculations required under points 2.2. and 2.3. shall be carried out with the suspension of loadable axles in the normal running configuration.

2.1.3. In the case of vehicles fitted with lift axles, the calculations required under points 2.2 and 2.3. shall be carried out with the axles lowered.

2.1.4. In the case of alternatively fuelled or zero-emission motor vehicles:

2.1.4.1. The additional weight required for alternative fuel or zero-emission technology in accordance with point 2.3. of Annex I to Directive 96/53/EC shall be defined on the basis of the documentation provided by the manufacturer. The correctness of the declared information shall be verified by the Technical Service, to the satisfaction of the Type-Approval Authority.

2.1.4.2. The manufacturer shall indicate the following additional symbol as well as the value of the additional weight below or to the side of the mandatory inscriptions on the manufacturer's statutory plate, outside a clearly marked rectangle which shall enclose only the mandatory information.

'96/53/EC ARTICLE 10B COMPLIANT – XXXX KG'

The height of the symbol's characters and stated value shall not be less than 4 mm.

In addition, until the introduction of a dedicated entry in the Certificate of Conformity, the value of the additional weight shall be stated under 'remarks' in the Certificate of Conformity as to allow inclusion of this information in on-board vehicle registration papers.

2.2. General requirements

2.2.1. The sum of the technically permissible maximum mass on the solo axles plus the sum of the technically permissible maximum mass on the groups of axles shall not be less than the technically permissible maximum laden mass of the vehicle.

$$M \leq \sum [m_i + \mu_j]$$

2.2.2. For each group of axles designated 'j', the sum of the technically permissible maximum mass on its axles shall not be less than the technically permissible maximum mass on the group of axles.

In addition, each of the masses m_i shall not be less than the part of μ_j applying on the axle 'i' as determined by the mass distribution for that group of axles.

2.3. Specific requirements

2.3.1. The mass of the vehicle in running order, plus the mass of the optional equipment plus the mass of the passengers, plus the mass of the coupling if not included in the mass in running order plus the technically permissible maximum mass at the coupling point shall not exceed the technically permissible maximum laden mass of the vehicle.

2.3.2. Where the vehicle is laden to its technically permissible maximum laden mass, the mass distributed on an axle 'i' shall not exceed the mass m_i on that axle, and the mass on the group of axles 'j' shall not exceed the mass μ_j.

2.3.3. The requirements of point 2.3.2 shall be complied with in the following load configurations:

2.3.3.1. Uniform distribution of the pay-mass:

The vehicle shall be at its mass in running order plus the mass of the optional equipment plus the mass of the passengers located at the seating reference points, plus the mass of the coupling (if not included in the mass in running order), plus the maximum permissible mass at the coupling point, plus the pay-mass being distributed uniformly on the cargo area.

2.3.3.2. Non-uniform distribution of pay-mass:

The vehicle shall be at its mass in running order plus the mass of the optional equipment plus the mass of the passengers located at the seating reference points, plus the mass of the coupling (if not included in the mass in running order), plus the maximum permissible mass at the coupling point, plus the pay-mass located in accordance with the manufacturers specifications.

For such purposes the manufacturer shall state the extreme permissible possible positions of the centre of gravity of the pay-mass and/or body and/or equipment or interior fittings (for instance: from 0,50 m to 1,30 m in front of the first rear axle).

2.3.3.3. Combination of uniform and non-uniform distribution:

The requirements of points 2.3.3.1. and 2.3.3.2. shall be fulfilled simultaneously.

Example, a tipper lorry (distributed load) equipped with an additional crane (localised load).

2.3.3.4. Mass transferred by the fifth wheel coupling (tractor unit for semi-trailer):

The vehicle shall be at its mass in running order plus the mass of the optional equipment plus the mass of the passengers located at the seating reference points, plus the mass of the coupling if not included in the mass in running order, plus the maximum permissible mass at the fifth wheel coupling point located in accordance with the manufacturers' specifications (minimum and maximum fifth-wheel lead).

2.3.3.5. The requirements of points 2.3.3.1. shall always be fulfilled where the vehicle is fitted with a flat cargo area.

2.3.4. Where the vehicle is laden to its technically permissible maximum laden mass, plus the mass of the coupling if not included in the mass in running order, plus the maximum permissible mass at the coupling point in such a way that the maximum permissible maximum mass on the rear group of axle (μ) or the maximum permissible maximum on the rear axle (m) is reached, the mass on the front steering axle(s) shall not be less than 20 % of the technically permissible maximum laden mass of the vehicle.

2.3.5. As regards special purposes vehicles of category N_2 and N_3, the technical service shall check compliance with the requirements of Section 2 in agreement with the manufacturer, taking into account the specific design of the vehicle (for example, mobile cranes).

3. Towing capacity

3.1. The technically permissible maximum laden mass of the combination shall not exceed the sum of the technically permissible maximum laden mass plus the technically permissible maximum towable mass.

4. Hill-starting ability and gradeability

4.1. Vehicles designed to tow a trailer and laden to their technically permissible maximum laden mass of the combination shall be capable of starting five times within five minutes at an up-hill gradient of at least 12 %.

4.2. As regard gradeability, off road vehicles shall be tested against the technical requirements of Section K.

4.2.1. The requirements of Section 5 of Appendix 1 to Annex I to Regulation (EU) 2018/858 shall also apply.

5. Engine power

5.1. Vehicles shall provide an engine power output of at least 5 kW per tonne of the technically permissible maximum laden mass of the combination.

5.1.1. In the case of a road tractor, or a tractor unit for semi-trailer intended for the transport of indivisible loads, the engine power shall be at least 2 kW per tonne of the technically permissible maximum laden mass of the combination.

5.1.2. The requirements in points 5.1. and 5.1.1. shall not apply to the electric-only driving mode of hybrid electric vehicles.

5.2. The engine power shall be measured in accordance with UNECE Regulation No 85.

6. Manoeuvrability

6.1. The vehicle shall be capable of manoeuvring on either side of a complete trajectory of 360° as shown in Figure 1 of Section H without any of the vehicle's outermost points protruding beyond the outer circle or intruding inside the inner circle as the case may be.

6.1.1. The test shall be conducted with the vehicle in both the unladen conditions (i.e. at its mass in running order) and loaded to its technically maximum permissible laden mass. If the vehicle is equipped with aerodynamic devices or equipment referred to in points 1.3.1.1., 1.3.1.2. and 1.3.1.3., the devices and equipment shall be in the deployed and in-use position or in the fixed in-use position where applicable for devices and equipment covered by point 1.3.1.3.

6.1.2. For the purposes of point 6.1., the parts permitted to protrude beyond the vehicle width referred to in Section F shall not be taken into account.

6.2. For vehicles fitted with axle-lift devices, the requirement of point 6.1. shall also apply with the lift axle(s) in the lifted position and where the loadable axle(s) is in service.

6.3. The requirements of point 6.1. shall be verified as follows:

6.3.1. The vehicle shall manoeuvre inside an area defined by two concentric circles, the outer circle having a radius of 12,50 m and the inner circle having a radius of 5,30 m

6.3.2. The outermost front point of the motor vehicle shall be guided along the contour of the outer circle (see Figure 1 of Section H)

6.4. With the agreement of the Technical Service and the Type-Approval Authority, the manoeuvrability requirements may be proved by computer simulation in accordance with Annex VIII to Regulation (EU) 2018/858. In case of doubt, the Technical Service or Type-Approval Authority may require a physical full-scale test to be carried out.

7. Maximum rear swing-out

7.1. The vehicle shall be tested in accordance with the steady-state test method described in point 7.1.1. If the vehicle is equipped with aerodynamic devices or equipment referred to in points 1.3.1.1., 1.3.1.2. and 1.3.1.3., the devices and equipment shall be in the deployed and in-use position.

7.1.1. Steady-state test method

7.1.1.1. The vehicle shall be stationary and shall have its front steered wheels so directed that if the vehicle moves, its outermost point would describe a circle of 12,50 m radius.

A vertical plane tangential to the side of the vehicle and facing outwards from the circle shall be established by marking a line on the ground.

The vehicle shall move forward such as the front outermost point follows the contour of the outer circle of 12,50 m radius.

7.2. The maximum rear swing-out shall not exceed: (see Figure 3 of Section I)

(a) 0,80 m;

(b) 1,00 m where the vehicle if fitted with an axle-lift device and the axle is cleared off the ground;

(c) 1,00 m where the rearmost axle is a steered axle.

7.3. With the agreement of the Technical Service and the Type-Approval Authority, the maximum rear swing-out requirements may be proved by computer simulation in accordance with Annex VIII to Regulation (EU) 2018/858. In case of doubt, the Technical Service or Type-Approval Authority may require a physical full-scale test to be carried out.

Section E

Vehicles of category O

1. Maximum authorised dimensions

1.1. The dimensions shall not exceed the following values:

1.1.1. Length

(a) Trailer: 12,00 m including drawbar;

(b) Semi-trailer: 12,00 m plus the front overhang.

1.1.2. Width

(a) 2,55 m for any vehicle;

(b) 2,60 m for vehicles fitted with a bodywork with insulated walls of at least 45 mm thick, having bodywork code 04 or 05 of Appendix 2 to Annex I to Regulation (EU) 2018/858.

1.1.3. Height: 4,00 m.

1.1.4. Front fitting radius of semi-trailer: 2,04 m.

1.2. For the purposes of measurement of the length, width and height, the vehicle shall be at its mass in running order, placed on a horizontal and flat surface with tyres inflated at the pressure recommended by the manufacturer.

1.3. The measurement of the length, height and front fitting radius shall be conducted where the loading surface or the reference surface referred to in point 1.2.1. second subparagraph of Annex 7 to UN Regulation No 55 is horizontal.

Adjustable drawbars shall be horizontal and aligned with the centre-line of the vehicle. They shall be set at their horizontal most elongated position.

1.4. The devices and equipment referred to in Section F shall not be taken into account for the determination of the length, width and height.

1.4.1. Additional requirements for aerodynamic devices referred to in Section F

1.4.1.1. Aerodynamic devices and equipment not exceeding 500 mm in length in the in-use position shall not increase the usable length of the loading area. They shall be constructed in such a way as to make it possible to lock them in both the retracted or folded and the in-use positions. Such devices and equipment shall furthermore be constructed so as to be retractable or foldable when the vehicle is at stand-still in such a way that the maximum authorised width of the vehicle is not exceeded by more than 25 mm on each side of the vehicle and the maximum authorised length of the vehicle is not exceeded by more than 200 mm as permitted only from a height above the ground of at least 1 050 mm so that they do not impair the capability of the vehicle to be used for intermodal transport. In addition, the requirements set out in points 1.4.1.1.1. to 1.4.1.1.3. shall be met.

1.4.1.1.1. The devices and equipment shall be type-approved in accordance with this Regulation.

1.4.1.1.2. It shall be possible for the operator to vary the position of the aerodynamic devices and equipment, and to retract or fold it, by applying a manual force not exceeding 40 daN. In addition, this may be done automatically as well.

1.4.1.1.3. It is not required for devices and equipment to be retractable or foldable if the maximum dimensional requirements are fully complied with under all conditions.

1.4.1.2. Aerodynamic devices and equipment exceeding 500 mm in length in the in-use position shall not increase the usable length of the loading area. They shall be constructed in such a way to make it possible to lock them in both the retracted or folded and the in-use positions. Such devices and equipment shall furthermore be constructed so as to be retractable or foldable when the vehicle is at stand-still in such a way that the maximum authorised width of the vehicle is not exceeded by more than 25 mm on each side of the vehicle and the maximum authorised length of the vehicle is not exceeded by more than 200 mm as permitted only from a height above the ground of at least 1 050 mm so that they do not impair the capability of the vehicle to be used for intermodal transport. In addition, the requirements set out in points 1.4.1.2.1. to 1.4.1.2.4. shall be met.

1.4.1.2.1. The devices and equipment shall be type-approved in accordance with this Regulation.

1.4.1.2.2. It shall be possible for the operator to vary the position of the aerodynamic devices and equipment, and retract or fold it, by applying a manual force not exceeding 40 daN. In addition, this may be done automatically as well.

1.4.1.2.3. Each main vertical element or combination of elements and main horizontal element or combination of elements forming the devices and equipment shall, when installed on the vehicle and in the in-use position, withstand vertical and horizontal traction and push forces, applied sequentially in up, down, left and right direction, of 200 daN ± 10 % applied statically to the geometric centre of the relevant perpendicular projected surface, at a maximum pressure of 2,0 MPa. The devices and equipment may deform, but the system for adjustment and locking shall not release as a result of the applied forces. The deformation shall be limited to ensure that the maximum authorised width of the vehicle is not exceeded by more than 25 mm on each side of the vehicle, during and after the test.

1.4.1.2.4. Each main vertical element or combination of elements and main horizontal element or combination of elements forming the devices and equipment shall also, when in the retracted or folded position, withstand a horizontal traction force applied in longitudinal rearward direction, of 200 daN ± 10 % applied statically to the geometric centre of the relevant perpendicular projected surface, at a maximum pressure of 2,0 MPa. The devices and equipment may deform, but the system for adjustment and locking shall not release as a result of the applied forces. The deformation shall be limited to ensure that the maximum authorised width of the vehicle is not exceeded by more than 25 mm on each side of the vehicle and the maximum authorised length of the vehicle is not exceeded by more than 200 mm.

1.4.1.3. It shall be verified by the technical service, to the satisfaction of the type-approval authority that aerodynamic devices and equipment positioned in both, the in-use and the retracted or folded positions, do not completely block the ventilation of the loading area. All other applicable requirements relating to the vehicle systems shall be fully complied with when the devices and equipment are placed in both their in-use and retracted or folded positions.

By way of derogation concerning the applicable requirements relating to rear underrun protection, the horizontal distances between the rear of the rear underrun protection device and the rear extremity of the vehicle as fitted with aerodynamic devices and equipment may be measured without taking the devices and equipment into account on condition that they exceed 200 mm in length, they are in the in-use condition and the fundamental sections of the elements placed at a height ≤ 2,0 m above the ground measured in unladen condition are made of material having a hardness of < 60 Shore (A). Narrow ribs, tubing and metal wire forming a frame or substrate to support the fundamental sections of the elements shall not be taken into account when determining the hardness. However, in order to eliminate the risk of injuries and penetration of other vehicles in the event of a collision, any ends of such ribs, tubing and metal wire shall not be directed rearward at the rear of the vehicle, with the aerodynamic devices and equipment both in the retracted or folded and the in-use positions.

As alternative to the derogation referred to in the previous paragraph, the horizontal distances between the rear of the rear underrun protection device and the rear extremity of the vehicle as fitted with aerodynamic devices and equipment may be measured without taking the aerodynamic devices and equipment into account provided that they exceed 200 mm in length, they are in the in-use condition and those devices or equipment comply with the test provisions set out in Section I.

The horizontal distances between the rear of the rear underrun protection device and the rear extremity of the vehicle shall however be measured with the aerodynamic devices and equipment positioned in the retracted or folded position or take into account the resulting projection length in accordance with point 1.6.1. of Section I, if this length exceeds that of the retracted or folded position.

2. Mass distribution for vehicles fitted with bodywork

2.1. Calculation procedure

Notations:

'M'		technically permissible maximum laden mass;
'm_0'		technically permissible maximum mass at the front coupling point;
'm_i'		the technically permissible maximum mass on the axle designated 'i', where i varies from 1 to the total number of axles of the vehicle;
'm_c'		technically permissible maximum mass at the rear coupling point;
'μ_j'		the technically permissible maximum mass on the group of axles designated 'j', where j varies from 1 to the total number of groups of axles.

2.1.1. Suitable calculations shall be carried out in order to make sure that the requirements set out in points 2.2. and 2.3. are fulfilled for each technical configuration within the type.

2.1.2. In the case of vehicles fitted with loadable axles, the calculations required under points 2.2. and 2.3. shall be carried out with the suspension of loadable axles in the normal running configuration.

2.1.3. In the case of vehicles fitted with lift axles, the calculations required under points 2.2. and 2.3. shall be carried out with the axles lowered.

2.2. General requirements

2.2.1. The sum of the technically permissible maximum mass at the front coupling point plus the technically permissible maximum mass on the solo axles and/or group(s) of axles plus the technically permissible maximum mass at the rear coupling point shall be not less than the technically permissible maximum laden mass of the vehicle.

$$M \leq \Sigma [m_0 + m_i + m_c] \text{ or } M \leq \Sigma [m_0 + \mu_j + m_c].$$

2.2.2. For each group of axles designated 'j', the sum of the masses m_i on its axles shall not be less than the mass μ_j.

In addition, each of the masses m_i shall not be less than the part of μ_j applying on the axle 'i' as determined by the mass distribution for that group of axles.

2.3. Specific requirements

2.3.1. The mass of the vehicle in running order, plus the mass of the optional equipment plus the technically permissible maximum mass at the coupling point(s) shall not exceed the technically permissible maximum laden mass of the vehicle.

2.3.2. Where the vehicle is laden to its technically permissible maximum laden mass, the mass distributed on a solo axle 'i' shall neither exceed the mass m_i on that axle, nor the mass μ_j on the group of axles, nor the technically permissible maximum mass at the coupling point m_0.

2.3.3. The requirements of point 2.3.2. shall be complied with in the following load configurations:

2.3.3.1. Uniform distribution of the pay-mass

The vehicle shall be at its mass in running order plus the mass of the optional equipment plus the pay-mass being distributed uniformly on the cargo area;

2.3.3.2. Non-uniform distribution of the pay-mass

The vehicle shall be at its mass in running order plus the mass of the optional equipment plus the pay-mass located in accordance with the manufacturer's specifications.

For such purposes the manufacturer shall state the extreme permissible possible positions of the centre of gravity of the pay-mass and/or body and/or equipment or interior fittings (for instance: from 0,50 m to 1,30 m in front of the first rear axle);

2.3.3.3. Combination of uniform and non-uniform distribution:

2.3.3.4. The requirements of points 2.3.3.1. and 2.3.3.2. shall be fulfilled simultaneously.

2.3.4. Specific requirements for trailer caravans

2.3.4.1. The minimum pay-mass (PM) shall meet the following requirement:

$$PM \text{ in kg} \geq 10\ (n+L)$$

Where

'n'		is the maximum number of berths and
'L'		is the overall length of the body length as defined in point 6.1.2. of Standard ISO 7237:1981.

3. Manoeuvrability requirements

3.1. Trailers and semi-trailers shall be so designed that, when coupled to a towing vehicle, the combination is capable of manoeuvring on either side of a complete trajectory of 360° made up of two concentric circles, the outer circle having a radius of 12,50 m and the inner circle having a radius of 5,30 m without any of the vehicle's outermost points of the towing vehicle protruding beyond the outer circle or any of the outermost points of the trailer or semi-trailer intruding inside the inner circle. If the trailer or semi-trailer is equipped with aerodynamic devices or equipment referred to in points 1.4.1.1. or 1.4.1.2., the devices and equipment shall be in the in-use and deployed position.

3.2. A semi-trailer not equipped with aerodynamic devices or equipment referred to in points 1.4.1.1. or 1.4.1.2. shall be deemed to comply with the requirement set out in point 3.1. if its reference wheelbase 'RWB' meets the following requirement:

$$RWB \leq [(12{,}50 - 2{,}04)^2 - (5{,}30 + \tfrac{1}{2}W)^2]^{\frac{1}{2}}$$

where:

'RWB'		is the distance between the king-pin axis and the centre line of the non-steering axles.
'W'		is the semi-trailer's width.

Where one or more of the non-steering axles has an axle lift device the reference wheelbase with the axle lowered or the axle lifted — whichever is the longest — shall be taken into account.

Section F

List of devices and equipment that are not required to be taken into account for the determination of the outermost dimensions

1. Subject to the additional restrictions provided in the following tables, the devices and equipment listed in Tables I, II and III are not required to be taken into account for the determination and calculation of the outermost dimensions where the following requirements are fulfilled:

(a) where devices are fitted at the front, with the exception of aerodynamic devices and equipment of cabs, the total protrusion of those devices shall not exceed 250 mm;

(b) the total protrusion of devices and equipment added to the length of the vehicle, with the exception of aerodynamic devices and equipment, shall not exceed 750 mm;

(c) the total protrusion of devices and equipment added to the width of the vehicle shall not exceed 100 mm.

2. The requirements set out in points (a), (b) and (c) of point 1 shall not apply to devices for indirect vision.

Table I

Vehicle length

Item		Vehicles categories									
		M_1	M_2	M_3	N_1	N_2	N_3	O_1	O_2	O_3	O_4
1.	Devices for indirect vision as defined in point 2.1. of UN Regulation No 46 [1]	x	x	x	x	x	x	x	x	x	x
2.	Wiper and washer devices	x	x	x	x	x	x				
3.	External sun visors	—	—	—	—	x	x	—	—	—	—
4.	Frontal protection system type-approved in accordance with this Regulation	x			x						
5.	Access steps and hand-holds	—	x	x	x	x	x	x	x	x	x
6.	Mechanical couplings	x	x	x	x	x	x	—	—	—	—
7.	Additional coupling at the rear of a trailer (when removable)	—	—	—	—	—	—	x	x	x	x
8.	Bike carrier (when removable or retractable)	x			x	—	—	—	—	—	—

Item		Vehicles categories									
		M_1	M_2	M_3	N_1	N_2	N_3	O_1	O_2	O_3	O_4
9.	Lift platforms, access ramps or similar equipment (when they are in undeployed position and do not protrude by more than 300 mm) provided that the loading capacity of the vehicle is not increased.	x	x	x	x	x	x	x	x	x	x
10.	Watching and detection aids including radars	—	x	x	—	x	x	x	x	x	x
11.	Resilient buffers and similar equipment	—	—	—	—	x	x	x	x	x	x
12.	Custom sealing devices and their protections	—	—	—	x	x	x	x	x	x	x
13.	Devices for securing the tarpaulin and their protection	x	—	—	x	x	x	x	x	x	x
14.	Length stops for demountable bodies	—	—	—	—	x	x	x	x	x	x
15.	Trolley booms of electrically-propelled vehicles	—	—	x	—	—	—	—	—	—	—
16.	Front or rear marking plates	—	x	x	—	x	x	x	x	x	x
17.	Optional lamps as defined in Section 2 of UN Regulation No 48 [2].	x	x	x	x	x	x	x	x	x	x
18.	Aerodynamic devices and equipment	—	x	x	—	x	x	—	—	x	x
19.	Antennas used for vehicle-to-vehicle or vehicle-to-infrastructure Communication	x	x	x	x	x	x	x	x	x	x

[1] Regulation No 46 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of devices for indirect vision and of motor vehicles with regard to the installation of these devices (OJ L 237, 8.8.2014, p.24).

[2] Regulation No 48 of the Economic Commission for Europe of the United Nations (UNECE) — Uniform provisions concerning the approval of vehicles with regard to the installation of lighting and light-signalling devices [2016/1723] (OJ L 14, 16.1.2019, p. 42).

Table II

Vehicle width

Item		Vehicles categories									
		M_1	M_2	M_3	N_1	N_2	N_3	O_1	O_2	O_3	O_4
1.	Devices for indirect vision as defined in paragraph 2.1. of UN Regulation No 46	x	x	x	x	x	x	x	x	x	x

Item		Vehicles categories									
		M_1	M_2	M_3	N_1	N_2	N_3	O_1	O_2	O_3	O_4
2.	The deflected part of the tyre walls at the point of contact with the road surface	x	x	x	x	x	x	x	x	x	x
3.	Tyre failure tell-tale devices	—	—	x	x	x	x	x	x	x	x
4.	Tyre-pressure indicators	—	—	x	x	x	x	x	x	x	x
5.	Side-marker lamps	x	x	x	x	x	x	x	x	x	x
6.	Lighting equipment										
	6.1. End-outline marker lamps	x	x	x	x	x	x	x	x	x	x
	6.2. Side-retro-reflectors	x	x	x	x	x	x	x	x	x	x
	6.3. Direction-indicator lamps	x	x	x	x	x	x	x	x	x	x
	6.4. Rear position lamps	—	—	—	—	x	x	x	x	x	x
	6.5. Service-door lighting systems	—	x	x	—	—	—	—	—	—	—
7.	Access ramps, lift platforms and similar equipment (when undeployed and provided that they do not exceed 10 mm from the side of the vehicle and the corners of the ramps facing forwards or rearwards are rounded to a radius of not less than 5 mm; the edges must be rounded to a radius of not less than 2,5 mm).	—	x	x	—	x	x	x	x	x	x
8.	Retractable lateral guidance devices intended for use on guided bus system, if not retracted.	—	—	x	—	—	—	—	—	—	—

Item		Vehicles categories									
		M_1	M_2	M_3	N_1	N_2	N_3	O_1	O_2	O_3	O_4
9.	Retractable steps when deployed and the vehicle is in stand-still position;	x	x	x	x	x	x	x	x	x	x
10.	Watching and detection aids including radars	—	x	x		x	x	x	x	x	x
11.	Aerodynamic devices and equipment The vehicle width, including that of conditioned body with insulated walls, shall not exceed 2 600 mm, including the measured projections, with the devices and equipment fixed in both the retracted or folded and the in-use positions.	—	x	x	—	x	x	—	—	x	x
12.	Customs sealing devices and their protection	—	—	—	x	x	x	x	x	x	x
13.	Devices for securing the tarpaulin and their protection not projecting by more than 20 mm where they are no more than 2,0 m from the ground level and no more than 50 mm where they are more than 2,0 m from the ground level. The edges shall be rounded to a radius of not less than 2,5 mm.	—	—	—	x	x	x	x	x	x	x
14.	Protruding flexible parts of a spray-suppression system referred to in this Regulation.	—	—	—	—	x	x	—	—	x	x
15.	Flexible mudguards not covered under entry 14.	—	x	x	x	x	x	x	x	x	x
16.	Snow chains	x	x	x	x	x	x	x	x	x	x

Item		Vehicles categories									
		M_1	M_2	M_3	N_1	N_2	N_3	O_1	O_2	O_3	O_4
17.	Safety railings on vehicle transporters. Only for vehicles designed and constructed to transport at least two other vehicles and for which the safety railings are more than 2,0 m but not more than 3,70 m from the ground and do not project by more than 50 mm from the outermost side of the vehicle. The vehicle width shall not exceed 2 650 mm.	—	—	—	—	x	x	—	—	x	x
18.	Antennas used for vehicle-to-vehicle or vehicle-to-infrastructure Communication	x	x	x	x	x	x	x	x	x	x
19.	Flexible hoses of tyre pressure monitoring systems provided that they do not protrude by more than 70 mm on each side from the outermost width of the vehicle						x			x	x

Table III

Vehicle height

		M_1	M_2	M_3	N_1	N_2	N_3	O_1	O_2	O_3	O_4
1.	Antennas used for radio, navigation, vehicle-to-vehicle or vehicle-to-infrastructure communication	x	x	x	x	x	x	x	x	x	x
2.	Pantographs or trolley booms in their elevated position	—	—	x	—	—	x	—	—	—	—

Section G

Permissible deviations for type-approval and conformity of production

1. **Dimensions**

1.1. Measurement of the overall length, width and height shall be carried out in accordance with point 1.2. of Sections B to E.

1.2. Under the condition that the limits specified in point 1.1. of Sections B to E are not exceeded, the actual dimensions may differ from those stated by the manufacturer by not more than 3 %.

2. **Mass in running order and actual mass of the vehicle**

2.1. The mass in running order shall be checked from the actual mass by weighing the vehicle and deducting the mass of the optional equipment fitted. For such purposes the weighing instrument shall comply with the requirements of Directive 2014/31/EU of the European Parliament and of the Council [6].

2.2. The mass in running order determined in accordance with the requirements of point 2.1. may deviate from the nominal value stated in point 2.6.(b) of Annex I to Regulation (EU) 2020/683 or in the relevant entry of the certificate of conformity by not more than:

(a) 3 % as regards the permissible lower and upper deviations (= the negative and positive deviation around the declared value) as regards M, N and O vehicles with the exception of special purpose vehicles;

(b) 5 % as regards the permissible lower and upper deviations (= the negative and positive deviation around the declared value) as regards special purpose vehicles;

(c) 5 % as regards the permissible lower and upper deviations (= the negative and positive deviation around the declared value) for the purposes of paragraphs (3) and (4) of Article 31 of Regulation (EU) 2018/858.

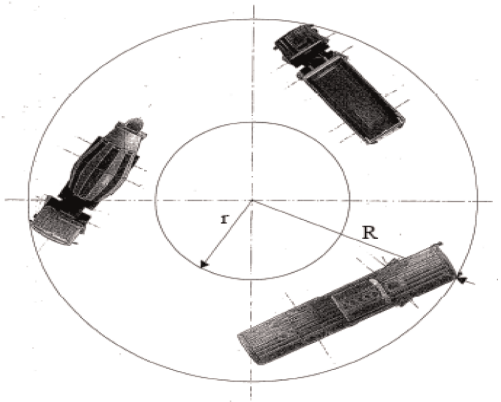
3. The permissible deviations referred to in this Section shall apply for the purposes of paragraphs (3) and (4) of Article 31 of Regulation (EU) 2018/858.

Section H

Figures regarding manoeuvrability requirements

Figure 1

Manoeuvrability circle r = 5,3 m R = 12,5 m



[6] OJ L 96, 29.3.2014, p. 107.

Figure 2

Drive-in method for M_2 and M_3 vehicles

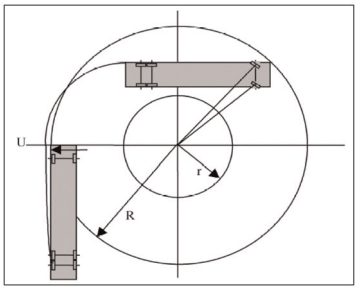


Figure 2a: rear swing-out (non-articulated vehicles)
R = 12,5 m
r = 5,3 m
U_{max} ≤ 60 cm

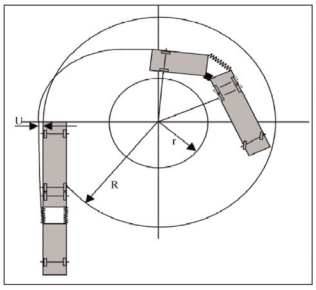
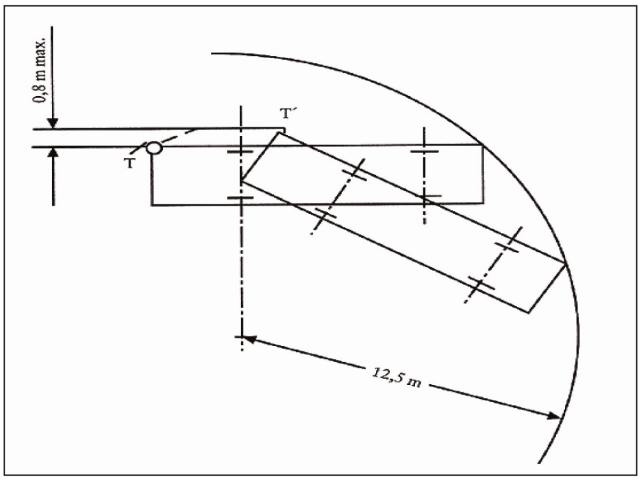


Figure 2b: rear swing-out (articulated vehicles)
R= 12,5 m
r = 5,3 m
U_{max} ≤ 60 cm

Figure 3

Steady-state method for N_2 and N_3 vehicles



Section I

Aerodynamic devices and equipment crash test

1. Test conditions for aerodynamic devices and equipment

1.1. At the request of the manufacturer the test shall be conducted on one of the following:

1.1.1. on a vehicle of the type for which the aerodynamic devices and equipment are intended;

1.1.2. on a part of the body of the vehicle type for which the aerodynamic devices and equipment are intended; that part shall be representative of the vehicle type(s) in question;

1.1.3. on a rigid wall.

1.2. Where the test is conducted as referred to in points 1.1.2. and 1.1.3., the parts used to connect the aerodynamic devices and equipment to a part of the vehicle body or to a rigid wall shall be equivalent to those which are used to secure the aerodynamic devices and equipment when it is installed on the vehicle. Every device shall be accompanied by installation and operating instructions giving sufficient information for any competent person to install it correctly.

1.3. At the request of the manufacturer the test procedure described in point 1.5. may be conducted by computer simulation in accordance with Annex VIII to Regulation (EU) 2018/858.

The mathematical model shall be validated only if it is comparable with the physical test conditions. To that effect, a physical test shall be conducted for the purposes of comparing the results obtained when using the mathematical model with the results of a physical test. Comparability of the test results shall be proven. A validation report shall be drafted by the manufacturer.

Any change made to the mathematical model or to the software likely to invalidate the validation report shall require a new validation in accordance with the previous paragraph.

1.4. Conditions for the conduct of tests or simulations.

1.4.1. The vehicle shall be at rest on a level, flat, rigid and smooth surface.

1.4.2. Any front wheels shall be in the straight ahead position.

1.4.3. The tyres shall be inflated to the pressure recommended by the vehicle manufacturer.

1.4.4. The vehicle shall be unladen.

1.4.5. The vehicle may, if necessary to achieve the test force required in point 1.5.1.2., be restrained by any method. This method shall be specified by the vehicle manufacturer.

1.4.6. Vehicles equipped with hydropneumatic, hydraulic or pneumatic suspension or a device for automatic levelling according to load shall be tested with the suspension or device in the normal running condition specified by the manufacturer.

1.5. Test procedure

1.5.1. The tests shall be carried out to assess that the aerodynamic devices and equipment offer a specified level of deformation to forces applied parallel to the longitudinal axis of the vehicle as referred to in point 1.6.1. Alternatively, the device may also become folded or retracted under the influence of force. The fulfilment of the requirement referred to in point 1.6.2. shall be verified by means of suitable test mandrels for the purpose of the crash test. The device used to distribute the test force over the stated flat surface shall be connected to the force actuator through a swivel joint. In cases of geometric incompatibilities an adapter may be used instead of a device with a flat surface.

1.5.1.1. A force shall be applied parallel to the longitudinal axis of the vehicle via a surface or adaptor not more than 250 mm in height and 200 mm wide with a radius of curvature of 5 ± 1 mm at the vertical edges. The surface shall not be rigidly fixed to the aerodynamic devices and equipment and shall be articulated in all directions. When the test is carried out on a vehicle as referred to in point 1.1.1., the height of the lower edge of the surface or adaptor shall be specified by the manufacturer in an area between the lowest edge of the aerodynamic devices and equipment and a point of the upper edge of the surface or adaptor that is no more than 2,0 m above the ground in vehicle-mounted condition (see figure 1). This point is to be specified on a laden vehicle with the technically permissible maximum laden mass.

Where the test is carried out on a part of the body of the vehicle type as referred to in point 1.1.2. or on a rigid wall as referred to in point 1.1.3., the height of the centre of the surface or adaptor shall be specified by the manufacturer in an area between the lowest edge of the aerodynamic devices and equipment and the point that represents the height of no more than 2,0 m above the ground in vehicle-mounted condition on a laden vehicle with the technically permissible maximum laden mass (see figure 2).

The exact location of the centre of the surface or adaptor in the area of application of forces shall be specified by the manufacturer. Where the aerodynamic devices and equipment have different degrees of stiffness in the area of application of the forces (e.g. due to reinforcements, different materials or thicknesses, etc.), the location of the centre of the surface or adaptor shall be located in the area with the highest resistance against external forces in longitudinal direction of the vehicle.

Figure 1

Test point height

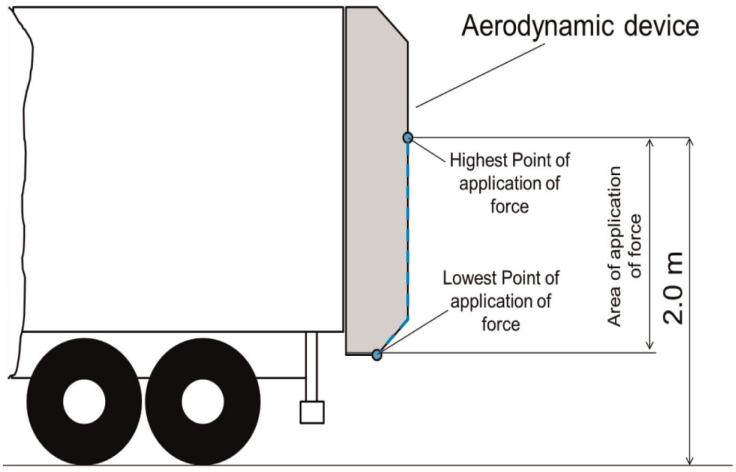
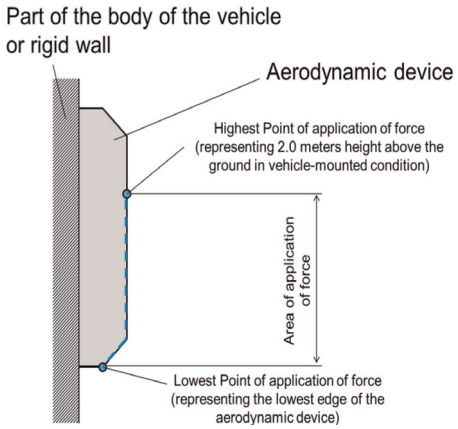


Figure 2

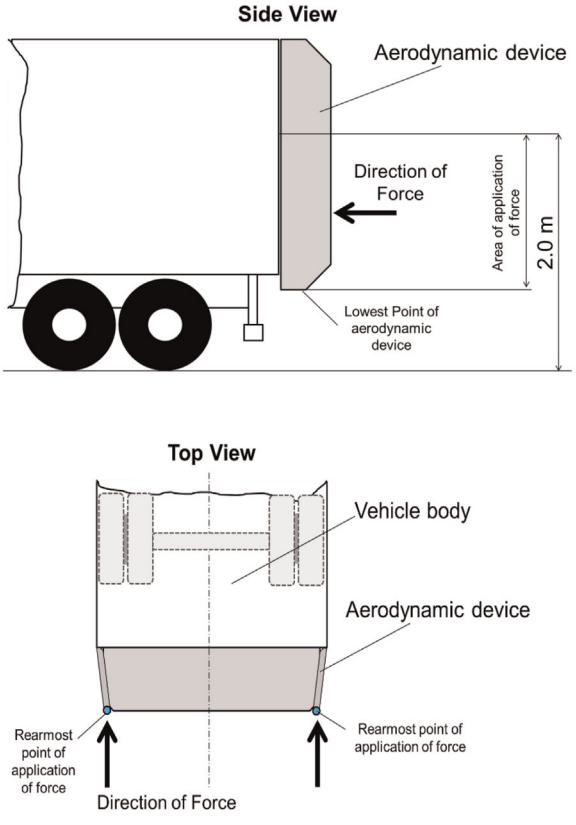
Example of test setup



1.5.1.1.1. A horizontal force of maximum 4 000 N ± 400 N shall be applied consecutively to two points situated symmetrically about the centre line of the vehicle or the centre line of the device on the rearmost outer edge of the aerodynamic devices and equipment in completely unfolded or in-use position (see figure 3). The order in which the forces are applied may be specified by the manufacturer.

Figure 3

Force application



1.6. Requirements

1.6.1. The aerodynamic devices and equipment shall be so fitted that, during the application of the test forces as specified in point 1.5.1.2., the devices and equipment deform, retract or fold resulting in projection length of ≤ 200 mm measured in horizontal longitudinal direction at the points of application of the forces. The resulting projection length shall be recorded.

1.6.2. The aerodynamic devices and equipment shall not endanger the occupants of other vehicles in a rear-end collision and shall not affect the operation of the rear underrun protection device.

Section J

Three-dimensional cab envelope

1. General procedure for the checking of conformity of the motor vehicle with the parameters relating to the three-dimensional cab envelope

1.1. Vertical boundaries of the motor vehicle cab assessment zone

1.1.1. The maximum width of the vehicle at cab location W_c shall be taken forward of the vertical transverse plane located at the foremost axle of the motor vehicle. The items listed in Section F shall not be taken into account for the purposes of this measurement.

1.1.2. The assessment zone of the motor vehicle's cab location shall be considered in such a way that it corresponds with the maximum width W_c. The zone shall be bounded by vertical longitudinal planes that are parallel to the longitudinal median plane of the motor vehicle and that are distance W_c apart.

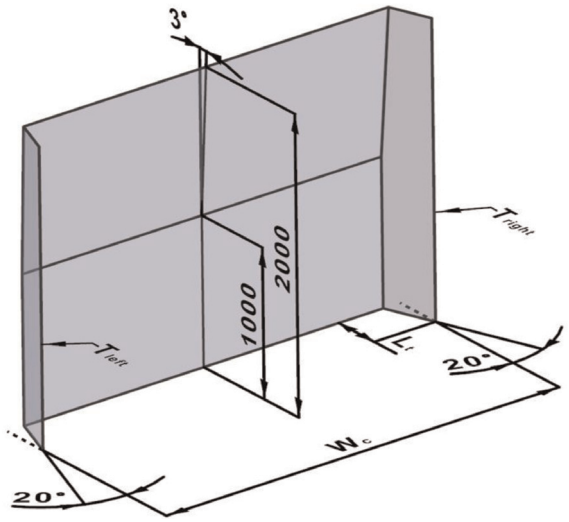
1.1.3. The horizontal longitudinal distance L_t shall be established from the most forward point of the motor vehicle's cab location taken at a height ≤ 2 000 mm from the ground measured in unladen condition.

The distance L_t shall be set at 200 mm for the purpose of this assessment (see Figure 1).

The rear side of the assessment zone shall be bounded by a vertical transverse plane, perpendicular to the longitudinal median plane of the motor vehicle, that is located rearward of the above mentioned most forward point by distance L_t.

Figure 1

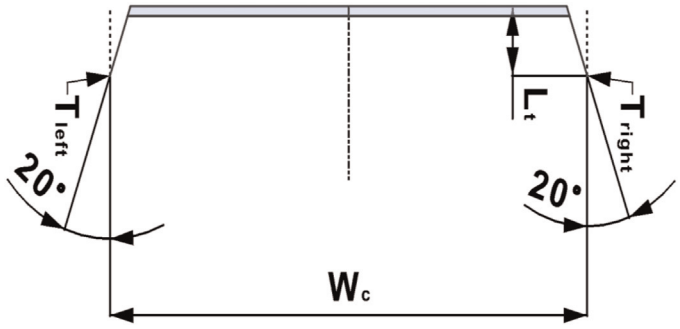
3D envelope



1.1.4. The intersections of the rear plane forming the side of the assessment zone with both angled outboard planes, lines T_{left} and T_{right}, shall be considered for the purpose of point 1.3.3.2. (see Figure 2).

Figure 2

3D envelope



1.2. Horizontal boundaries of the motor vehicle cab assessment zone

1.2.1. In the assessment zone, the lower front fascia boundary line shall be set at ground level and the upper front fascia boundary line shall be set at 2 000 mm above the ground as measured in unladen condition.

1.3. Specific provisions for the motor vehicle cab assessment zone

1.3.1. For the purposes of this Section, the front fascia at the motor vehicle's cab location shall be considered, regardless of type of material. However, the items listed in Section F shall not be taken into account.

1.3.2. Rake of the front of the cab

1.3.2.1. For the purposes of this Section, 'rake' shall be considered, meaning the rearward inclination of the motor vehicle's front fascia at the cab location from the vertical, where any point located above another point lies rearward of that other point.

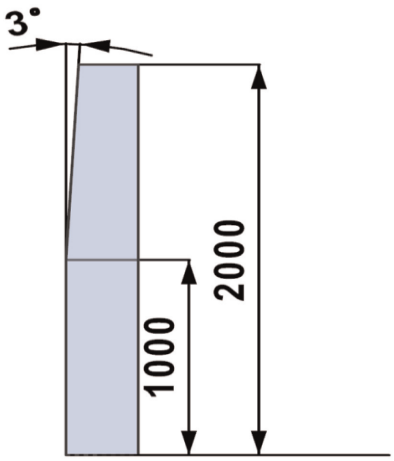
1.3.2.2. For the assessment zone of the rake, the most forward point of the motor vehicle's cab location as referred to in point 1.1.3. shall be considered.

The vertical transverse plane through the most forward point of the cab, taken at a height of ≤ 2 000 mm from the ground measured in unladen condition, shall be considered as regards its intersection with the horizontal plane that is located at the height of 1 000 mm. The intersecting line shall then be taken as the base envelope line to assess the vehicle cab's rake in the given assessment zone.

1.3.2.3. A plane rotating around the base envelope line referred to in the second paragraph of point 1.3.2.2., inclined rearward from the vertical by 3°, shall be taken (see Figure 3).

Figure 3

Rake



1.3.2.4. No point of the actual surface of the front fascia, as located in the assessment zone of the rake, shall lie forward of the rearward inclined plane referred to in point 1.3.2.3. when the most forward point of the motor vehicle's cab location touches the vertical transverse plane.

1.3.3. Tapering of the sides of the motor vehicle cab.

1.3.3.1. In the assessment zone of the motor vehicle's cab location, the front fascia shall be tapered in such a way that the relevant nominal surfaces generally converge towards a common area that lies forward of the cab and in the longitudinal median plane of the motor vehicle.

1.3.3.2. Two symmetrical vertical planes, one on the left side and one on the right side, shall be considered, both under a horizontal angle of 20° in relation to the longitudinal median plane and thus 40° apart. These planes are located in such a way that they also intersect with lines T_{left} and T_{right} referred to in point 1.1.4., respectively.

1.3.3.3. No point of the actual surface of the front fascia, as located in the left and right outboard zone, shall lie outward of the respective vertical plane referred to in point 1.3.3.2. with the most forward point of the motor vehicle's cab location touching the vertical transverse plane referred to in point 1.3.2.4.

2. If any of the conditions set out in this Section are not met, it shall be considered that the motor vehicle cab does not conform to parameters of the three-dimensional envelope as referred to in point 1.4.1. of Section D.

Section K

Gradeability of off-road vehicles

1. General

1.1. This section lays down the technical requirements for the purposes of verifying the gradeability of a vehicle in order to be categorised as off-road vehicle in accordance with Section 5 of Appendix 1 to Annex I to Regulation (EU) 2018/858.

1.2. The technical service shall verify if the complete or completed vehicle, or tractor unit for semi-trailer is to be considered as an off-road vehicle in accordance with the requirements laid down in Annex I to Regulation (EU) 2018/858.

1.3. For incomplete vehicles, this verification shall be carried out only at the request of the manufacturer.

2. Test conditions

2.1. Vehicle conditions

2.1.1. The vehicle shall be set in the conditions recommended by the manufacturer and fitted with the equipment referred to in Annex I to Regulation (EU) 2020/683.

2.1.2. The adjustment of the brakes, clutch (or equivalent), engine and gear box shall be set in accordance with the manufacturer's recommendations for the purposes of use off the normal roads.

2.1.3. The tyres shall be those recommended for off-roads use. They shall have a tread depth of not less than 90 % of the tread depth of a new tyre. The tyre pressure shall be adjusted to the value recommended by the tyre manufacturer.

2.1.4. The vehicle shall be loaded at its technically permissible maximum laden mass with a load distribution proportional to the distribution of the maximum mass on the axles as stated by the manufacturer.

For example a vehicle of 7,5 tonnes with a maximum mass on the front axle of 4 tonnes and a maximum mass on the rear axle of 6 tonnes shall be tested with a mass of 3 tonnes (40 %) on the front axle and 4,5 tonnes (60 %) on the rear axle.

2.2. Test track conditions

2.2.1. The surface of the test track shall be dry, made of asphalt or concrete

2.2.2. The gradient shall show a continuous percentage of 25 % with a tolerance of + 3 % (ϑ = 14 degrees).

2.2.3. In agreement with the manufacturer, the test may be performed on a gradient that shows a percentage greater than 25 %. The test shall be conducted with maximum masses reduced in relation to the test conditions.

2.3. These conditions shall be reported.

2.3.1. The surface of the track shall show a good coefficient of adhesion.

The Skid Resistance Index ('SRI') of the surface shall be measured in accordance with Standard CEN/TS 13036-2: 2010 Road and airfield surface characteristics – Test methods – Part 2: Assessment of the skid resistance of a road pavement surface by use of dynamic measuring systems.

The mean value of the SRI shall be reported.

3. Test procedure

3.1. The vehicle shall be first placed on a horizontal surface.

3.2. The mode of traction shall be set as for off-roads use. The gear(s) engaged shall allow a steady speed.

3.3. Sections 5 and 6 of Appendix 1 to Annex I to Regulation (EU) 2018/858 shall apply.

Section L

Conditions of equivalence of a suspension-to-air suspension

1. This section lays down the technical conditions relating to the equivalence of a suspension to air-suspension for vehicle driving axle(s).

2. In order to be recognised as equivalent to air suspension, a suspension shall comply with the following requirements:

During free transient low-frequency vertical oscillation of the sprung mass above a driving axle or group of axles, the measured frequency and damping with the suspension carrying its maximum load shall fall within the limits defined in points 2.3. to 2.6.

2.1. Each axle shall be fitted with hydraulic dampers. On groups of axles, the dampers shall be positioned to minimise the oscillation of the groups of axles.

2.2. The mean damping ratio Dm shall be more than 20 % of critical damping for the suspension in its normal condition with hydraulic dampers in place and operating.

2.3. The damping ratio Dr of the suspension with all hydraulic dampers removed or incapacitated shall be not more than 50 % of Dm.

2.4. The frequency of the sprung mass above the driving axle or group of axles in a free transient vertical oscillation shall not be higher than 2,0 Hz.

2.5. The test procedures for measuring the frequency and damping shall be laid down in point 3.

3. Test procedure

3.1. Frequency and damping

3.1.1. The free oscillation of the sprung mass shall be given by the following equation:

$$M\frac{d^2Z}{dt^2} + C\frac{dZ}{dt} + KZ = O$$

Where

'M' is the sprung mass (kg),

'Z' is the vertical displacement of the sprung mass (m),

'C' is the total damping coefficient (N.s/m) and

'K' is the total vertical stiffness between the road surface and the sprung mass (N/m)

3.1.2. The frequency of oscillation ('F' in Hz) of the sprung mass shall be given by the following equation:

$$F = \frac{1}{2\pi}\sqrt{\frac{K}{M} - \frac{C^2}{4M^2}}$$

3.1.3. The damping is critical when C = Co

where:

$$Co = 2\sqrt{KM}$$

The damping ratio as a fraction of critical is C/Co.

3.1.4. During free transient oscillation of the sprung mass the vertical motion of the mass will follow a damped sinusoidal path (Figure 2). The frequency can be estimated by measuring the time for as many cycles of oscillation as can be observed. The damping can be estimated by measuring the heights of successive peaks of the oscillation in the same direction.

3.1.5. If the peak amplitudes of the first and second cycles of the oscillation are A_1 and A_2, then the damping ratio D is given by the following equation:

$$D = \frac{C}{Co} = \frac{1}{2\pi} = \ln \frac{A_1}{A_2}$$

'ln' being the natural logarithm of the amplitude ratio.

3.2. Test procedure

To establish by test the damping ratio Dm, the damping ratio Dr, with hydraulic dampers removed, and the frequency F of the suspension, the loaded vehicle shall be either:

(a) driven at low speed (5 km/h ± 1 km/h) over an 80 mm step with the profile shown in Figure 1. The transient oscillation to be analysed for frequency and damping occurs after the wheels of the driving axle have left the step;

(b) pulled down by its chassis so that the driving axle load is 1,5 times its maximum static value. The vehicle held down is suddenly released and the subsequent oscillation analysed;

(c) pulled up by its chassis so that the sprung mass is lifted by 80 mm above the driving axle. The vehicle held up is suddenly dropped and the subsequent oscillation analysed;

(d) subjected to other procedures insofar as it has been proved by the manufacturer, to the satisfaction of the technical service, that they are equivalent.

3.3. Test equipment of the vehicle and loading conditions

3.3.1. The vehicle shall be fitted with a vertical displacement transducer between driving axle and chassis, directly above the driving axle. From the trace, the time interval between the first and second compression peaks shall be measured to obtain the damping.

For twin driving groups of axles, vertical displacement transducers shall be fitted between each driving axle and the chassis directly above it.

3.3.2. The tyres shall be inflated to the appropriate pressure recommended by the manufacturer.

3.3.3. The test for verifying the equivalence of the suspensions shall be made at the technically permissible maximum mass on the axle or group of axles, and the equivalence assumed to cover all the lower masses.

Figure 1

Step for suspension tests

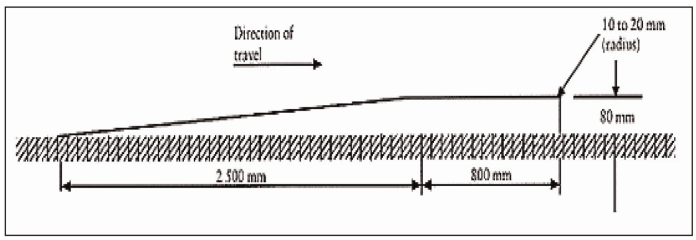
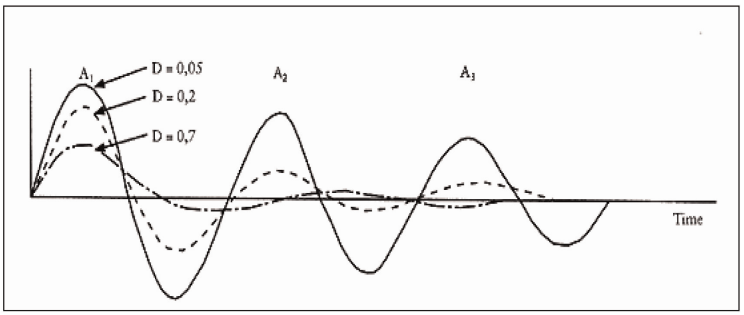


Figure 2

A damped transient response



Section M

Technical specifications for the installation of lift- or loadable axle(s) on vehicles

1. If a vehicle is fitted with one or more lift- or loadable axles it shall be ensured that under normal driving conditions the registration/in-service maximum permissible masses on solo axles or groups of axles are not exceeded. To that end the lift- or loadable axle(s) shall be lowered to the ground or be loaded automatically if the nearest axle(s) of the group or the front axle(s) of the motor vehicle is/are laden to its/their registration/in-service maximum permissible mass(es).

   Where a lift axle is in elevated position, it shall be ensured that the mass on the steering axle(s) continues to be sufficient to ensure the safe driving of the vehicle in all circumstances. For such purposes, the vehicle manufacturer shall specify, in the case of incomplete vehicles, the minimum mass on the steering axle(s)

2. Every axle-lift device fitted to a vehicle, as well as the systems for its operation, shall be designed and installed in such a manner as to protect them against any improper use or tampering.

3. Requirements for moving off vehicles on slippery surfaces and to improve their manoeuvrability

3.1. By way of derogation from the requirements of point 1 and to help motor vehicles or vehicle combinations to move off on slippery ground and to increase the traction of the tyres on these surfaces as well to improve their manoeuvrability, the axle lift device may actuate the lift- or loadable axle(s) of a motor vehicle or semi-trailer to increase or decrease the mass on the driving axle of the motor vehicle, subject to the following conditions:

   (a) the mass corresponding to the load on each axle of the vehicle may exceed the maximum authorised mass on the axle in force in the Member State by up to 30 % provided it does not exceed the value stated by the manufacturer for this special purpose;

   (b) the mass corresponding to the remaining load on the front axle(s) shall remain above zero (i.e. in case of a rear loadable axle with long rear overhang, the vehicle may not tip up);

   (c) the lift- or loadable axle(s) shall be actuated only by a specific control;

   (d) after the vehicle has moved off and before its speed exceeds 30 km/h, the axle(s) shall automatically be lowered again to the ground or be reloaded.

PART 3

Section A

EU TYPE-APPROVAL CERTIFICATE (VEHICLE SYSTEM)

Communication concerning *granting | extension | refusal | withdrawal* ([7]) of type-approval of a type of vehicle with regard to its masses and dimensions in accordance with the requirements laid down in Annex XIII to Regulation (EU) 2021/535, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension | refusal | withdrawal* ([7]):

SECTION I

(To be completed in accordance with Section I of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

SECTION II

(To be completed in accordance with Section II of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

Addendum

to EU type-approval certificate number …

1. Additional information:

1.1. The vehicle has been type-approved in accordance with Article 6(3) or (4) of Regulation (EU) 2020/… *[Please, insert reference to this Regulation]* (i.e. the outermost dimensions of the vehicle exceeds the maximum dimensions mentioned in Section B, C, D or E of Part 3) yes/no ([7])

1.2. The vehicle has been type-approved for the purposes of Article 8b of Directive 96/53/EC (i.e. aerodynamic devices or equipment at the rear of the vehicle): yes/no ([7])

1.3. The vehicle has been type-approved for the purposes of with Article 9a of Directive 96/53/EC (i.e. an elongated cab or a cab fitted with aerodynamic devices or equipment): yes/no ([7])

1.4. The vehicle has been type-approved for the purposes of Article 10b of Directive 96/53/EC:

1.4.1. Additional weight of alternatively fuelled vehicles: yes/no ([7])

1.4.2. Additional weight of zero-emission vehicles: yes/no ([7])

2. The vehicle is fitted with air-suspension: yes/no ([7])

3. The vehicle is fitted with a suspension recognised to be equivalent to air-suspension: yes/no ([7])

4. The vehicle fulfils the requirements for an off-road vehicle: yes/no ([7])

5. Remarks:

([7]) Delete where not applicable.

Section B

EU TYPE-APPROVAL CERTIFICATE (STU)

Communication concerning *granting* / *extension* / *refusal* / *withdrawal* ([8]) of type-approval of a type of an aerodynamic device or equipment as a separate technical unit in accordance with the requirements laid down in Annex XIII to Regulation (EU) 2021/535, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension* / *refusal* / *withdrawal* ([8]):

SECTION I

(To be completed in accordance with Section I of the template of Model C in Annex III to Commission Implementing Regulation (EU) 2020/683)

SECTION II

(To be completed in accordance with Section II of the template of Model C in Annex III to Commission Implementing Regulation (EU) 2020/683)

Addendum

to EU type-approval certificate number …

1. Brief description of the type of separate technical unit:
2. Detailed description of the aerodynamic device or equipment:
2.1. Number of separate elements:
2.2. Description of construction and materials:
2.3. Description of locking and adjustment system:
2.4. Description of attachment and mounting to the vehicle:
2.5. Separate technical unit: semi-universal/vehicle specific ([8])
3. List of specific vehicle types for which the separate technical unit has been approved (if applicable):
4. Detailed description of the specific mounting area specifications on vehicles in case of semi-universal aerodynamic devices or equipment (if applicable):
5. Remarks:
6. Type-approval mark and its location:

([8]) Delete where not applicable.

Section C

EU SEPARATE TECHNICAL UNIT TYPE-APPROVAL MARK FOR A AN AERODYNAMIC DEVICE OR EQUIPMENT

1. The EU separate technical unit type-approval mark shall consist of:

1.1. A rectangle surrounding the lower-case letter 'e' followed by the distinguishing number of the Member State which has granted the EU separate technical unit type-approval:

1	for Germany
2	for France
3	for Italy
4	for the Netherlands
5	for Sweden
6	for Belgium
7	for Hungary
8	for the Czech Republic
9	for Spain
12	for Austria
13	for Luxembourg
17	for Finland
18	for Denmark
19	for Romania

20	for Poland
21	for Portugal
23	for Greece
24	for Ireland
25	for Croatia
26	for Slovenia
27	for Slovakia
29	for Estonia
32	for Latvia
34	for Bulgaria
36	for Lithuania
49	for Cyprus
50	for Malta

1.2. In the vicinity of the rectangle the 'base approval number' contained in Section 4 of the type-approval number preceded by the two figures indicating the sequence number assigned to this Regulation or latest major technical amendment to this Regulation. The sequence number is '00' at present.

1.3. In case of an aerodynamic device or equipment of cabs, the sequence number shall be preceded by the symbol '96/53/EC ARTICLE 9A COMPLIANT'.

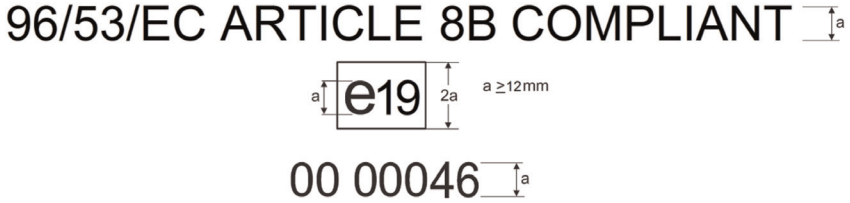
1.4. In case of an aerodynamic device or equipment to be located on the rear of a vehicle, the sequence number shall be preceded by the symbol '96/53/EC ARTICLE 8B COMPLIANT'.

2. The EU separate technical unit type-approval mark shall be affixed to a main part of the aerodynamic device or equipment in such a way as to be indelible as well as clearly and easily legible even if the device is fitted to a vehicle.

3. An example of an EU separate technical unit type-approval mark is shown in Figure 1.

Figure 1

Example of EU separate technical unit type-approval mark



Explanatory note:

The EU separate technical unit type-approval of an aerodynamic device or equipment to be installed at the rear of a vehicle (for the purpose of compliance with Article 8b of Directive 96/53/EC) was issued by Romania under number 00046. The first two digits "00" indicate that the separate technical unit was approved in accordance with this Regulation.

ANNEX XIV

HYDROGEN SYSTEM MATERIAL COMPATIBILITY AND FUELLING RECEPTACLE

PART 1

Section A

Information document relating to the EU type-approval of a vehicle with regard to its hydrogen system

MODEL

Information document No … relating to the EU type-approval of a vehicle with regard to its hydrogen system.

The following information shall be supplied in triplicate and include a list of contents. Any drawings or pictures shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

0.

0.1.

0.2.

0.2.1.

0.3.

0.3.1.

0.4.

0.5.

0.8.

0.9.

1.

1.1.

1.3.3.

1.4.

3.

3.9.

3.9.1.

3.9.1.1.

3.9.1.2.

3.9.1.3.

3.9.1.4.

3.9.6.

3.9.6.1.

3.9.6.2.

3.9.7.

3.9.7.1.

3.9.7.2.

3.9.8.

Explanatory note:

This information document is based on the template laid down in Annex I to Commission Implementing Regulation (EU) 2020/683 and shall be completed with the relevant information under the point numbers listed above as defined in that template.

Section B

Information document relating to the EU type-approval of hydrogen components

MODEL

Information document No … relating to the EU type-approval of a vehicle with regard to its hydrogen system.

The following information shall be supplied in triplicate and include a list of contents. Any drawings or pictures shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

0.

0.1.

0.2.

0.2.1.

0.5.

0.8.

0.9.

3.

3.9.

3.9.1.

3.9.1.1.

3.9.1.2.

3.9.1.3.

3.9.2.

3.9.2.1.

3.9.2.2.

3.9.2.3.

3.9.2.4.

3.9.2.5.

3.9.2.6.

3.9.2.7.

3.9.2.8.

3.9.3.

3.9.3.1.

3.9.3.2.

3.9.3.3.

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3.9.3.5.

3.9.3.6.

3.9.3.7.

3.9.3.8.

3.9.3.9.

3.9.3.10.

3.9.3.11.

3.9.4.

3.9.4.1.

3.9.4.2.

3.9.4.3.

3.9.4.4.

3.9.4.5.

3.9.4.6.

3.9.4.7.

3.9.5.

3.9.5.1.

3.9.5.2.

3.9.5.3.

3.9.5.4.

3.9.5.5.

3.9.5.6.

3.9.5.7.

Explanatory notes:

This information document is based on the template laid down in Annex I to Commission Implementing Regulation (EU) 2020/683 and shall be completed with the relevant information under the point numbers listed above as defined in that template.

PART 2

Section A

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

1.1. '*burst disc*' means the non-reclosing operating part of a pressure relief device which, when installed in the device, is designed to burst at a predetermined pressure to permit the discharge of compressed hydrogen;

1.2. '*check valve*' means a non-return valve that prevents reverse flow in the vehicle fuel line;

1.3. '*compressed hydrogen storage system (CHSS)*' means a system designed to store hydrogen fuel for a hydrogen-powered vehicle and composed of a pressurized container, pressure relief devices (PRDs) and shut off device(s) that isolate the stored hydrogen from the remainder of the fuel system and its environment;

1.4. '*container*' (for hydrogen storage) means the component within the hydrogen storage system that stores the primary volume of hydrogen fuel;

1.5. '*date of removal from service*' means the date (month and year) specified for removal from service;

1.6. '*date of manufacture*' (of a compressed hydrogen container) means the date (month and year) of the proof pressure test carried out during manufacture;

1.7. '*enclosed or semi-enclosed spaces*' means the special volumes within the vehicle (or the vehicle outline across openings) that are external to the hydrogen system (storage system, fuel cell system and fuel flow management system) and its housings (if any) where hydrogen may accumulate (and thereby pose a hazard), as it may occur in the passenger compartment, luggage compartment and space under the hood;

1.8. '*exhaust point of discharge*' means the geometric centre of the area where fuel cell purged gas is discharged from the vehicle;

1.9. '*fuel cell system*' means a system containing the fuel cell stack(s), air processing system, fuel flow control system, exhaust system, thermal management system and water management system;

1.10. '*fuelling receptacle*' means the equipment to which a fuelling station nozzle attaches to the vehicle and through which fuel is transferred to the vehicle. The fuelling receptacle is used as an alternative to a fuelling port;

1.11. '*hydrogen concentration*' means the percentage of the hydrogen moles (or molecules) within the mixture of hydrogen and air (equivalent to the partial volume of hydrogen gas);

1.12. '*hydrogen-powered vehicle*' means any motor vehicle that uses hydrogen as a fuel to propel the vehicle, including fuel cell and internal combustion engine vehicles. Hydrogen fuel for passenger vehicles is specified in ISO 14687-2: 2012 and SAE J2719: (September 2011 Revision);

1.13. '*luggage compartment*' means the space in the vehicle for luggage and/or goods accommodation, bounded by the roof, hood, floor, side walls, being separated from the passenger compartment by the front bulkhead or the rear bulkhead;

1.14. '*liquefied hydrogen storage system (LHSS)*' means liquefied hydrogen storage container(s) PRDs, shut-off device, a boil-off system and the interconnection piping (if any) and fittings between the above components;

1.15. '*manufacturer*' means the person or body responsible to the approval authority for all aspects of the type approval process and for ensuring conformity of production. It is not essential that the person or body is directly involved in all stages of the construction of the vehicle, system or component which is the subject of the approval process;

1.16. '*maximum allowable working pressure (MAWP)*' means the highest gauge pressure to which a pressure container or storage system is permitted to operate under normal operating conditions;

1.17. '*nominal working pressure (NWP)*' means the gauge pressure that characterizes typical operation of a system. For compressed hydrogen gas containers, NWP is the settled pressure of compressed gas in fully fuelled container or storage system at a uniform temperature of 15 °C;

1.18. '*maximum fuelling pressure (MFP)*' means the maximum pressure applied to compressed system during fuelling. The maximum fuelling pressure is 125 % of the nominal working pressure (NWP);

1.19. '*pressure relief device (PRD)*' means a device that, when activated under specified performance conditions, is used to release hydrogen from a pressurized system and thereby prevent failure of the system;

1.20. '*rupture*' or '*burst*' both mean to come apart suddenly and violently, break open or fly into pieces due to the force of internal pressure;

1.21. '*safety relief valve*' means a pressure relief device that opens at a pre-set pressure level and can re-close;

1.22. '*shut-off valve*' means a valve between the storage container and the vehicle fuel system that can be automatically activated and defaults to the 'closed' position when not connected to a power source;

1.23. '*single failure*' means a failure caused by a single event, including any consequential failures resulting from this failure;

1.24. '*thermally-activated pressure relief device (TPRD)*' means a non- reclosing PRD that is activated by temperature to open and release hydrogen gas;

1.25. '*vehicle fuel system*' means an assembly of components used to store or supply hydrogen fuel to a fuel cell (FC) or internal combustion engine (ICE).

Section B

Technical specifications for the type-approval of liquefied hydrogen storage systems

1. Requirements for liquefied hydrogen storage systems (LHSS).

1.1. General requirements.

1.1.1. This section specifies the requirements for the LHSS. Actual systems will differ in the type, number, configuration and arrangement of the functional constituents. The boundaries of the LHSS are defined by the interfaces, which can isolate the stored liquefied (and/or gaseous) hydrogen from the remainder of the fuel system and the environment. All components located within this boundary are subject to the requirements defined in this Regulation. Figure 1 shows typical LHSS consisting of a hydrogen storage container, three kinds of closure devices and their fittings. The closure devices shall include the following functions, which may be combined:

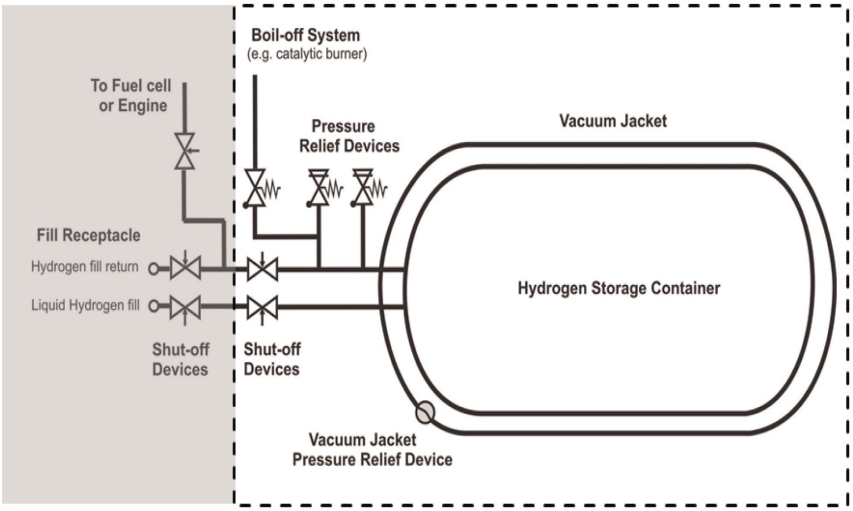
(a) Automatic shut-off device;

(b) Boil-off system; and

(c) Pressure relief device (PRD).

Figure 1

Typical liquefied hydrogen storage system



1.2. Performance requirements:

The liquefied hydrogen storage system shall qualify for the performance test requirements specified in this point. The manufacturer shall specify a Maximum Allowable Working Pressure (MAWP). The test elements within these performance requirements are those in points 1.2.1. to 1.2.4.

1.2.1. Verification of baseline metrics.

1.2.1.1. Proof pressure:

A system is pressurized to a pressure $p_{test} \geq 1,3$ (MAWP ± 0,1 MPa) in accordance with point 2.1.1. without visible deformation, degradation of container pressure, or detectable leakage.

1.2.1.2. Baseline initial burst pressure.

1.2.1.3. The burst test is performed per the test procedure in point 2.1.2. on one sample of the inner container that is not integrated in its outer jacket and not insulated.

1.2.1.4. The burst pressure shall be at least equal to the burst pressure used for the mechanical calculations. For steel containers that is either:

(a) Maximum Allowable Working Pressure (MAWP) (in MPa) plus 0.1 MPa multiplied by 3.25; or

(b) Maximum Allowable Working Pressure (MAWP) (in MPa) plus 0.1 MPa multiplied by 1.5 and multiplied by R_m/R_p, where R_m is the minimum ultimate tensile strength of the container material and R_p (minimum yield strength) is 1.0 for austenitic steels and Rp is 0.2 for other steels.

1.2.1.5. Baseline pressure cycle life.

1.2.1.5.1. When using metallic containers and/or metallic vacuum jackets, the manufacturer shall either provide a calculation in order to demonstrate that the container is designed according to current regional legislation or accepted standards (e.g. in US the ASME Boiler and Pressure Vessel Code, in Europe EN 1251-1 and EN 1251-2 and in all other countries an applicable regulation for the design of metallic pressure containers), or define and perform suitable tests (including point 2.1.3.) that prove the same level of safety compared to a design supported by calculation according to accepted standards.

1.2.1.5.2. For non-metallic containers and/or vacuum jackets, in addition to point 2.1.3. testing, suitable tests shall be designed by the manufacturer to prove the same level of safety compared to a metallic container.

1.2.2. Verification for expected on-road performance.

1.2.2.1. Boil-off

1.2.2.1.1. The boil-off test is performed on a liquefied hydrogen storage system equipped with all components. The test is performed on a system filled with liquid hydrogen per the test procedure in point 2.2.1. and shall demonstrate that the boil-off system limits the pressure in the inner storage container to below the maximum allowable working pressure.

1.2.2.2. Leak

1.2.2.2.1. After the boil-off test in point 2.2.1., the system is kept at boil-off pressure and the total discharge rate due to leakage shall be measured per the test procedure in point 2.2.2. The maximum allowable discharge from the hydrogen storage system is R*150 Nml/min where R = (Vwidth+1)*(Vheight+0.5)*(Vlength+1)/30.4 and Vwidth, Vheight, Vlength are the vehicle width, height, length (m), respectively.

1.2.2.3. Vacuum loss.

1.2.2.3.1. The vacuum loss test is performed on a liquefied hydrogen storage system equipped with all components as described in Figure 1 above. The test is performed on a system filled with liquid hydrogen per the test procedure in point 2.2.3. and shall demonstrate that both primary and secondary pressure relief devices limit the pressure to the values specified in point 2.2.3. in case vacuum pressure is lost.

1.2.3. Verification of service-terminating conditions:

1.2.3.1. Bonfire test.

1.2.3.1.1. The function of the pressure relief devices and the absence of rupture under the following service-terminating conditions shall be demonstrated in accordance with the test procedures provided in point 2.3.

1.2.3.1.2. A hydrogen storage system is filled to half-full liquid level and exposed to fire in accordance with test procedure of point 2.3. The pressure relief device(s) shall release the contained gas in a controlled manner without rupture.

1.2.3.1.3. For steel containers the test is passed when the requirements relating to the pressure limits for the pressure relief devices as described in point 2.3. are fulfilled. For other container materials, an equivalent level of safety shall be demonstrated.

1.2.3.2. Requirements for pressure relief device and shut-off device.

1.2.3.2.1. The pressure relief device and shut-off device, as described in Figure 1, shall comply with one of the following requirements:

(a) The devices shall be type-approved in accordance with point 1 of this section and produced in conformity with the approved type; or

(b) The manufacturer of the liquefied hydrogen storage system shall ensure that the devices comply with the requirements of point 1 of this section.

1.2.4. Labelling:

A label shall be permanently affixed on each container with at least the following information: Name of the Manufacturer, Serial Number, Date of Manufacture, MAWP, fuel type (i.e. 'CHG' for gaseous hydrogen or 'LH2' for liquid hydrogen).

2. Test procedures for LHSS.

2.1. Tests for verification of baseline metrics.

2.1.1. Proof pressure test.

2.1.1.1. The inner container and the pipe work situated between the inner container and the outer jacket shall withstand an inner pressure test at room temperature according to the following requirements.

2.1.1.2. The test pressure p_{test} is defined by the manufacturer and shall fulfil the following requirements:

$p_{test} \geq 1{,}3$ (MAWP ± 0,1 MPa)

(a) For metallic containers, either p_{test} is equal to or greater than the maximum pressure of the inner container during fault management (as determined in point 2.2.3.) or the manufacturer proves by calculation that at the maximum pressure of the inner container during fault management no yield occurs; and

(b) For non-metallic containers, p_{test} is equal to or greater than the maximum pressure of the inner container during fault management (as determined in point 2.2.3.).

2.1.1.3. The test is conducted according to the following procedure:

(a) The test is conducted on the inner storage container and the interconnecting pipes between inner storage container and vacuum jacket before the outer jacket is mounted;

(b) The test is either conducted hydraulically with water or a glycol/water mixture, or alternatively with gas. The container is pressurized to test pressure p_{test} at an even rate and kept at that pressure for at least 10 minutes; and

(c) The test is done at ambient temperature. In the case of using gas to pressurize the container, the pressurization is done in a way that the container temperature stays at or around ambient temperature.

2.1.1.4. The test is passed successfully if, during the first 10 minutes after applying the proof pressure, no visible permanent deformation, no visible degradation in the container pressure and no visible leakage are detectable.

2.1.2. Baseline initial burst pressure.

2.1.2.1. The test is conducted according to the following procedure:

(a) The test is conducted on the inner container at ambient temperature;

(b) The test is conducted hydraulically with water or a water/glycol mixture;

(c) The pressure is increased at a constant rate, not exceeding 0.5 MPa/min until burst or leakage of the container occurs;

(d) When MAWP is reached there is a wait period of at least ten minutes at constant pressure, during which time the deformation of the container can be checked; and

(e) The pressure is recorded or written during the entire test.

2.1.2.2. For steel inner containers, the test is passed successfully if at least one of the two passing criteria described in point 1.1.1.2. is fulfilled. For inner containers made out of an aluminium alloy or other material, a passing criterion shall be defined which guarantees at least the same level of safety compared to steel inner containers.

2.1.3. Baseline pressure cycle life.

2.1.3.1. Containers and/or vacuum jackets are pressure cycled with a number of cycles at least three times the number of possible full pressure cycles (from the lowest to highest operating pressure) for an expected on-road performance. The number of pressure cycles is defined by the manufacturer under consideration of operating pressure range, size of the storage and, respectively, maximum number of refuellings and maximum number of pressure cycles under extreme usage and storage conditions. Pressure cycling is conducted between atmospheric pressure and MAWP at liquid nitrogen temperatures, e.g. by filling the container with liquid nitrogen to certain level and alternately pressurizing and depressurizing it with (pre-cooled) gaseous nitrogen or helium.

2.2. Verification for expected on-road performance.

2.2.1. Boil-off test.

2.2.1.1. The test is conducted according to the following procedure:

(a) For pre-conditioning, the container is fuelled with liquid hydrogen to the specified maximum filling level. Hydrogen is subsequently extracted until it meets half filling level, and the system is allowed to completely cool down for at least 24 hours and a maximum of 48 hours;

(b) The container is filled to the specified maximum filling level;

(c) The container is pressurized until boil-off pressure is reached; and

(d) The test lasts for at least another 48 hours after boil-off started and is not terminated before the pressure stabilizes. Pressure stabilization has occurred when the average pressure does not increase over a two hours period.

2.2.1.2. The pressure of the inner container is recorded or written during the entire test. The test is passed successfully if the following requirements are fulfilled:

(a) The pressure stabilizes and stays below MAWP during the whole test; and

(b) The pressure relief devices are not allowed to open during the whole test.

2.2.2. Leak test.

2.2.2.1. The test shall be conducted according to the procedure described in point 2.2. of Section C of this Part.

2.2.3. Vacuum loss test.

2.2.3.1. The first part of the test is conducted according to the following procedure:

(a) The vacuum loss test is conducted with a completely cooled-down container (according to the procedure in point 2.2.1.);

(b) The container is filled with liquid hydrogen to the specified maximum filling level;

(c) The vacuum enclosure is flooded with air at an even rate to atmospheric pressure; and

(d) The test is terminated when the first pressure relief device does not open any more.

2.2.3.2. The pressure of the inner container and the vacuum jacket is recorded or written during the entire test. The opening pressure of the first safety device is recorded or written. The first part of test is passed if the following requirements are fulfilled:

(a) The first pressure relief device opens below or at MAWP and limit the pressure to not more than 110 % of the MAWP;

(b) The first pressure relief device does not open at pressure above MAWP; and

(c) The secondary pressure relief device does not open during the entire test.

2.2.3.3. After passing the first part, the test shall be repeated subsequently to re-generation of the vacuum and cool-down of the container as described above.

(a) The vacuum is re-generated to a value specified by the manufacturer. The vacuum shall be maintained at least 24 hours. The vacuum pump may stay connected until the time directly before the start of the vacuum loss;

(b) The second part of the vacuum loss test is conducted with a completely cooled-down container (according to the procedure in point 2.2.1.);

(c) The container is filled to the specified maximum filling level;

(d) The line downstream the first pressure relief device is blocked and the vacuum enclosure is flooded with air at an even rate to atmospheric pressure; and

(e) The test is terminated when the second pressure relief device does not open any more.

2.2.3.4. The pressure of the inner container and the vacuum jacket is recorded or written during the entire test. For steel containers the second part of the test is passed if the secondary pressure relief device does not open below 110 % of the set pressure of the first pressure relief device and limits the pressure in the container to a maximum 136 % of the MAWP if a safety valve is used, or, 150 % of the MAWP if a burst disk is used as the secondary pressure relief device. For other container materials, an equivalent level of safety shall be demonstrated.

2.3. Verification test for service-terminating performance due to fire.

2.3.1. The tested liquefied hydrogen storage system shall be representative of the design and the manufacturing of the type to be approved. Its manufacturing shall be completely finished and it shall be mounted with all its equipment.

2.3.2. The first part of the test is conducted according to the following procedure:

(a) The bonfire test is conducted with a completely cooled-down container (according to the procedure in point 2.2.1.);

(b) The container contained during the previous 24 hours a volume of liquid hydrogen at least equal to half of the water volume of the inner container;

(c) The container is filled with liquid hydrogen so that the quantity of liquid hydrogen measured by the mass measurement system is half of the maximum allowed quantity that may be contained in the inner container;

(d) A fire burns 0,1 m underneath the container. The length and the width of the fire exceed the plan dimensions of the container by 0,1 m. The temperature of the fire is at least 590 °C. The fire shall continue to burn for the duration of the test;

(e) The pressure of the container at the beginning of the test is between 0 MPa and 0,01 MPa at the boiling point of hydrogen in the inner container;

(f) The test shall continue until the storage pressure decreases to or below the pressure at the beginning of the test, or alternatively in case the first PRD is a re-closing type, the test shall continue until the safety device has opened for a second time; and

(g) The test conditions and the maximum pressure reached within the container during the test are recorded in a test certificate signed by the manufacturer and the technical service.

2.3.3. The test is passed if the following requirements are fulfilled:

(a) The secondary pressure relief device is not operated below 110 % of the set pressure of the primary pressure relief device; and

(b) The container shall not burst and the pressure inside the inner container shall not exceed the permissible fault range of the inner container.

2.3.4. The permissible fault range for steel containers is as follows:

(a) If a safety valve is used as secondary pressure relief device, the pressure inside the container does not exceed 136 % of the MAWP of the inner container;

(b) If a burst disk is used outside the vacuum area as secondary pressure relief device, the pressure inside the container is limited to 150 % of the MAWP of the inner container; and

(c) If a burst disc is used inside the vacuum area as secondary pressure relief device, the pressure inside the container is limited to 150 % of the MAWP plus 0,1 MPa (MAWP ± 0,1 MPa) of the inner container.

2.3.5. For other materials, an equivalent level of safety shall be demonstrated.

Section C

Technical specifications for the type-approval of specific components for liquefied hydrogen storage system

1. Requirements for specific components for LHSS

1.1. Pressure relief device qualification requirements

The pressure relief device shall meet the following performance qualification requirements:

(a) Pressure test (point 2.1. test procedure);

(b) External leakage test (point 2.2. test procedure);

(c) Operational test (point 2.4. test procedure);

(d) Corrosion resistance test (point 2.5. test procedure); and

(e) Temperature cycle test (point 2.8. test procedure).

1.2. Shut-off device qualification requirements

The shut-off device shall meet the following performance qualification requirements:

(a) Pressure test (point 2.1. test procedure);

(b) External leakage test (point 2.2. test procedure);

(c) Endurance test (point 2.3. test procedure);

(d) Corrosion resistance test (point 2.5. test procedure);

(e) Resistance to dry-heat test (point 2.6. test procedure);

(f) Ozone ageing test (point 2.7. test procedure);

(g) Temperature cycle test (point 2.8.test procedure); and

(h) Flex line cycle test (point 2.9. test procedure).

2. Test procedures for specific components for LHSS:

The test procedures for pressure relief devices and shut-off valves are described below:

Testing shall be performed with hydrogen gas having gas quality compliant with ISO 14687-2/SAE J2719. All tests shall be performed at ambient temperature 20 ± 5 °C unless otherwise specified.

2.1. Pressure test

2.1.1. A hydrogen containing component shall withstand without any visible evidence of leak or deformation a test pressure of 150 % MAWP with the outlets of the high pressure part plugged. The pressure shall subsequently be increased from 150 % to 300 % MAWP. The component shall not show any visible evidence of rupture or cracks.

2.1.2. The pressure supply system shall be equipped with a positive shut-off valve and a pressure gauge having a pressure range of not less than 150 % and no more than 200 % of the test pressure; the accuracy of the gauge shall be 1 % of the pressure range.

2.1.3. For components requiring a leakage test, this test shall be performed prior to the pressure test.

2.2. External leakage test

2.2.1. A component shall be free from leakage through stem or body seals or other joints, and shall not show evidence of porosity in casting when tested as described in point 2.3.3. at any gas pressure between zero and its MAWP.

2.2.2. The test shall be performed on the same equipment at the following conditions:

(a) At ambient temperature;

(b) At the minimum operating temperature or at liquid nitrogen temperature after sufficient conditioning time at this temperature to ensure thermal stability; and

(c) At the maximum operating temperature after sufficient conditioning time at this temperature to ensure thermal stability.

2.2.2.1. During this test, the equipment under test shall be connected to a source of gas pressure. A positive shut-off valve and a pressure gauge having a pressure range of not less than 150 % and not more than 200 % of the test pressure shall be installed in the pressure supply piping; the accuracy of the gauge shall be 1 % of the pressure range. The pressure gauge shall be installed between the positive shut-off valve and the sample under test.

2.2.2.2. Throughout the test, the sample shall be tested for leakage, with a surface active agent without formation of bubbles or measured with a leakage rate less than 216 Nml/hr.

2.3. Endurance Test

2.3.1. A component shall be capable of conforming to the applicable leakage test requirements of points 2.2. and 2.9., after being subjected to 20 000 operation cycles.

2.3.2. The appropriate tests for external leakage and seat leakage, as described in points 2.2. and 2.9. shall be carried out immediately following the endurance test.

2.3.3. The shut-off valve shall be securely connected to a pressurized source of dry air or nitrogen and subjected to 20 000 operation cycles. A cycle shall consist of one opening and one closing of the component within a period of not less than 10 ± 2 seconds.

2.3.4. The component shall be operated through 96 % of the number of specified cycles at ambient temperature and at the MAWP of the component. During the off cycle the downstream pressure of the test fixture shall be allowed to decay to 50 % of the MAWP of the component.

2.3.5. The component shall be operated through 2 % of the total cycles at the maximum material temperature (– 40 °C to + 85 °C) after sufficient conditioning time at this temperature to ensure thermal stability and at MAWP. The component shall comply with points 2.2. and 2.9. at the appropriate maximum material temperature (– 40 °C to + 85 °C) at the completion of the high temperature cycles.

2.3.6. The component shall be operated through 2 % of the total cycles at the minimum material temperature (– 40 °C to + 85 °C) but not less than the temperature of liquid nitrogen after sufficient conditioning time at this temperature to ensure thermal stability and at the MAWP of the component. The component shall comply with points 2.2. and 2.9. at the appropriate minimum material temperature (– 40 °C to + 85 °C) at the completion of the low temperature cycles.

2.4. Operational test

2.4.1. The operational test shall be carried out in accordance with EN 13648-1 or EN 13648 2. The specific requirements of the standard are applicable.

2.5. Corrosion resistance test

2.5.1. Metallic hydrogen components shall comply with the leakage tests referred to points 2.2. and 2.9., after being submitted to 144 hours salt spray test according to ISO 9227 with all connections closed.

2.5.2. A copper or brass hydrogen containing component shall comply with the leakage tests referred to points 2.2. and 2.9., after being submitted to 24 hours immersion in ammonia according to ISO 6957 with all connections closed.

2.6. Resistance to dry-heat test

2.6.1. The test shall be carried out in compliance with ISO 188. The test piece shall be exposed to air at a temperature equal to the maximum operating temperature for 168 hours. The change in tensile strength shall not exceed ±25 %. The change in ultimate elongation shall not exceed the following values: maximum increase 10 % and maximum decrease 30 %.

2.7. Ozone ageing test

2.7.1. The test shall be in compliance with ISO 1431-1. The test piece, which shall be stressed to 20 % elongation, shall be exposed to air at + 40 °C with an ozone concentration of 50 parts per hundred million during 120 hours.

2.7.2. No cracking of the test piece is allowed.

2.8. Temperature cycle test

2.8.1. A non-metallic part containing hydrogen shall comply with the leakage tests referred to in point 2.2. and 2.9. after having been submitted to a 96 hours temperature cycle from the minimum operating temperature up to the maximum operating temperature with a cycle time of 120 minutes, under MAWP.

2.9. Flex line cycle test

2.9.1. Any flexible fuel line shall be capable of conforming to the applicable leakage test requirements referred to in point 2.2., after being subjected to 6 000 pressure cycles.

2.9.2. The pressure shall change from atmospheric pressure to the MAWP of the container within less than five seconds, and after a time of at least five seconds, shall decrease to atmospheric pressure within less than five seconds.

2.9.3. The appropriate test for external leakage, as referred to in point 2.2., shall be carried out immediately following the endurance test.

Section D

Technical specifications for the type-approval of vehicle fuel systems incorporating liquefied hydrogen storage systems

1. Requirements for vehicle fuel systems incorporating LHSS

This section specifies requirements for the integrity of the hydrogen fuel delivery system, which includes the liquefied hydrogen storage system, piping, joints, and components in which hydrogen is present.

1.1. In-use fuel system integrity

1.1.1. Over-pressure protection for the low pressure system

The hydrogen system downstream of a pressure regulator shall be protected against overpressure due to the possible failure of the pressure regulator. The set pressure of the overpressure protection device shall be lower than or equal to the maximum allowable working pressure for the appropriate section of the hydrogen system. The over-pressure protection shall comply with the installation verification referred to in point 2.6.

1.1.2. Hydrogen discharge systems

1.1.2.1. Pressure relief systems

Pressure relief devices (such as a burst disc) shall comply with the installation verification referred to in point 2.6. and may be used outside the hydrogen storage system. The hydrogen gas discharge from other pressure relief devices shall not be directed:

(a) towards exposed electrical terminals, exposed electrical switches or other ignition sources;

(b) into or towards the vehicle passenger or luggage compartments;

(c) into or towards any vehicle wheel housing; and

(d) towards hydrogen gas containers.

1.1.2.2. Vehicle exhaust system

1.1.2.2.1. The vehicle exhaust system shall comply with the test for the vehicle exhaust system referred to in point 2.4.

1.1.2.2.2. At the vehicle exhaust system's point of discharge, the hydrogen concentration level shall:

(a) Not exceed 4 % average by volume during any moving three-second time interval during normal operation including start-up and shutdown; and

(b) Not exceed 8 % at any time.

1.1.3. Protection against flammable conditions: single failure conditions

1.1.3.1. Hydrogen leakage and/or permeation from the hydrogen storage system shall not directly vent into the passenger, luggage, or cargo compartments, or to any enclosed or semi-enclosed spaces within the vehicle that contains unprotected ignition sources.

1.1.3.2. Any single failure downstream of the main hydrogen shut off valve shall not result in any level of a hydrogen concentration in anywhere in the passenger compartment according to test procedure referred to in point 2.3.2.

1.1.3.3. If, during operation, a single failure results in a hydrogen concentration exceeding 3 % by volume in air in the enclosed or semi-enclosed spaces of the vehicle, then a warning shall be provided (point 1.1.3.5.). If the hydrogen concentration exceeds 4 % by volume in the air in the enclosed or semi-enclosed spaces of the vehicle, the main shutoff valve shall be closed to isolate the storage system. (point 2.3. test procedure).

1.1.3.4. Fuel system leakage

The hydrogen fuelling line (e.g. piping, joint, etc.) downstream of the main shut off valve(s) to the fuel cell system or the engine shall not leak. Compliance shall be verified at NWP (point 2.5. test procedure).

1.1.3.5. Tell-tale signal warning to driver

The warning shall be given by a visual signal or display text with the following properties:

(a) Visible to the driver while in the driver's designated seating position with the driver's seat belt fastened;

(b) Yellow in colour if the detection system malfunctions (e.g. circuit disconnection, short-circuit, sensor fault). It shall be red in compliance with point 1.1.3.3.

(c) When illuminated, shall be visible to the driver under both daylight and night time driving conditions; and

(d) Remains illuminated when 3 % concentration or detection system malfunction) exists and the master control is in the 'on' position or the propulsion system is otherwise activated.

1.2. Post-crash fuel system integrity

Frontal, side and rear crash tests shall be performed as required for the relevant vehicle category in accordance with Regulation (EU) 2019/2144.

Where one or more of these crash tests are not required, the LHSS, including the safety devices affixed to it shall be installed in such a way that the following accelerations can be absorbed without breaking of the fixation or loosening of the filled LHSS container(s):

Vehicle of categories M_1 and N_1:

(a) 20 g in forward and rearward direction of travel; and

(b) 8 g horizontally perpendicular to the direction of travel.

Vehicles of categories M_2 and N_2:

(a) 10 g in forward direction of travel; and

(b) 5 g horizontally perpendicular to the direction of travel.

Vehicles of categories M_3 and N_3:

(a) 6,6 g in the forward direction of travel; and

(b) 5 g horizontally perpendicular to the direction of travel.

Any substitute mass used shall be representative for a fully equipped and filled LHSS container/assembly.

1.2.1. Fuel leakage limit

The volumetric flow of hydrogen gas leakage shall not exceed an average of 118 NL per minute for 60 minutes after the crash as determined in accordance with point 2.1.

1.2.2. Concentration limit in enclosed spaces

Hydrogen gas leakage shall not result in a hydrogen concentration in the air greater than 4 % by volume in the passenger and luggage compartments (point 2.2. test procedures). The requirement is satisfied if it is confirmed that the shut-off valve of the storage system has closed within 5 seconds of the crash and no leakage from the storage system.

1.2.3. Container Displacement

The storage container(s) shall remain attached to the vehicle at a minimum of one attachment point.

1.3. Flammable materials used in the vehicle shall be protected from liquefied air that may condense on elements of the fuel system.

1.4. The insulation of the components shall prevent liquefaction of the air in contact with the outer surfaces, unless a system is provided for collecting and vaporizing the liquefied air. The materials of the components nearby shall be compatible with an atmosphere enriched with oxygen.

2. Test procedures for vehicle fuel system incorporating LHSS

The test procedures for vehicle fuel systems incorporating LHSS according to points 2.1., 2.2. and 2.7. apply only to vehicles of categories M_1 and N_1 that are subjected to one or more crash tests.

2.1. Post-crash liquefied hydrogen storage system leak test

Prior to conducting the crash test, instrumentation is installed in the hydrogen storage system to perform the required pressure and temperature measurements if the standard vehicle does not already have instrumentation with the required accuracy.

The storage system is then purged, if necessary, following manufacturer directions to remove impurities from the container before filling the storage system with compressed hydrogen or helium gas. Since the storage system pressure varies with temperature, the targeted fill pressure is a function of the temperature. The target pressure shall be determined from the following equation:

$$P_{target} = NWP \times (273 + T_o) / 288$$

where NWP is the nominal working pressure (MPa), To is the ambient temperature to which the storage system is expected to settle, and Ptarget is the targeted fill pressure after the temperature settles.

The container is filled to a minimum of 95 % of the targeted fill pressure and allowed to settle (stabilize) prior to conducting the crash test.

The main stop valve and shut-off valves for hydrogen gas, located in the downstream hydrogen gas piping, are kept open immediately prior to the impact.

2.1.1. Post-crash leak test - compressed hydrogen storage system filled with compressed hydrogen

The hydrogen gas pressure, P_0 (MPa), and temperature, T_0 (°C), is measured immediately before the impact and then at a time interval, Δt (min), after the impact. The time interval, Δt, starts when the vehicle comes to rest after the impact and continues for at least 60 minutes. The time interval, Δt, is increased if necessary in order to accommodate measurement accuracy for a storage system with a large volume operating up to 70 MPa; in that case, Δt can be calculated from the following equation:

$$\Delta t = V_{CHSS} \times NWP / 1\ 000 \times ((-0{,}027 \times NWP + 4) \times R_s - 0.21) - 1.7 \times R_s$$

where $R_s = P_s / NWP$, P_s is the pressure range of the pressure sensor (MPa), NWP is the Nominal Working Pressure (MPa), V_{CHSS} is the volume of the compressed hydrogen storage system (L), and Δt is the time interval (min). If the calculated value of Δt is less than 60 minutes, Δt is set to 60 minutes.

The initial mass of hydrogen in the storage system can be calculated as follows:

$$P_o' = P_o \times 288 / (273 + T_0)$$

$$\rho_o' = -0{,}0027 \times (P_0')^2 + 0{,}75 \times P_0' + 0{,}5789$$

$$M_o = \rho_o' \times V_{CHSS}$$

Correspondingly, the final mass of hydrogen in the storage system, M_f, at the end of the time interval, Δt, can be calculated as follows:

$$P_f' = P_f \times 288 / (273 + T_f)$$

$$\rho_f' = -0{,}0027 \times (P_f')^2 + 0{,}75 \times P_f' + 0{,}5789$$

$$M_f = \rho_f' \times V_{CHSS}$$

where P_f is the measured final pressure (MPa) at the end of the time interval, and T_f is the measured final temperature (°C).

The average hydrogen flow rate over the time interval (that shall be less than the criteria in point 1.2.1.) is therefore:

$$V_{H2} = (M_f - M_o) / \Delta t \times 22{,}41 / 2{,}016 \times (P_{target} / P_o)$$

where V_{H2} is the average volumetric flow rate (NL/min) over the time interval and the term (P_{target} / P_o) is used to compensate for differences between the measured initial pressure, P_o, and the targeted fill pressure P_{target}.

2.1.2. Post-crash leak test - Compressed hydrogen storage system filled with compressed helium

The helium gas pressure, P_0 (MPa), and temperature T_0 (°C), are measured immediately before the impact and then at a predetermined time interval after the impact. The time interval, Δt, starts when the vehicle comes to rest after the impact and continues for at least 60 minutes.

The time interval, Δt, shall be increased if necessary in order to accommodate measurement accuracy for a storage system with a large volume operating up to 70MPa; in that case, Δt can be calculated from the following equation:

$$\Delta t = V_{CHSS} \times NWP / 1\ 000 \times ((-0{,}028 \times NWP + 5{,}5) \times R_s - 0{,}3) - 2{,}6 \times R_s$$

where $R_s = P_s / NWP$, P_s is the pressure range of the pressure sensor (MPa), NWP is the Nominal Working Pressure (MPa), V_{CHSS} is the volume of the compressed hydrogen storage system (L), and Δt is the time interval (min). If the value of Δt is less than 60 minutes, Δt is set to 60 minutes.

The initial mass of hydrogen in the storage system is calculated as follows:

$$P_o' = P_o \times 288 / (273 + T_0)$$

$$\rho_o' = -0{,}0043 \times (P_0')^2 + 1{,}53 \times P_0' + 1{,}49$$

$$M_o = \rho_o' \times V_{CHSS}$$

The final mass of hydrogen in the storage system at the end of the time interval, Δt, is calculated as follows:

$$P_f' = P_f \times 288 / (273 + T_f)$$

$$\rho_f' = -0{,}0043 \times (P_f')^2 + 1{,}53 \times P_f' + 1{,}49$$

$$M_f = \rho_f' \times V_{CHSS}$$

where P_f is the measured final pressure (MPa) at the end of the time interval, and T_f is the measured final temperature (°C).

The average helium flow rate over the time interval is therefore

$$V_{He} = (M_f - M_o) / \Delta t \times 22{,}41 / 4{,}003 \times (P_o / P_{target})$$

where V_{He} is the average volumetric flow rate (NL/min) over the time interval and the term P_o / P_{target} is used to compensate for differences between the measured initial pressure (P_o) and the targeted fill pressure (P_{target}).

Conversion of the average volumetric flow of helium to the average hydrogen flow is done with the following expression:

$$V_{H2} = V_{He} / 0{,}75$$

where V_{H2} is the corresponding average volumetric flow of hydrogen (that shall be less than the criteria in point 1.2.1. to pass).

2.2. Post-crash concentration test for enclosed spaces

2.2.1. The measurements are recorded in the crash test that evaluates potential hydrogen (or helium) leakage as determined in accordance with point 2.1.

2.2.2. Sensors are selected to measure either the build-up of the hydrogen or helium gas or the reduction in oxygen (due to displacement of air by leaking hydrogen/helium).

2.2.3. Sensors are calibrated to traceable references to ensure an accuracy of ±5 % at the targeted criteria of 4 % hydrogen or 3 % helium by volume in air, and a full scale measurement capability of at least 25 % above the target criteria. The sensor shall be capable of a 90 % response to a full scale change in concentration within 10 seconds.

2.2.4. Prior to the crash impact, the sensors are located in the passenger and luggage compartments of the vehicle as follows:

(a) At a distance within 250 mm of the headliner above the driver's seat or near the top centre the passenger compartment;

(b) At a distance within 250 mm of the floor in front of the rear (or rear most) seat in the passenger compartment;

(c) At a distance within 100 mm of the top of luggage compartments within the vehicle that are not directly affected by the particular crash impact to be conducted.

2.2.5. The sensors are securely mounted on the vehicle structure or seats and protected for the planned crash test from debris, air bag exhaust gas and projectiles. The measurements following the crash are recorded by instruments located within the vehicle or by remote transmission.

2.2.6. The vehicle may be located either outdoors in an area protected from the wind and possible solar effects or indoors in a space that is large enough or ventilated to prevent the build-up of hydrogen to more than 10 % of the targeted criteria in the passenger, luggage, and cargo compartments.

2.2.7. Post-crash data collection in enclosed spaces commences when the vehicle comes to a rest. Data from the sensors are collected at least every 5 seconds and continue for a period of 60 minutes after the test. A first-order lag (time constant) up to a maximum of 5 seconds may be applied to the measurements to provide "smoothing" and filter the effects of spurious data points.

2.2.8. The filtered readings from each sensor shall be below the targeted criteria of 3 ± 1,0 % for hydrogen or 2,25 ± 0,75 % for helium at all times throughout the 60 minutes post-crash test period.

2.3. Compliance test for single failure conditions

Either test procedure of point 2.3.1. or point 2.3.2. shall be executed:

2.3.1. Test procedure for vehicle equipped with hydrogen gas leakage detectors

2.3.1.1. Test condition

2.3.1.1.1. Test vehicle: The propulsion system of the test vehicle is started, warmed up to its normal operating temperature, and left operating for the test duration. If the vehicle is not a fuel cell vehicle, it is warmed up and kept idling. If the test vehicle has a system to stop idling automatically, measures are taken so as to prevent the engine from stopping.

2.3.1.1.2. Test gas: Two mixtures of air and hydrogen gas: 2 ± 1,0 % concentration (or less) of hydrogen in the air to verify function of the warning, and 3 ± 1,0 % concentration (or less) of hydrogen in the air to verify function of the shut-down. The proper concentrations are selected based on the recommendation (or the detector specification) by the manufacturer.

2.3.1.2. Test method

2.3.1.2.1. Preparation for the test: The test is conducted without any influence of wind by appropriate means such as;

(a) A test gas induction hose is attached to the hydrogen gas leakage detector;

(b) The hydrogen leak detector is enclosed with a cover to make gas stay around hydrogen leak detector.

2.3.1.2.2. Execution of the test

(a) Test gas is blown to the hydrogen gas leakage detector;

(b) Proper function of the warning system is confirmed when tested with the gas to verify function of the warning;

(c) The main shut-off valve is confirmed to be closed when tested with the gas to verify function of the shut-down. For example, the monitoring of the electric power to the shut-off valve or of the sound of the shut-off valve activation may be used to confirm the operation of the main shut-off valve of the hydrogen supply.

2.3.2. Test procedure for integrity of enclosed spaces and detection systems.

2.3.2.1. Preparation:

The test is conducted without any influence of wind.

Special attention is paid to the test environment as during the test flammable mixtures of hydrogen and air may occur.

2.3.2.1.1. Prior to the test, the vehicle is prepared to allow remotely controllable hydrogen releases from the hydrogen system. The number, location and flow capacity of the release points downstream of the main hydrogen shutoff valve are defined by the vehicle manufacturer taking worst case leakage scenarios under single failure condition into account. As a minimum, the total flow of all remotely controlled releases shall be adequate to trigger demonstration of the automatic "warning" and hydrogen shut-off functions.

2.3.2.1.2. For the purpose of the test, a hydrogen concentration detector is installed where hydrogen gas may accumulate most in the passenger compartment (e.g. near the headliner) when testing for compliance with point 1.1.3.2. and hydrogen concentration detectors are installed in enclosed or semi enclosed volumes on the vehicle where hydrogen can accumulate from the simulated hydrogen releases when testing for compliance with point 1.1.3.1.

2.3.2.2. Procedure:

Vehicle doors, windows and other covers are closed.

The propulsion system is started, allowed to warm up to its normal operating temperature and left operating at idle for the test duration.

A leak is simulated using the remote controllable function.

The hydrogen concentration is measured continuously until the concentration does not rise for 3 minutes. When testing for compliance with point 1.1.3.3., the simulated leak is then increased using the remote controllable function until the main hydrogen shutoff valve is closed and the tell-tale warning signal is activated. The monitoring of the electric power to the shut-off valve or of the sound of the shut-off valve activation may be used to confirm the operation of the main shut-off valve of the hydrogen supply.

When testing for compliance with point 1.1.3.2., the test is successfully completed if the hydrogen concentration in the passenger compartment does not exceed 1.0 %. When testing for compliance with point 1.1.3.3., the test is successfully completed if the tell-tale warning and shut-off function are executed at (or below) the levels specified in point 1.1.3.3.; otherwise, the test is failed and the system is not qualified for vehicle service.

2.4. Compliance test for the vehicle exhaust system

2.4.1. The power system of the test vehicle (e.g. fuel cell stack or engine) is warmed up to its normal operating temperature.

2.4.2. The measuring device is warmed up before use to its normal operating temperature.

2.4.3. The measuring section of the measuring device is placed on the centre line of the exhaust gas flow within 100 mm from the exhaust point of discharge external to the vehicle.

2.4.4. The exhaust hydrogen concentration is continuously measured during the following steps:

(a) The power system is shut down;

(b) Upon completion of the shut-down process, the power system is immediately started; and

(c) After a lapse of one minute, the power system is turned off and measurement continues until the power system shut-down procedure is completed.

2.4.5. The measurement device shall have a measurement response time of less than 300 milliseconds.

2.5. Compliance test for fuel line leakage

2.5.1. The power system of the test vehicle (e.g. fuel cell stack or engine) is warmed up and operating at its normal operating temperature with the operating pressure applied to fuel lines.

2.5.2. Hydrogen leakage is evaluated at accessible sections of the fuel lines from the high-pressure section to the fuel cell stack (or the engine), using a gas leak detector or a leak detecting liquid, such as soap solution.

2.5.3. Hydrogen leak detection is performed primarily at joints.

2.5.4. When a gas leak detector is used, detection is performed by operating the leak detector for at least 10 seconds at locations as close to fuel lines as possible.

2.5.5. When a leak detecting liquid is used, hydrogen gas leak detection is performed immediately after applying the liquid. In addition, visual checks are performed a few minutes after the application of liquid in order to check for bubbles caused by trace leaks.

2.6. Installation verification

The system is visually inspected for compliance.

2.7. Post-crash leak test for the liquefied hydrogen storage systems

Prior to the vehicle crash test, the following steps are taken to prepare the liquefied hydrogen storage system (LHSS):

(a) If the vehicle does not already have the following capabilities as part of the standard vehicle; the following shall be installed before the test:

— LHSS pressure sensor. The pressure sensor shall have a full scale of reading of at least 150 % of MAWP, an accuracy of at least 1 % of full scale, and capable of reading values of at least 10 kPa;

— LHSS temperature sensor. The temperature sensor shall be capable of measuring cryogenic temperatures expected before crash. The sensor is located on an outlet, as near as possible to the container;

(b) Fill and drain ports. The ability to add and remove both liquefied and gaseous contents of the LHSS before and after the crash test shall be provided;

(c) The LHSS is purged with at least 5 volumes of nitrogen gas;

(d) The LHSS is filled with nitrogen to the equivalence of the maximum fill level of hydrogen by weight;

(e) After fill, the (nitrogen) gas vent is to be closed, and the container allowed to equilibrate.

The leak-tightness of the LHSS is confirmed.

After the LHSS pressure and temperature sensors indicate that the system has cooled and equilibrated, the vehicle shall be crashed per state or regional regulation. Following the crash, there shall be no visible leak of cold nitrogen gas or liquid for a period of at least 1 hour after the crash. Additionally, the operability of the pressure controls or PRDs shall be proven to ensure that the LHSS is protected against burst after the crash. If the LHSS vacuum has not been compromised by the crash, nitrogen gas may be added to the LHSS via the fill / drain port until pressure controls and/or PRDs are activated. In the case of re-closing pressure controls or PRDs, activation and re-closing for at least 2 cycles shall be demonstrated. Exhaust from the venting of the pressure controls or the PRDs shall not be vented to the passenger or luggage, compartments during these post-crash tests.

Either test procedure referred to in point 2.7.1. or the alternative test procedure in point 2.7.2. (consisting of points 2.7.2.1. and 2.7.2.2.) may be chosen at the discretion of the manufacturer.

2.7.1. Post-crash leak test for the liquefied hydrogen storage systems

2.7.1.1. Following confirmation that the pressure control and/or safety relief valves are still functional, the leak tightness of the LHSS may be proven by detecting all possible leaking parts with a sniff sensor of a calibrated Helium leak test device used in sniff modus. The test can be performed as an alternative if the following pre-conditions are fulfilled:

(a) No possible leaking part shall be below the liquid nitrogen level as indicated on the storage container;

(b) All possible leaking parts are pressurized with helium gas when the LHSS is pressurized;

(c) Required covers and/or body panels and parts can be removed to gain access to all potential leak sites.

2.7.1.2. Prior to the test the manufacturer shall provide a list of all possible leaking parts of the LHSS. Possible leaking parts are:

(a) Any connectors between pipes and between pipes and the container;

(b) Any welding of pipes and components downstream the container;

(c) Valves;

(d) Flexible lines;

(e) Sensors.

2.7.1.3. Prior to the leak test overpressure in the LHSS should be released to atmospheric pressure and afterwards the LHSS should be pressurized with helium to at least the operating pressure but well below the normal pressure control setting (so the pressure regulators do not activate during the test period). The test is passed if the total leakage amount (i.e. the sum of all detected leakage points) is less than 216 Nml/hr.

2.7.2. Alternative post-crash tests for the liquefied hydrogen storage systems

Both tests of points 2.7.2.1. and 2.7.2.2. are conducted under the test procedure referred to in of point 2.7.2.

2.7.2.1. Alternative post-crash leak test

2.7.2.1.1. Following confirmation that the pressure control and/or safety relief valves are still functional, the following test may be conducted to measure the post-crash leakage. The concentration test described in point 2.1.1. shall be conducted in parallel for the 60 minute test period if the hydrogen concentration has not already been directly measured following the vehicle crash.

2.7.2.1.2. The container shall be vented to atmospheric pressure and the liquefied contents of the container shall be removed and the container shall be heated up to ambient temperature. The heat-up could be done, e.g. by purging the container sufficient times with warm nitrogen or increasing the vacuum pressure.

2.7.2.1.3. If the pressure control set point is less than 90 % of the MAWP, the pressure control shall be disabled so that it does not activate and vent gas during the leak test.

2.7.2.1.4. The container shall then be purged with helium by either:

(a) flowing at least 5 volumes through the container; or

(b) pressurizing and de-pressurizing the container the LHSS at least 5 times.

2.7.2.1.5. The LHSS shall then be filled with helium to 80 % of the MAWP of the container or to within 10 % of the primary relief valve setting, whichever results in the lower pressure, and held for a period of 60 minutes. The measured pressure loss over the 60 minute test period shall be less than or equal to the following criterion based on the liquid capacity of the LHSS:

(a) 0,20 MPa allowable loss for 100 l systems or less;

(b) 0,10 MPa allowable loss for systems greater than 100 l and less than or equal to 200 l; and

(c) 0,05 MPa allowable for systems greater than 200 l.

2.7.2.2. Post-crash enclosed spaces test

2.7.2.2.1. The measurements shall be recorded in the crash test that evaluates potential liquid hydrogen leakage in test procedure point 2.7.2.1. if the LHSS contains hydrogen for the crash test or during the helium leak test in test procedure point 2.2.

2.7.2.2.2. Select sensors to measure the build-up of hydrogen or helium (depending which gas is contained within the Liquefied Hydrogen Storage Systems (LHSS) for the crash test). Sensors may measure either measure the hydrogen/helium content of the atmosphere within the compartments or measure the reduction in oxygen (due to displacement of air by leaking hydrogen/helium).

2.7.2.2.3. The sensors shall be calibrated to traceable references, have an accuracy of 5 % of reading at the targeted criteria of 4 % hydrogen (for a test with liquefied hydrogen) or 0.8 % helium by volume in the air (for a test at room temperature with helium), and a full scale measurement capability of at least 25 % above the target criteria. The sensor shall be capable of a 90 % response to a full scale change in concentration within 10 seconds.

2.7.2.2.4. The installation in vehicles with LHSS shall meet the same requirements as for vehicles with compressed hydrogen storage systems in point 2.2. Data from the sensors shall be collected at least every 5 seconds and continue for a period of 60 minutes after the vehicle comes to a rest if post-crash hydrogen is being measured or after the initiation of the helium leak test if helium build-up is being measured. Up to a 5 second rolling average may be applied to the measurements to provide "smoothing" and filter effects of spurious data points. The rolling average of each sensor shall be below the targeted criteria of 4 % hydrogen (for a test with liquefied hydrogen) or 0.8 % helium by volume in the air (for a test at room temperature with helium) at all times throughout the 60 minute post-crash test period.

Section E

Technical specifications for motor vehicles with regard to their hydrogen system, including material compatibility, fuelling receptacle and vehicle identification

1. General requirements for vehicles equipped with compressed hydrogen storage systems (CHSS) that are complimentary to requirements set out in UN Regulation No 134 ([1]) and for vehicles equipped with LHSS.

1.1. The installed components of a CHSS, i.e. high pressure container and primary closing devices comprising TPRD, check valve and automatic shut-off valve, shall be type-approved and marked in accordance with this Regulation as well as with UN Regulation No 134 (i.e. a double marking is required).

1.2. The installed components of a LHSS, i.e. pressure relief devices and shut-off devices, shall be type-approved and marked in accordance with this Regulation.

1.3. The manufacturer shall ensure that, as set out in Section F, the materials used in hydrogen storage systems are compatible with hydrogen and expected additives and production contaminants and expected temperatures and pressures. This does not apply to materials that do not come in contact with hydrogen in normal condition.

1.4. Vehicle identification.

1.4.1. In the case of hydrogen vehicles of categories M_1 and N_1 one label shall be installed within the engine (or equivalent) compartment of the vehicle and one in the vicinity of the fuelling receptacle.

1.4.2. In the case of hydrogen vehicles of categories M_2 and M_3, labels shall be installed on the front and rear of the vehicle, in the vicinity of the fuelling receptacle and to the side of each door or set of doors.

1.4.3. In the case of hydrogen vehicles of categories N_2 and N_3, labels shall be installed on the front and rear of the vehicle and in the vicinity of the fuelling receptacle.

1.4.4. Labels shall be in conformity with sections 4. to 4.7. of international standard ISO 17840-4:2018.

2. Fuelling receptacle requirements for vehicles equipped with CHSS that are complimentary to requirements set out in UN Regulation No 134 and for vehicles equipped with LHSS.

([1]) Regulation No 134 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of motor vehicles and their components with regard to the safety-related performance of hydrogen-fuelled vehicles (HFCV) [2019/795] (OJ L 129, 17.5.2019, p. 43).

2.1. Fuelling receptacle label:

A label shall be affixed close to the fuelling receptacle; for instance inside a refilling hatch, showing the following information: fuel type (e.g. "CHG" for gaseous hydrogen), MFP, NWP, date of removal from service of containers.

2.2. The fuelling receptacle shall be mounted on the vehicle to ensure positive locking of the fuelling nozzle. The receptacle shall be protected from tampering and the ingress of dirt and water (e.g. installed in a compartment which can be locked). Test procedure is by visual inspection.

2.3. The fuelling receptacle shall not be mounted within the external energy absorbing elements of the vehicle (e.g. bumper) and shall not be installed in the passenger compartment, luggage compartment and other places where hydrogen gas could accumulate and where ventilation is not sufficient. Test procedure is by visual inspection.

2.4. The geometry of the fuelling receptacle of compressed hydrogen gas vehicles shall conform to international standard ISO 17268:2012 (or later revisions) and be compatible with specification H35, H35HF, H70 or H70HF depending on its nominal working pressure and specific application.

2.5. If appropriate, the geometry of the fuelling receptacle of liquefied hydrogen gas vehicles may be at the manufacturer's discretion and in agreement with the technical service in absence of a standard as indicated in point 2.4.

Section F

Technical specifications for hydrogen components on material compatibility

1. Requirements

1.1. This section sets out the requirements and test procedures for storage system and components of CHSS and LHSS with respect to material compatibility. It does not apply to materials that do not come in contact with hydrogen under normal conditions.

2. Specific requirements

2.1. The materials used in CHSS shall be compatible with hydrogen when they are in contact with hydrogen in liquid and/or gaseous state. Incompatible materials shall not be in contact with each other.

2.2. Steels

2.2.1. Steels used in CHSS shall conform to the material requirements of sections 6.1. to 6.4. of standard EN 9809-1:2018 or sections 6.1. to 6.3. of standard EN 9809-2:2018 as appropriate.

2.3. Stainless steels

2.3.1. Stainless steels used in CHSS shall conform to sections 4.1. to 4.4. of standard EN 1964-3:2000.

2.3.2. Welded stainless steels for liners of containers shall conform to sections 4.1. to 4.3. as well as sections 6.1., 6.2. and 6.4. of standard EN 13322-2:2006 as appropriate.

2.4. Aluminium alloys

2.4.1. Aluminium alloys used in CHSS shall conform to the material requirements of sections 6.1. and 6.2. of international standard ISO 7866:2012.

2.4.2. Welded aluminium alloys for liners of containers shall conform to sections 4.2. and 4.3. as well as sections 4.1.2. and 6.1. of standard EN 12862:2000.

2.5. Plastic liner materials

2.5.1. The material for plastic liners of hydrogen storage containers may be thermosetting or thermoplastic.

2.6. Fibres

2.6.1. The manufacturer of the container shall keep on file for the intended life of the container design the published specifications for composite materials including principal test results, i.e. tensile test, the material manufacturer's recommendations for storage, conditions and shelf life.

2.6.2. The manufacturer of the container shall keep on file, for the intended life of each batch of containers, the fibre manufacturer's certification that each shipment conforms to the manufacturer's specifications for the product.

2.6.3. The manufacturer shall make the information available immediately upon request of a national authority responsible for market surveillance activities as well as upon request of the Commission.

2.7. Resins

2.7.1. The polymeric material for impregnation of the fibres may be thermosetting or thermoplastic resin.

3. Hydrogen compatibility test

3.1. For metallic materials used in CHSS, hydrogen compatibility of the material, including that of welds, shall be demonstrated in accordance with international standards ISO 11114-1:2017 and ISO 11114-4:2017, with the tests carried out in hydrogen environments as anticipated in service (e.g. in case of 70 MPa systems, the hydrogen compatibility testing is carried out in 70 Mpa environment at the temperature of -40 °C). Alternatively, in agreement with the technical service and the type-approval authority, compliance may be demonstrated in accordance with the standard SAE J2579:2018.

3.2. Demonstration of compliance with the provisions of point 3.1. is not required for:

(a) steels that conform to paragraphs 6.3. and 7.2.2. of standard EN 9809-1:2018;

(b) aluminium alloys that conform to paragraph 6.1. of international standard ISO 7866:2012; or

(c) in case of fully wrapped containers with a non-metallic liner.

3.3. Concerning materials used in LHSS, compatibility shall be demonstrated in accordance with international standard EN 1251-1:2000 and DIN EN ISO 21028-1:2017-01, or, at the manufacturer's discretion, other relevant standards such as SAE J2579:2018, insofar relevant and possible, with the tests carried out in hydrogen environments as anticipated in service. The material hydrogen compatibility can be demonstrated either on specimen level or on the storage system or component itself with field-relevant load assumptions. The technical service shall verify all these items and the test results shall be documented in detail in the test report.

PART 3

Section A

EU TYPE-APPROVAL CERTIFICATE (VEHICLE SYSTEM)

Communication concerning *granting | extension | refusal | withdrawal* [2] of type-approval of a type of vehicle with regard to the hydrogen system, including material compatibility and fuelling receptacle, in accordance with the requirements laid down in Annex XIV to Regulation (EU) 2021/535, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension | refusal | withdrawal* [2]:

SECTION I

(To be completed in accordance with Section I of the template of Model B in Annex III to Commission Implementing Regulation (EU) 2020/683)

SECTION II

(To be completed in accordance with Section II of the template of Model B in Annex I to Commission Implementing Regulation (EU) 2020/683)

Addendum

to EU type-approval certificate number …

Additional information

Type-approval numbers in accordance with UN Regulation 134 and Regulation (EU) 2021/535 of the hydrogen system and each component installed on the vehicle type:

1. Safety-related performance of a hydrogen-fuelled vehicle when equipped with compressed hydrogen storage system(s):

   UN Regulation No 134:

2. Hydrogen storage system(s):

   UN Regulation No 134:

   Regulation (EU) 2021/535:

3. Automatic shut-off valve(s):

   UN Regulation No 134:

   Regulation (EU) 2021/535:

4. Check valve(s) or non-return valve(s):

   UN Regulation No 134:

   Regulation (EU) 2021/535:

5. Thermally-activated pressure relief device (TPRD):

   UN Regulation No 134:

   Regulation (EU) 2021/535:

[2] Delete where not applicable.

Section B

EU TYPE-APPROVAL CERTIFICATE (COMPONENT)

Communication concerning *granting | extension | refusal | withdrawal* ([3]) of type-approval of a type of component for hydrogen systems in accordance with the requirements laid down in Annex XIV to Regulation (EU) 2021/535, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension | refusal | withdrawal* ([3]):

SECTION I

(To be completed in accordance with Section I of the template of Model C in Annex III to Commission Implementing Regulation (EU) 2020/683)

SECTION II

(To be completed in accordance with Section II of the template of Model C in Annex III to Commission Implementing Regulation (EU) 2020/683)

Addendum

to EU type-approval certificate number …

1. Additional information:
2. Brief description of the component as regards its design characteristics and constituent materials:
3. Example of the type-approval marking:
4. Remarks:

([3]) Delete where not applicable.

Section C

EU type-approval mark of components

1. The EU type-approval mark for components referred to in Article 38(2) of Regulation (EU) 2018/858 shall consist of the following:

1.1. A rectangle surrounding the lower-case letter 'e', followed by the distinguishing number of the Member State which has granted the EU type-approval for the component or separate technical unit in accordance with the following:

1	for Germany	19	for Romania
2	for France	20	for Poland
3	for Italy	21	for Portugal
4	for the Netherlands	23	for Greece
5	for Sweden	24	for Ireland
6	for Belgium	25	for Croatia
7	for Hungary	26	for Slovenia
8	for the Czech Republic	27	for Slovakia
9	for Spain	29	for Estonia
		32	for Latvia
12	for Austria	34	for Bulgaria
13	for Luxembourg	36	for Lithuania
17	for Finland	49	for Cyprus
18	for Denmark	50	for Malta

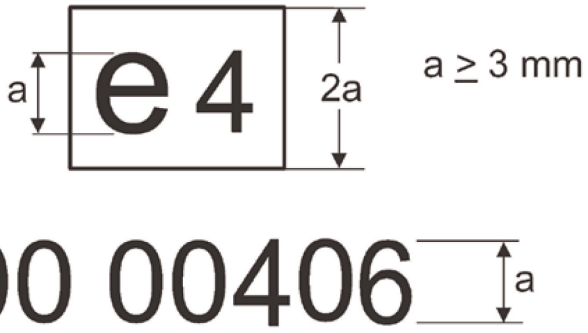
1.2. In the vicinity of the rectangle, two digits indicating the series of amendments laying down the requirements with which this component complies, '00' at present, followed by a space and the five-digit number referred to in point 2.4. of Annex IV of Regulation (EU) 2018/858.

2. The EU type-approval mark of the components shall be indelible and clearly legible.

3. An example of an EU component type-approval mark is shown in Figure 1.

Figure 1

Example of EU component type-approval mark



Explanatory note:

Legend The EU component type-approval was issued by the Netherlands under number 00406. The first two digits "00" indicate that the component was approved in accordance with this Regulation.