

Submitted by the expert from EC

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Proposal for amendments to the original version of Regulation No. 141 “Uniform provisions concerning the approval of vehicles with regard to their Tyre Pressure Monitoring Systems (TPMS)”

The proposed amendments to UNECE Regulation No. 141, submitted by the expert from the European Commission, are marked in bold for new or strike-through for deleted characters.

I. Proposal

Agreement

Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions*

(Revision 2, including the amendments which entered into force on 16 October 1995)

Addendum 140 – Regulation No. 141

Date of entry into force as an annex to the 1958 Agreement: 22 January 2017

Uniform provisions concerning the approval of vehicles with regard to their Tyre Pressure Monitoring Systems (TPMS)

This document is meant purely as documentation tool. The authentic and legal binding text is: ECE/TRANS/WP.29/2016/63.



UNITED NATIONS

* Former title of the Agreement: Agreement Concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, done at Geneva on 20 March 1958.

Regulation No. 141

Uniform provisions concerning the approval of vehicles with regard to their Tyre Pressure Monitoring Systems (TPMS)

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1. Scope

~~This Regulation applies to the approval of vehicles of category M₁ up to a maximum mass of 3,500 kg and N₁¹ when equipped with a tyre pressure monitoring system, except for vehicles fitted with dual wheels on an axle.~~

This Regulation applies to the approval of vehicles of category: M₁ up to a maximum mass of 3,500kg, M₂, M₃, N₁, N₂, N₃, O₃, O₄¹, when equipped with a tyre pressure monitoring system.

2. Definitions

For the purposes of this Regulation:

- 2.1. "*Approval of a vehicle*" means the approval of a vehicle type with regard to its tyre pressure monitoring system.
- 2.2. "*Vehicle type*" means vehicles which do not differ significantly in such essential aspects as:
 - (a) The manufacturer's trade name or mark;
 - (b) Vehicle features which significantly influence the performances of the tyre pressure monitoring system;
 - (c) The design of the tyre pressure monitoring system.
- 2.3. "*Wheel*" means a complete wheel consisting of a rim and a wheel disc;
- 2.4. "***Twin wheel***" means the fitment of a pair of wheels on one side of an axle, on the same hub;
- 2.5. "*Tyre*" means a pneumatic tyre, being a reinforced flexible envelope that is provided with, or forms in conjunction with the wheel on which it is mounted, a continuous, essentially toroidal, closed chamber containing a gas (usually air) or a gas and liquid, that is intended normally to be used at a pressure greater than atmospheric pressure;
- 2.6. "*Maximum mass*" means the maximum value of the vehicle stated by the manufacturer to be technically permissible (this mass may be higher than the "permissible maximum mass" laid down by the national administration);
- 2.7. "*Maximum axle load*" means the maximum value, as indicated by the manufacturer, of the total vertical force between the contact surfaces of the tyres or tracks of one axle and the ground and resulting from the part of the vehicle mass supported by that axle; this load may be higher than the "authorized axle load" laid down by the national administration. The sum of the axle loads may be greater than the value corresponding to the total mass of the vehicle;
- 2.8. "***Tyre Pressure Monitoring System (TPMS)***" means a system fitted on a vehicle which can evaluate the pressure of the tyres or the variation of

¹ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.4, para. 2 - www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html.

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- pressure over time and transmit corresponding information to the user while the vehicle is running;**
- ~~a system fitted on a vehicle, able to perform a function to evaluate the inflation pressure of the tyres or the variation of this inflation pressure over time and to transmit corresponding information to the user while the vehicle is running;~~
- 2.9.** "*Cold tyre inflation pressure*" means the tyre pressure at ambient temperature, in the absence of any pressure build-up due to tyre usage;
- 2.10.** "*Recommended cold inflation pressure (P_{rec})*" means the pressure recommended for each tyre position by the vehicle manufacturer, for the intended service conditions (e.g. speed and load) of the given vehicle, as defined on the vehicle placard and/or the vehicle owner's manual;
- 2.11.** "*In service operating pressure (P_{warm})*" means the inflation pressure for each tyre position elevated from the cold pressure (P_{rec}) by temperature effects during vehicle usage;
- 2.12.** "*Test Pressure (P_{test})*" means the actual pressure of the tyre(s) selected for each tyre position after deflation during the test procedure.

3. Application for approval

- 3.1.** The application for approval of a vehicle type with regard to its tyre pressure monitoring system shall be submitted by the vehicle manufacturer or by his duly accredited representative;
- 3.2.** It shall be accompanied, in triplicate, by a description of the vehicle type with regard to the items specified in Annex 1 to this Regulation;
- 3.3.** A vehicle representative of the vehicle type to be approved shall be submitted to the Type Approval Authority or the Technical Service responsible for conducting the approval tests.
- 3.4.** The Type Approval Authority shall verify the existence of satisfactory arrangements for ensuring effective control of the conformity of production before type approval is granted.

4. Approval

- 4.1.** If the vehicle submitted for approval pursuant to this Regulation meets all the requirements of paragraph 5. below, approval of that vehicle type shall be granted.
- 4.2.** An approval number shall be assigned to each type approved. Its first two digits (at present 00 for the regulation in its original form) shall indicate the series of amendments incorporating the most recent major technical amendments made to the regulation at the time of issue of the approval. The same Contracting Party may not assign the same number to another type of vehicle.
- 4.3.** Notice of approval or of extension or of refusal of approval of a vehicle type pursuant to this Regulation shall be communicated to the Contracting Parties to the Agreement which apply this Regulation by means of a form conforming to the model in Annex 1 to this Regulation.

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- 4.4. There shall be affixed, conspicuously and in a readily accessible place specified on the approval form, to every vehicle conforming to a vehicle type approved under this Regulation an international approval mark consisting of:
 - 4.4.1. A circle surrounding the letter "E" followed by the distinguishing number of the country which granted approval;²
 - 4.4.2. The number of this Regulation, followed by the letter "R", a dash and the approval number to the right of the markings prescribed in paragraph 4.4.1.
 - 4.5. If the vehicle conforms to a vehicle type approved, under one or more regulations annexed to the Agreement, in the country which granted approval under this Regulation, the symbol prescribed in paragraph 4.4.1. need not be repeated; in such a case, the regulation and approval numbers and the additional symbols for all the regulations under which approval has been granted in the country which granted approval under this Regulation shall be placed in vertical columns to the right of the symbol prescribed in paragraph 4.4.1.
 - 4.6. The approval mark shall be clearly legible and be indelible.
 - 4.7. The approval mark shall be placed close to or on the vehicle data plate affixed by the manufacturer.
 - 4.8. Annex 2 to this Regulation gives examples of approval marks.

5. Specifications and tests

- 5.1. General
 - 5.1.1. ~~Any vehicle of categories M₁ up to 3,500 kg and N₁, in both cases with all axles equipped with single tyres, and fitted with a tyre pressure monitoring system complying with the definition of paragraph 2.7. shall meet the performance requirements contained in paragraphs 5.1.2. to 5.5.57. of this Regulation over a wide range of road and environmental conditions encountered within the territory of the Contracting Parties.~~
Any vehicle of categories M₁ up to 3,500kg, M₂, M₃, N₁, N₂, N₃, O₃, O₄ in all cases fitted with a tyre pressure monitoring system complying with the definition of paragraph 2.8, shall meet the performance requirements contained in paragraphs 5.1.2. to 5.5.7. of this Regulation over a wide range of road and environmental conditions encountered within the territory of the Contracting Parties.
 - 5.1.2. The effectiveness of the tyre pressure monitoring system fitted on a vehicle shall not be adversely affected by magnetic or electrical fields. This shall be demonstrated by fulfilling the technical requirements and respecting the transitional provisions of Regulation No. 10 by applying:
 - (a) The 03 series of amendments for vehicles without a coupling system for charging the Rechargeable Electric Energy Storage System (traction batteries);

² The distinguishing numbers of the Contracting Parties to the 1958 Agreement are reproduced in Annex 3 to the Consolidated Resolution on the Construction of Vehicles (R.E.3), document ECE/TRANS/WP.29/78/Rev.4, Annex 3 - www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html.

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- (b) The 04 series of amendments for vehicles with a coupling system for charging the Rechargeable Electric Energy Storage System (traction batteries)
- 5.1.3. **For vehicles of category M₁ up to a maximum mass of 3,500 kg and N₁,** the system shall operate from a speed of 40 km/h or below, up to the vehicle's maximum design speed.
- For vehicles of categories M₂, M₃, N₂, N₃, O₃, O₄, the system shall operate from a speed of 25 km/h or below, up to the vehicle's maximum design speed.**
- 5.1.4. The vehicle shall fulfil the tests (puncture, diffusion and malfunction) as specified in Annex 3.
- 5.1.5. If a variant of any vehicle submitted for approval is fitted with twin wheels, that variant shall be used for the tests defined in Annex 3 of this regulation and one of the tyres on a twin wheel (the 'test tyre') must be deflated for the puncture test in 2.5 of Annex 3 of this regulation.**
- 5.2. Tyre pressure detection for incident-related pressure loss.
- 5.2.1. The TPMS shall illuminate the warning signal described in paragraph 5.5. within not more than ten minutes of cumulative driving time after the in-service operating pressure in one of the vehicle's tyres has been reduced by twenty per cent or it is at a minimum pressure of 150 kPa, whatever whichever is higher. **For vehicles of category M₁ up to a maximum mass of 3,500 kg and N₁, the minimum pressure is 150 kPa. For vehicles of categories M₂, M₃, N₂, N₃, O₃ and O₄, the minimum pressure is 250 kPa.**
- 5.3. Detection for a tyre pressure level significantly below the recommended pressure for optimum performance including fuel consumption and safety.
- ~~5.3.1. The TPMS shall illuminate the warning signal described in paragraph 5.5. within not more than sixty minutes of cumulative driving time after the in-service operating pressure in any of the vehicle's tyres, up to a total of four tyres, has been reduced by twenty per cent or it is at a minimum pressure of 150 kPa, whatever is higher.~~
- The TPMS shall illuminate the warning signal described in paragraph 5.5. within not more than sixty minutes of cumulative driving time after the in-service operating pressure in any of the vehicle's tyres, has been reduced by twenty per cent or it is at the minimum pressure, whichever is higher.**
- For vehicles of category M₁ up to a maximum mass of 3,500 kg and N₁, the minimum pressure is 150 kPa. For vehicles of category M₂, M₃, N₂, N₃, O₃ and O₄, the minimum pressure is 250 kPa.**
- 5.4. Malfunction detection.
- 5.4.1. The TPMS shall illuminate the warning signal described in paragraph 5.5. not more than 10 minutes after the occurrence of a malfunction that affects the generation or transmission of control or response signals in the vehicle's tyre pressure monitoring system.
- 5.5. Warning indication.
- 5.5.1. The warning indication shall be by means of an optical warning signal conforming to Regulation No. 121.

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- 5.5.2** **In the case of an N₂ or N₃ category vehicle drawing an O₃ or O₄ category vehicle, the optical warning signal referred to in 5.5.1 must indicate whether any warning relates to the drawing or to the drawn vehicle.**
 - 5.5.3.** The warning signal shall be activated when the ignition (start) switch is in the "on" (run) position (bulb check). This requirement does not apply to tell-tales shown in a common space.
 - 5.5.4.** The warning signal must be visible even by daylight; the satisfactory condition of the signal must be easily verifiable by the driver from the driver's seat.
 - 5.5.5** **For O₃ and O₄ vehicles, the optical warning signal referred to in 5.5.1 must be displayed to the driver of the drawing vehicle, as specified in paragraph 5.5.4.**
 - 5.5.6.** The malfunction indication may be the same warning signal as the one used to indicate under-inflation. If the warning signal described in paragraph 5.5.1. is used to indicate both under-inflation and a malfunction of the TPMS, the following shall apply: with the ignition (start) switch in the "on" (run) position the warning signal shall flash to indicate a malfunction. After a short period of time the warning signal shall remain continuously illuminated as long as the malfunction exists and the ignition (start) switch is in the "on" (run) position. The flashing and illumination sequence shall be repeated each time the ignition (start) switch is in the "on" (run) position until the malfunction has been corrected.
 - 5.5.7.** The tell-tale of the warning described in paragraph 5.5.1. may be used in a flashing mode in order to provide information about the reset status of the tyre pressure monitoring system in accordance with the owner's manual of the vehicle.

6. Supplementary information

- 6.1.** The owner's manual, if any, of the vehicle shall contain at least the following information:
 - 6.1.1.** A statement that the vehicle is equipped with such a system (and information how to reset the system, if the actual system includes such a feature).
 - 6.1.2.** An image of the tell-tale symbol described in paragraph 5.5.1. (and an image of the malfunction tell-tale symbol, if a dedicated tell-tale is used for this function).
 - 6.1.3.** Additional information about the significance of the low tyre pressure warning tell-tale illuminating and a description of the corrective action to be undertaken if this happens.
- 6.2.** If no owner's manual is supplied with the vehicle, the information required in paragraph 6.1. above shall be displayed in a prominent place on the vehicle.

7. Modifications and extension of approval of the vehicle type

- 7.1. Every modification of the vehicle type as defined in paragraph 2.2. of this Regulation shall be notified to the Type Approval Authority which approved the vehicle type. The Type Approval Authority may then either:
 - 7.1.1. Consider that the modifications made do not have an adverse effect on the conditions of the granting of the approval and grant an extension of approval;
 - 7.1.2. Consider that the modifications made affect the conditions of the granting of the approval and require further tests or additional checks before granting an extension of approval.
- 7.2. Confirmation or refusal of approval, specifying the alterations, shall be communicated by the procedure specified in paragraph 4.3. above to the Contracting Parties to the Agreement applying this Regulation.
- 7.3. The Type Approval Authority shall inform the other Contracting Parties of the extension by means of the communication form which appears in Annex 1 to this Regulation. It shall assign a serial number to each extension, to be known as the extension number.

8. Conformity of production

- 8.1. The conformity of production procedures shall comply with those set out in Appendix 2 of the Agreement (E/ECE/324–E/ECE/TRANS/505/Rev.2), with the following requirements:
- 8.2. The Type Approval Authority which has granted type approval, may at any time verify the conformity of production in each production facility. The normal frequency of these verifications shall be at least once per year.

9. Penalties for non-conformity of production

- 9.1. The approval granted in respect of a vehicle type pursuant to this Regulation may be withdrawn if the requirements laid down in paragraph 8 are not complied with.
- 9.2. If a Contracting Party to the Agreement, which applies this Regulation, withdraws an approval it has previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation, by means of a copy of the approval form bearing at the end, in large letters, the signed and dated annotation "APPROVAL WITHDRAWN".

10. Production definitively discontinued

If the holder of the approval completely ceases to manufacture a type of vehicle approved in accordance with this Regulation, he shall so inform the authority which granted the approval. Upon receiving the relevant communication that authority shall inform thereof the other Contracting Parties to the Agreement applying this Regulation by means of a copy of the approval form bearing at the end, in large letters, the signed and dated annotation "PRODUCTION DISCONTINUED".

11. Names and addresses of Technical Services responsible for conducting approval tests, and of Type Approval Authorities

The Contracting Parties to the Agreement which apply this Regulation shall communicate to the United Nations Secretariat the names and addresses of the Technical Services responsible for conducting approval tests and of the Type Approval Authorities which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval, issued in other countries, are to be sent.

12. Transitional provisions

- 12.1.** As from the official date of entry into force of the XX series of amendments [this series of amendments], no Contracting Party applying this Regulation shall refuse to grant or refuse to accept type approvals under this Regulation as amended by the 07 series of amendments.
- 12.2.** As from 24 months after the date of entry into force of the XX series of amendments [this series of amendments], Contracting Parties applying this Regulation shall grant type approvals only if the vehicle type to be approved meets the requirements of this Regulation as amended by the XX series of amendments [this series of amendments].
- 12.3.** Contracting Parties applying this UN Regulation shall not refuse to grant type approvals according to any preceding series of amendments to this UN Regulation or extensions thereof.
- 12.4.** Until 24 months after the date of entry into force of the XX series of amendments [this series of amendments], no Contracting Party applying this Regulation shall refuse national or regional type approval of a vehicle type-approved to the preceding series of amendments to this Regulation.
- 12.5.** As from 24 months after the date of entry into force of the XX series of amendments [this series of amendments], Contracting Parties applying this Regulation shall not be obliged to accept, for the purpose of national or regional type approval, a vehicle type approved to the preceding series of amendments to this Regulation.
- 12.6.** Notwithstanding the transitional provisions above, Contracting Parties who start to apply this UN Regulation after the date of entry into force of the most recent series of amendments are not obliged to accept UN type-

approvals which were granted in accordance with any of the preceding series of amendments to this UN Regulation.

- 12.7. As from the official date of entry into force of the XX series of amendments [this series of amendments with the current supplement], no Contracting Party applying this UN Regulation shall refuse to grant or refuse to accept type approvals under this UN Regulation as amended by the XX series of amendments [this series of amendments with the current supplement].
- 12.8. As from 1 September following the entry into force of the XX series of amendments + 12 months, Contracting Parties applying this UN Regulation shall not be obliged to accept UN type-approvals to the preceding series of amendments, first issued after that date.
- 12.9. Until 1 September of (year of date in paragraph 12.8 above) + 6 months, Contracting Parties applying this UN Regulation shall accept UN type-approvals to the preceding series of amendments, first issued before (date in paragraph 12.8 above).
- 12.10. As from 1 September of [(year of date in paragraph 12.8 above) + 6 months], Contracting Parties applying this UN Regulation shall not be obliged to accept UN type-approvals issued to the preceding series of amendments to this Regulation.
- 12.11. Notwithstanding paragraph 12.10, Contracting Parties applying this UN Regulation shall continue to accept UN type-approvals issued according to the preceding series of amendments to this UN Regulation, for the vehicles/vehicle systems which are not affected by the changes introduced by the XX series of amendments [this series of amendments with the current supplement].

Annex 1

Communication

(maximum format: A4 (210 x 297 mm))

issued by: Name of administration:



concerning:²

- Approval
- Approval extended
- Approval refused
- Approval withdrawn
- Production definitively discontinued

of a vehicle type with regard to its tyre pressure monitoring system pursuant to Regulation No. 141.

Approval No.:

Extension No.:

1. Trade name or mark of the vehicle:

.....

2. Vehicle type (if applicable, variants that are included):

3. Manufacturer's name and address:

4. If applicable, name and address of the manufacturer's representative:

.....

5. Vehicle submitted for approval on:.....

6. Technical Service responsible for conducting approval tests:

7. Date of test report:

8. Number of test report:

9. Brief description of the vehicle type:

¹ Distinguishing number of the country which has granted/extended/refused/withdrawn approval (see approval provisions in the regulation).

² Strike out what does not apply.

9.1. Mass of the vehicle when tested:

Front axle:

Second axle:

Third axle:

Forth axle:

Fifth axle:

Sixth axle:

Total:

9.2. Marking and wheel size(s) of standard unit equipment:

9.3. Brief description of the tyre pressure monitoring system

10. Result of the tests:

	<i>Measured Time to warning (mm:ss)</i>
"Puncture test"	
"Diffusion test"	
"Malfunction test"	

11. Position of approval mark:

12. Reason(s) of extension (if applicable):

13. Approval granted/refused/extended/withdrawn²

14. Place:

15. Date:

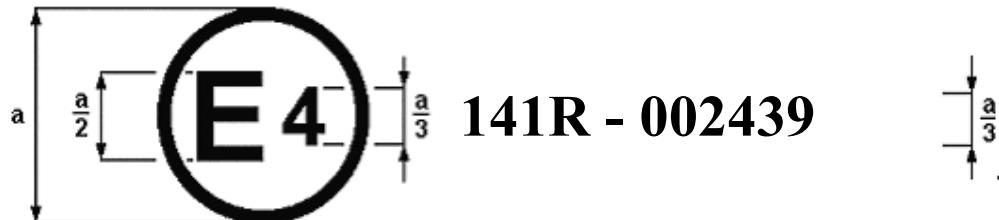
16. Signature:

17. The list of documents deposited with the Type Approval Authority which has granted approval is annexed to this communication and can be obtained upon request.

Annex 2

Arrangements of approval marks

(See paragraph 4.4. of this Regulation)



$a = 8 \text{ mm min.}$

The above approval mark affixed to a vehicle shows that the vehicle type concerned has, with regard to the equipment of a tyre pressure monitoring system, been approved in the Netherlands (E 4), pursuant to Regulation No. 141 under approval number 002439. The approval number indicates that the approval was granted in accordance with the requirements of Regulation No. 141 in its original form.

Annex 3

Tests for Tyre Pressure Monitoring Systems (TPMS)

1. Test conditions
 - 1.1. Ambient temperature.

The ambient temperature shall be between 0 °C and 40 °C.
 - 1.2. Road test surface.

The road shall have a surface affording good adhesion. The road surface shall be dry during testing.
 - 1.3. The tests shall be conducted in an environment free of interferences from radio wave.
 - 1.4. Vehicle conditions.
 - 1.4.1. Test weight.

The vehicle may be tested at any condition of load, the distribution of the mass among the axles being that stated by the vehicle manufacturer without exceeding any of the maximum permissible mass for each axle.

However, in the case where there is no possibility to set or reset the system, the vehicle shall be unladen. There may be, in addition to the driver, a second person on the front seat who is responsible for noting the results of the tests. The load condition shall not be modified during the test.
 - 1.4.2. Vehicle speed.

The TPMS shall be calibrated and tested **for vehicles of category M₁ up to a maximum mass of 3,500 kg and N₁**:

 - (a) In a speed range from forty km/h and 120 km/h or the vehicle's maximum design speed if it is less than 120 km/h for the puncture test to verify the requirements of paragraph 5.2. to this Regulation; and
 - (b) In a speed range from forty km/h and 100 km/h **or the vehicle's maximum design speed if it is less than 100 km/h** for the diffusion test to verify the requirements of paragraph 5.3 to this Regulation and for the malfunction test to verify the requirements of paragraph 5.4. to this Regulation.

The TPMS shall be calibrated and tested for vehicles of categories M₂, M₃, N₂, N₃, O₃, O₄:

 - (c) **In a speed range from 25 km/h and [90] km/h (or the vehicle's maximum design speed if it is less than [90] km/h) for the puncture test to verify the requirements of paragraph 5.2. to this Regulation; and**
 - (d) **In a speed range from 25 km/h and [90] km/h (or the vehicle's maximum design speed if it is less than [90] km/h) for the diffusion test to verify the requirements of paragraph 5.3 to this Regulation and for the malfunction test to verify the requirements of paragraph 5.4. to this Regulation.**

The whole speed range shall be covered during the test.

For vehicles equipped with cruise control, the cruise control shall not be engaged during testing.

1.4.3. Rim position.

The vehicle rims may be positioned at any wheel position, consistent with any related instructions or limitations from the vehicle's manufacturer.

1.4.4. Stationary location.

When the vehicle is parked, the vehicle's tyres shall be shaded from direct sun. The location shall be shielded from any wind that may affect the results.

1.4.5. Brake pedal application.

Driving time shall not accumulate during service brake application while the vehicle is moving.

1.4.6. Tyres.

The vehicle shall be tested with the tyres installed on the vehicle according to the vehicle manufacturer's recommendation. However, the spare tyre may be utilised for testing TPMS malfunction.

1.5. Accuracy of pressure measurement equipment.

Pressure measurement equipment to be used for the tests contained in this annex shall be accurate to at least +/-3kPa.

2. Test procedure

The test shall be performed at a test speed within the range in accordance with paragraph 1.4.2. to this annex, at least once for the test case according to paragraph 2.6.1. to this annex ("puncture test"), and at least once for each test case according to paragraph 2.6.2. to this annex ("diffusion test").

2.1. Before inflating the vehicle's tyres, leave the vehicle stationary outside at ambient temperature with the engine off shaded from direct sunlight and not exposed to wind or other heating or chilling influences for at least one hour. Inflate the vehicle's tyres to the vehicle manufacturer's recommended cold inflation pressure (P_{rec}), in accordance with the vehicle manufacturer's recommendation for the speed and load conditions, and tyre positions. All pressure measurements shall be carried out using the same test equipment.

2.2. With the vehicle stationary and the ignition locking system in the "Lock" or "Off" position, activate the ignition locking system to the "On" or "Run" position. The tyre pressure monitoring system shall perform a check of lamp function for the low tyre pressure tell-tale as specified in paragraph 5.5.2. of this Regulation. This last requirement does not apply to tell-tales shown in a common space.

2.3. If applicable, set or reset the tyre pressure monitoring system in accordance with the vehicle manufacturer's recommendations.

2.4. Learning phase.

2.4.1. Drive the vehicle for a minimum of twenty minutes within the speed range in paragraph 1.4.2. to this annex, and with an average speed of eighty km/h (± 10 km/h) **for M₁ vehicles of mass up to 3,500kg and N₁ vehicles, and fifty-seven km/h (+10 km/h) for M₂, M₃, N₂, N₃, O₃ and O₄ vehicles.** It is

allowed to be outside the speed range for a maximum cumulative time of two minutes during the learning phase.

2.4.2. At the discretion of the Technical Service, where the driving test is undertaken on a track (circle/oval) with only turns in a single direction, then the driving test in paragraph 2.4.1. above should be equally split (+/-2 minutes) in both directions.

2.4.3. Within the five minutes of completing the learning phase, measure the warm pressure of the tyre(s) to be deflated. The warm pressure shall be taken as the value P_{warm} . This value will be used for subsequent operations.

2.5. Deflation phase.

2.5.1. Procedure for the puncture test to verify the requirements of paragraph 5.2. to this Regulation.

Following the requirements specified in 5.1.5, deflate one of the vehicle's tyres within five minutes of measuring the warm pressure as described in paragraph 2.4.3. above, until it is at $P_{\text{warm}} - 20$ per cent, or it is at a minimum pressure of 150 kPa (**for M₁ up to 3,500kg and N₁ or 250 kPa (for M₂, M₃, N₂, N₃, O₃, O₄), whichever is higher, namely P_{test}. Following a stabilisation period of between two and five minutes the pressure P_{test} shall be rechecked and adjusted if necessary.**

2.5.2. Procedure for the diffusion test to verify the requirements of paragraph 5.3. to this Regulation.

Deflate all ~~four~~ tyres within five minutes of measuring the warm pressure as described in paragraph 2.4.3. above, until the deflated tyres are at $P_{\text{warm}} - 20$ per cent plus a further deflation of 7 kPa, namely P_{test}. Following a stabilisation period of between two and five minutes the pressure P_{test} shall be rechecked and adjusted if necessary.

2.6. Low tyre pressure detection phase.

2.6.1. Procedure for the puncture test to verify the requirements of paragraph 5.2. to this Regulation.

2.6.1.1. Drive the vehicle along any portion of the test course (not necessarily continuously). The sum of the total cumulative drive time shall be the lesser of 10 minutes or the time at which the low tyre pressure tell-tale illuminates.

2.6.2. Procedure for the diffusion test to verify the requirements of paragraph 5.3. to this Regulation.

2.6.2.1. Drive the vehicle along any portion of the test course. After not less than twenty (20) minutes and not more than forty (40) minutes bring the vehicle to a complete standstill with the engine switched off and the ignition key removed for not less than one (1) minute or more than three (3) minutes. Resume the test. The sum of the total cumulative drive time shall be the lesser of sixty (60) minutes of cumulative driving under the conditions set out in paragraph 1.4.2. above or the time at which the low tyre pressure tell-tale illuminates.

2.6.3. If the low tyre pressure signal did not illuminate, discontinue the test.

2.7. If the low tyre pressure tell-tale illuminated during the procedure in paragraph 2.6. above, deactivate the ignition locking system to the "Off" or "Lock" position. After a five minutes period, reactivate the vehicle's ignition

locking system to the "On" ("Run") position. The tell-tale must illuminate and remain illuminated as long as the ignition locking system is in the "On" ("Run") position.

- 2.8. Inflate all of the vehicle's tyres to the vehicle manufacturer's recommended cold inflation pressure. Reset the system in accordance with the instructions of the vehicle manufacturer. Determine whether the tell-tale has extinguished. If necessary, drive the vehicle until the tell-tale has been extinguished. If the tell-tale does not extinguish, discontinue the test.

- 2.9. Repetition of the deflation phase.

The test may be repeated, at the same or different loads, using the relevant test procedures in paragraphs 2.1. to 2.8. above, with the relevant tyre(s) on the vehicle under-inflated, in accordance with the provisions of paragraph 5.2. or 5.3. to this Regulation, whichever is relevant.

3. TPMS malfunction detection

- 3.1. Simulate a TPMS malfunction, for example, by disconnecting the power source to any TPMS component, disconnecting any electrical connection between TPMS components, or installing a tyre or wheel on the vehicle that is incompatible with the TPMS. When simulating a TPMS malfunction, the electrical connections for the tell-tale lamps shall not be disconnected.

- 3.2. Drive the vehicle for up to ten minutes of cumulative time (not necessarily continuously) along any portion of the test course.

- 3.3. The sum of the total cumulative drive time under paragraph 3.2. shall be the lesser of ten minutes or the time at which the TPMS malfunction tell-tale illuminates.

- 3.4. If the TPMS malfunction indicator did not illuminate in accordance with paragraph 5.4. to this Regulation, as required, discontinue the test.

- 3.5. If the TPMS malfunction indicator is illuminated or illuminates during the procedure in paragraphs 3.1 to 3.3 above, deactivate the ignition locking system to the "Off" or "Lock" position. After five minutes, reactivate the vehicle's ignition locking system to the "On" ("Run") position. The TPMS malfunction indicator shall again signal a malfunction and remain illuminated as long as the ignition locking system is in the "On" ("Run") position.

- 3.6. Restore the TPMS to normal operation. If necessary, drive the vehicle until the warning signal has extinguished. If the warning lamp has not extinguished, discontinue the test.

- 3.7. The test may be repeated using the test procedures in paragraphs 3.1. to 3.6. above, with each such test limited to simulation of a single malfunction.
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II. Justification

The current amendments are submitted aiming to introduce TPMS requirements in Regulation (EU) 2019/2144 following the requirements in UNECE Regulation No. 141.

1. Scope

Scope amended to include M₂, M₃, N₂, N₃, O₃ and O₄ vehicles. Original scope of Regulation 141 (M₁ up to maximum mass of 3,500kg and N₁) retained, albeit without the restriction to only vehicles with single tyres, since larger vehicles with twin tyres will be included in the scope of the amended regulation.

2. Definitions

2.4 Twin wheels

Definition for “twin wheel” added since majority of vehicles in larger categories have multiple tyres on each side of at least some axles.

2.8 TPMS

Definition of Tyre Pressure Monitoring System modified to follow the definition in GSR [Regulation (EU) 2019/2144].

5. Specifications and tests

5.1.1

Scope amended to include M₂, M₃, N₂, N₃, O₃, O₄ and N₁ vehicles with twin wheels as well. Consideration of only vehicles fitted with single tyres removed since the amended regulation will apply to vehicles with single and twin tyres.

5.1.3

Speed ranges of operation for M₂, M₃, N₂, N₃, O₃, and O₄ vehicles added in line with typical operating speeds for vehicles of these categories.

5.1.5

Requirement added to ensure that for the puncture test, a tyre from the twin wheel (if present on any variant submitted for approval) is tested. This is to ensure that the TPMS can detect a puncture on a twin wheel.

5.2.1, 5.3.1

Requirements on minimum tyre pressure level for M₂, M₃, N₂, N₃, O₃, and O₄ vehicles in puncture test and diffusion test set to 250 kPa in line with review of vehicles in these categories and stakeholder information.

5.5.2, 5.5.5

Requirement added for N2 and N3 vehicles to distinguish a TPMS warning from the tractor unit and the trailer. This is to ensure that the vehicle location of the TPMS issue can be identified by the driver.

12. Transitional provisions

Addition of transitional provisions.

Annex 1 : Communication

9.1

Addition of axle loads for multiple axles so that information can be recorded for M₂, M₃, N₂, N₃, O₃, and O₄ vehicles.

Annex 3: Tests for Tyre Pressure Monitoring Systems (TPMS)

1.4.2

(b) Correction of units and addition of “or the vehicle's maximum design speed if it is less than 100 km/h” for M1 and N1 vehicles for diffusion test to be consistent with those for puncture test.

(c) and (d) addition of new speed ranges for M2, M3, N2, N3, O3, and O4 vehicles for puncture and diffusion test respectively. These speed ranges have been selected after a review of vehicles in these categories and information provided by stakeholders.

2.4.1

Average speed for the learning phase added for M2, M3, N2, N3, O3, and O4 vehicles. The value (57 km/h) is the rounded-down average of the speed ranges in 1.4.2. of Annex 3.

2.5.1

Reference to 5.1.5 added to clarify the previously described selection of the test tyre for the puncture test (selection of the twin tyre if applicable) and modification of minimum pressure level in line with the wider range of vehicle categories in scope.

2.5.2

Deletion of “four” as the scope now means that vehicles could well have more than four wheels. It is the intention that all tyres will be deflated for the diffusion test; this will be assessed in forthcoming testing.