



Vehicle Standard (Australian Design Rule 107/00 – Emergency Lane Keeping Systems for Passenger Vehicles and Light Goods Vehicles) 2025

I, XXX, XXX, determine this national road vehicle standard under section 12 of the *Road Vehicle Standards Act 2018*.

Dated

[DRAFT FOR CONSULTATION]

XXX

XXX

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1. LEGISLATIVE PROVISIONS

1.1. Name of Standard

1.1.1. This standard is the Vehicle Standard (Australian Design Rule 107/00 – Emergency Lane Keeping Systems for Passenger Vehicles and Light Goods Vehicles) 2025.

1.1.2. This standard may also be cited as Australian Design Rule 107/00 – Emergency Lane Keeping Systems for Passenger Vehicles and Light Goods Vehicles, Australian Design Rule 107/00, or ADR 107/00.

1.2. Commencement

1.2.1. This standard commences on the day after it is registered.

2. FUNCTION

2.1. The function of this standard is to specify requirements for Emergency Lane Keeping Systems, that provides the driver with a warning and corrects the vehicle's trajectory when the vehicle unintentionally leaves the lane.

3. APPLICABILITY

3.1. This vehicle standard applies to category MA, MB, MC and NA vehicles, from the dates set out in clauses 3.1.1 to 3.1.2 and the table under clause 3.3 below.

3.1.1. 1 November 2027 for new model vehicles.

3.1.2. 1 November 2028 for all vehicles.

3.2. For the purposes of clause 3.1.1, a “new model” is a vehicle model first produced with a ‘*Date of Manufacture*’ on or after the date prescribed in that clause.

3.3. Applicability Table

Vehicle Category	ADR Category Code	UN Category Code*	Manufactured on or After**	Acceptable Prior Rules
Moped 2 wheels	LA	L ₁	Not Applicable	
Moped 3 wheels	LB	L ₂	Not Applicable	
Motor cycle	LC	L ₃	Not Applicable	
Motor cycle and sidecar	LD	L ₄	Not Applicable	
Motor tricycle	LE	L ₅		
	LEM		Not Applicable	
	LEP		Not Applicable	
	LEG		Not Applicable	
Passenger car	MA	M ₁	1 November 2027	Nil
Forward-control passenger vehicle	MB	M ₁	1 November 2027	Nil
Off-road passenger vehicle	MC	M ₁	1 November 2027	Nil
Light omnibus	MD	M ₂		
up to 3.5 tonnes 'GVM' and up to 12 seats	MD1		Not Applicable	
up to 3.5 tonnes 'GVM' and more than 12 seats	MD2		Not Applicable	
over 3.5 tonnes and up to 4.5 tonnes 'GVM'	MD3		Not Applicable	
over 4.5 tonnes and up to 5 tonnes 'GVM'	MD4		Not Applicable	
Heavy omnibus	ME	M ₃	Not Applicable	
Light goods vehicle	NA	N ₁	1 November 2027	Nil
Medium goods vehicle	NB	N ₂		
over 3.5 tonnes up to 4.5 tonnes 'GVM'	NB1		Not Applicable	
over 4.5 tonnes up to 12 tonnes 'GVM'	NB2		Not Applicable	
Heavy goods vehicle	NC	N ₃	Not Applicable	
Very light trailer	TA	O ₁	Not Applicable	
Light trailer	TB	O ₂	Not Applicable	
Medium trailer	TC	O ₃	Not Applicable	
Heavy trailer	TD	O ₄	Not Applicable	

* The category code may also be in the format L1, L2, L3 etc

** See clauses 3.1 to 3.2.

4. DEFINITIONS

- 4.1. For vehicle categories, definitions and meanings used in this standard, refer to:
 - 4.1.1. Vehicle Standard (Australian Design Rule – Definitions and Vehicle Categories) 2005; and
 - 4.1.2. Definitions in Appendix A of this standard.

5. REQUIREMENTS

- 5.1. Vehicles must be equipped with an Emergency Lane Keeping System (ELKS) and meet the requirements of:
 - (a) Appendix A, as varied by clause 6 (Exemptions and Alternative Procedures); or
 - (b) the alternative standard under clause 7.1.

6. EXEMPTIONS AND ALTERNATIVE PROCEDURES

- 6.1. Compliance with the following parts, paragraphs and annexes of Appendix A is not required for the purposes of this standard:
 - Paragraph 3 Application for approval
 - Paragraph 4 Approval
 - Paragraph 9 Modification and extension of approval of the vehicle type
 - Paragraph 10 Conformity of production
 - Paragraph 11 Penalties for non-conformity of production
 - Paragraph 12 Production definitively discontinued
 - Paragraph 13 Names and addresses of Technical Services responsible for conducting approval tests, and of Type Approval Authorities

Annexes

- Annex 1 Communication
 - Annex 2 Arrangement of the approval mark
- 6.2. In paragraphs 6.5.2, 6.6.2, 7.2.1 and 8.2.1 of Appendix A, “Annex 3 of UN Regulation No 130” must be read as “Annex 3 of UN Regulation No 130, incorporating the 01 series of amendments”.
- 6.3. In paragraphs 6.3.1, 7.2, 7.2.2.1, 8.2, and 8.2.2.1 of Appendix A, omit “Technical Service” (wherever occurring), substitute “Testing Facility”.
- 6.4. Omit paragraph 6.4 (“Provisions for the Periodic Technical Inspection”) of Appendix A.
- 6.5. In paragraph 6.4.1 of Appendix A, omit “At a periodic Technical Inspection,”.
- 6.6. In paragraph 6.4.2 of Appendix A, omit “At the time of type approval,”.
- 6.7. In paragraphs 7.3.2.3, 8.3.1.2, 8.3.2.2, and 8.3.3.3 of Appendix A, omit “to the satisfaction of the Technical Service”.

- 6.8. In paragraph 8.3.1.1 of Appendix A, omit “with the consent of the Type Approval Authority”.
- 6.9. In paragraphs 1, 3.1, 3.1.1, 3.4.1, 3.4.4, 4.1.1, 4.1.2 and 5 in Annex 3 of Appendix A, omit “Technical Service” (wherever occurring), substitute “Testing Facility”.
- 6.10. In paragraph 1 in Annex 3 of Appendix A, omit “, for type approval purposes”.
- 6.11. In paragraph 2.3 in Annex 3 of Appendix A, omit “type”.
- 6.12. In paragraph 3.1 in Annex 3 of Appendix A, omit “For periodic technical inspections, the documentation shall describe how the current operational status of “the system” can be checked.”
- 6.13. In paragraph 3.1.1 (a) in Annex 3 of Appendix A, omit “for the approval”.
- 6.14. In paragraph 3.1.1 (a) in Annex 3 of Appendix A, omit “at the time of submission of the type-approval application”.
- 6.15. In paragraph 3.1.1 (a) in Annex 3 of Appendix A, omit “The Technical Service shall ensure that this documentation package remains available for a period determined in agreement with the Approval Authority. This period shall be at least 10 years counted from the time when production of the vehicle is definitely discontinued”.
- 6.16. In paragraph 3.1.1 (b) in Annex 3 of Appendix A, omit “at the time of type approval”.
- 6.17. In paragraph 3.1.1 (b) in Annex 3 of Appendix A, omit “The manufacturer shall ensure that this material and analysis data remains available for a period of 10 years counted from the time when production of the vehicle is definitely discontinued”.
- 6.18. In paragraph 3.4.4 in Annex 3 of Appendix A, omit “at the time of the type-approval”.
- 6.19. In paragraph 5 in Annex 3 of Appendix A, omit “to the Type Approval Authority”.
- 6.20. In paragraph 3.6 in Annex 3 – Appendix 1 of Appendix A, omit “Provisions for the periodic technical inspection of "The System" (Annex 3, paragraph 3.1.)”.
- 6.21. In paragraph 4.4 in Annex 3 – Appendix 1 of Appendix A, omit “Technical Service”, substitute “Testing Facility”.
- 6.22. If there is a conflict between clause 6 (exemptions and alternative procedures) and Appendix A, clause 6 takes precedence.

7. ALTERNATIVE STANDARDS

- 7.1. For vehicles equipped with an Emergency Lane Keeping System (ELKS), the technical requirements of the United Nations Regulation No. 17X – UNIFORM PROVISIONS CONCERNING THE APPROVAL OF MOTOR VEHICLES WITH REGARD TO THE EMERGENCY

LANE KEEPING SYSTEMS (ELKS) FOR M₁ AND N₁ VEHICLES, incorporating the original version of the regulation (00 series of amendments), subject to clause 7.1.1. below.

- 7.1.1. “Annex 3 of UN Regulation No 130” (wherever occurring) must be read as “Annex 3 of UN Regulation No 130, incorporating the 01 series of amendments”.

APPENDIX A

**THIS PAGE IS RESERVED FOR THE UN REGULATION
NO. 17X TITLE PAGE**

UN Regulation No. 17X

Uniform provisions concerning the approval of motor vehicles with regard to the Emergency Lane Keeping Systems (ELKS) for M₁ and N₁ vehicles¹

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¹ This regulation is based off European Regulation 2021/646, Document 32021R0646, OJ L 133, 20.4.2021, p. 31–53, European Commission, <https://eur-lex.europa.eu/homepage.html>, © European Union, 1998-2024.

Introduction

This Regulation establishes uniform provisions for Emergency Lane Keeping Systems (ELKS) fitted to motor vehicles of the Categories M₁ and N₁.

The system shall automatically detect a potential lane departure, provide the driver with an appropriate warning and correct the vehicle's trajectory when the driver unintentionally leaves the lane.

The driver can maintain control and override the system at any time by taking a deliberate action, such as steering or other control inputs.

While this Regulation cannot account for all the traffic conditions and infrastructure features during the type-approval process, it acknowledges that the required performance may not be achieved in all circumstances. Vehicle condition, road adhesion, weather conditions, deteriorated infrastructure and traffic scenarios can all impact system performances. Real-world conditions should not trigger false warnings or steering interventions that discourage the driver's use of the system.

In the case of a failure in the system, the safe operation of the vehicle shall not be endangered.

This Regulation is an "if-fitted" regulation. It shall not prevent Contracting Parties from mandating the fitting of ELKS designed to prevent unintentional lane departures approved in accordance to this Regulation.

1. Scope

This Regulation applies to the approval of vehicles of categories M₁ and N₁² with regards to their Emergency Lane Keeping Systems (ELKS).

2. Definitions

For the purpose of this Regulation:

- 2.1. *'Vehicle type with regard to its emergency lane-keeping system'* means a category of vehicles which do not differ in such essential aspects as:
- (1) Vehicle features which significantly influence the performances of the emergency lane-keeping system;
 - (2) The type and design of the emergency lane-keeping system.
- 2.2. *'Corrective directional control function (CDCF)'* means a control function within an electronic control system whereby, for a limited duration, changes to the steering angle of one or more wheels and/or braking of individual wheels may result from the automatic evaluation of signals initiated on-board the vehicle optionally enriched by data provided off-board the vehicle, in order to correct lane departure, e.g. to avoid crossing lane markings, leaving the road.
- 2.3. *'Subject vehicle'* means the vehicle being tested.
- 2.4. *'Distance to lane marking (DTLM)'* means the remaining lateral distance (perpendicular to the lane marking) between the inner side of the lane marking and most outer edge of the tyre before the subject vehicle crosses the inner side of the lane marking.

² As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.6, para. 2 – www.unece.org/transport/standards/transport/vehicle-regulations-wp29/resolutions

- 2.5. *'Flat road'* means a road with a slope less than 1 per cent in the longitudinal direction and for the lateral direction, less than 2 per cent for half a lane width either side of the centreline and less than 3 per cent for the outer half of the lane.
- 2.6. *'Dry road'* means a road with a nominal peak braking coefficient of 0.9.
- 2.7. *'Lane Departure Warning System (LDWS)'* means a system to warn the driver of an unintentional drift of the vehicle out of its travel lane.

3. Application for approval

- 3.1. The application for approval of a vehicle type with regard to the ELKS shall be submitted by the vehicle manufacturer or by the manufacturer's authorized representative to the Type Approval Authority of the Contracting Party, according to the provisions of Schedule 3 of the 1958 Agreement.
- 3.2. It shall be accompanied by the following documentation (a model of the information document is provided in Annex 1).
 - 3.2.1. A description of the vehicle type with regard to the items specified in paragraph 2.1 together with a documentation package as required in Annex 1 which gives access to the basic design of the ELKS and the means by which it is linked to other vehicle systems, or by which it directly controls output variables.
- 3.3. A vehicle representative of the vehicle type to be approved shall be submitted to the Type Approval Authority or its designated technical service responsible for conducting the approval tests.

4. Approval

- 4.1. If the vehicle type submitted for approval pursuant to this UN Regulation meets the requirements of paragraphs 5 to 8 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 (e.g. 00 for the UN Regulation in its original form) shall indicate the series of amendments incorporating the technical amendments made to the UN Regulation at the time of issue of the approval. The same Contracting Party shall not assign the same number to another type of vehicle.
- 4.3. Communication including approval of extension of refusal or of withdrawal of approval or of production definitively discontinued of a vehicle type pursuant to this UN Regulation shall be communicated to the Contracting Parties to the Agreement applying this UN Regulation by means of a form conforming to the model in Annex 1 to this UN Regulation and documentation supplied by the applicant being in a format not exceeding A4 (210 × 297mm), and on an appropriate scale or electronic format.
- 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 UN Regulation, an international approval mark conforming to the model described in Annex 2, consisting of either:
 - 4.4.1. A circle surrounding the letter "E" followed by:
 - (a) The distinguishing number of the country which has granted approval; and
 - (b) The number of this Regulation, followed by the letter "R", a dash and the approval number to the right of the circle prescribed in this paragraph.

- 4.5. The approval mark shall be clearly legible and be indelible.
- 4.6. The Type Approval Authority shall verify the existence of satisfactory arrangements for ensuring effective checks on conformity of production before type-approval is granted.

5. General requirements

- 5.1. An emergency lane-keeping system (ELKS) shall comprise a lane departure warning system (LDWS) and a corrective directional control function (CDCF).
- 5.1.1. The LDWS shall meet the requirements of paragraphs 6.1 to 6.4 and paragraph 6.5.
- 5.1.2. The CDCF shall meet the requirements of paragraphs 6.1 to 6.4 and paragraph 6.6.
- 5.2. ELKS lane departure warnings and interventions
Subject to specific requirements below the system shall be designed to minimise warnings and interventions for driver intended manoeuvres.

6. Specific requirements

- 6.1. ELKS failure warning
A warning shall be provided when there is a failure in the ELKS that prevents the requirements of this Regulation being met.
- 6.1.1. The failure warning shall be a constant visual warning signal.
- 6.1.1.1. There shall not be an appreciable time interval between each ELKS self-check (an integrated function that checks for a system failure on a continuous basis at least while the system is active), and subsequently there shall not be a delay in illuminating the warning signal, in the case of an electrically detectable failure.
- 6.1.1.2. Upon detection of any non-electrical failure condition (e.g. sensor misalignment), the warning signal as defined in paragraph 6.1.1 shall be activated.
- 6.1.2. If the vehicle is equipped with a means to deactivate the ELKS a warning shall be given when the system is deactivated according to paragraph 6.2. This shall be a constant visual warning signal. The failure warning signal specified in paragraph 6.1.1 may be used for this purpose.
- 6.2. ELKS deactivation
- 6.2.1. Manual deactivation
When a vehicle is equipped with a means to manually deactivate the ELKS function, either partially or fully, the following conditions shall apply as appropriate:
- 6.2.1.1. The full ELKS function shall be automatically and fully reinstated upon a new initiation of the powertrain³.
A new engine start (or run cycle) which is performed automatically, e.g. the operation of a stop/start system, shall not be considered an “initiation of the powertrain” wherever that term is used in this Regulation.

³ As defined in Mutual Resolution No. 2 (M.R.2) of the 1958 and the 1998 Agreements containing vehicle propulsion system definitions, see document ECE/TRANS/WP.29/1121.

- 6.2.1.2. The manual deactivation of the full ELKS shall not be possible with less than two deliberate actions, e.g. press and hold on a button, or select and confirm on menu option. It shall be possible to easily suppress acoustic warnings of the LDWS, but such action shall not at the same time deactivate the LDWS or the CDCF.
- 6.2.1.3. The manual deactivation capability shall be tested in accordance with the relevant vehicle test(s) specified in paragraph 6.
- 6.2.2. Automatic deactivation

If the vehicle is equipped with a means to automatically deactivate the ELKS function, either partially or fully, for instance in situations such as off-road use, being towed, a trailer being hitched to the vehicle or the Electronic Stability Control (ESC) being deactivated, the following conditions shall apply as appropriate:

 - 6.2.2.1. In accordance with Annex 3 of this Regulation, the vehicle manufacturer shall provide a list of situations and corresponding criteria where the ELKS function is automatically deactivated which shall be annexed to the test report.
 - 6.2.2.2. The ELKS function shall be automatically and fully reactivated as soon as the conditions that led to the automatic deactivation are not present anymore.
- 6.2.3. A constant visual warning signal shall inform the driver that the ELKS function has been deactivated. The failure warning signal specified in paragraph 6.1.1 above may be used for this purpose.
- 6.3. Automatic suppression
 - 6.3.1. For driver intended manoeuvres

In accordance with Annex 3 of this Regulation, the manufacturer shall provide a documentation package which gives access to the basic design and logic of the system for detection of likely driver intended manoeuvres and automatic suppression of the ELKS. This package shall include a list of parameters detected and a basic description of the method used to decide that the system should be suppressed, including limit values where possible. For both the CDCF and LDWS, the Technical Service shall assess the documentation package to show that driver unintentional manoeuvres, within the scope of the lane keep test parameters (in particular lateral departure velocity), will not result in automatic suppression of the system.
 - 6.3.2. Automatic suppression of the ELKS is also permitted in situations when other driver assists or automated steering functions, (i.e. Automatically commanded steering function, emergency steering function or automated lane keeping), are controlling the lateral movement of the vehicle or other safety related functions (i.e. that is capable of changing the dynamic behaviour of the vehicle such as Advanced Emergency Braking System (AEBS), ESC, etc.) are intervening. These situations shall be declared by the manufacturer in accordance with Annex 3 of this Regulation.
- 6.4. Provisions for the Periodic Technical Inspection
 - 6.4.1. At a Periodic Technical Inspection, it shall be possible to confirm the correct operational status of the ELKS by a visible observation of the failure warning signal status following an initiation of the powertrain and any bulb check. In the case of the failure warning signal being in a common space, the common space must be observed to be functional prior to the failure warning signal status check.
 - 6.4.2. At the time of type approval, the means to protect against simple unauthorised modification of the operation of the failure warning signal chosen by the manufacturer shall be confidentially outlined. Alternatively, this protection

requirement is fulfilled when a secondary means of checking the correct operational status of the ELKS is available.

6.5. LDWS requirements

6.5.1. Speed range

The LDWS shall be active at least within the vehicle speed range between 65 km/h and 130 km/h (or the maximum vehicle speed if it is lower than 130 km/h) and at all vehicle load conditions, unless deactivated as per paragraph 6.2.

6.5.2. Lane departure warning

When activated and operated within the prescribed speed range, the LDWS shall be able to warn the driver at the latest if the vehicle crosses over a visible lane marking for the lane in which it is running by more than a DTLM of – 0.3 m:

- (a) For lateral departure velocities in the range of the 0.1 m/s to 0.5 m/s;
- (b) On straight, flat and dry roads;
- (c) For solid line and dashed lane markings in line with one of those described in Annex 3 (Visible lane marking identification) to UN Regulation No 130 on Uniform provisions concerning the approval of motor vehicles with regard to the Lane Departure Warning System;
- (d) With the markings being in good condition and of a material conforming to the standard for visible markings of that contracting party;
- (e) In all illumination conditions without blinding of the sensors (e.g. direct blinding due to sunlight) and with activated passing-beam (dipped-beam) headlamps if necessary;
- (f) In absence of weather conditions affecting the visibility of lane markings (e.g. no fog).

It is recognized that the performance required may not be fully achieved in other conditions than those listed above. However, the system shall not unreasonably switch the control strategy in these other conditions.

The lane departure warning capability shall be tested in accordance with the relevant vehicle test(s) specified in paragraph 7.

6.5.3. LDWS warning indication

6.5.3.1. The lane departure warning referred to in paragraph 6.5.2 shall be noticeable by the driver and be provided by:

- (a) At least two warning means out of visual, acoustic and haptic; or
- (b) One warning means out of haptic and acoustic, with spatial indication about the direction of unintended drift of the vehicle.

The warning mentioned above may be suppressed when there is a driver action which indicates an intention to depart from the lane;

6.5.3.1.1. Where a visual signal is used for the lane departure warning, it may use the failure warning signal as specified in paragraph 6.1.1 above in a flashing mode.

6.5.3.1.2. When there is a lane keep intervention by the CDCF, this shall be considered a haptic warning according to paragraph 6.5.3.1.

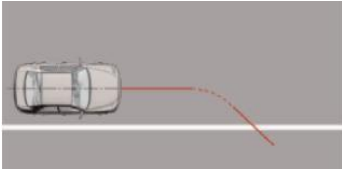
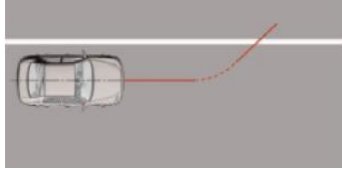
6.5.3.2. The LDWS visual warning signal shall be activated following an initiation of the powertrain. This requirement does not apply to warning signals shown in a common space.

- 6.5.3.3. The LDWS visual warning signals shall be visible even by daylight; the satisfactory condition of the signals must be easily verifiable by the driver from the driver's seat.
- 6.5.3.4. The visual warning signal shall be tested in accordance with the relevant vehicle test(s) specified in paragraph 7.
- 6.6. CDCF performance requirements
- 6.6.1. Speed range

The CDCF shall be active at least between 70 km/h and 130 km/h (or the maximum vehicle speed if it is below 130 km/h) and at all vehicle load conditions, unless deactivated as per paragraph 6.2. However, in the case that the vehicle reduces its speed from above 70 km/h to below 70 km/h, the system shall be active at least until the vehicle speed reduces below 65 km/h.
- 6.6.2. Lane keep

In the absence of conditions leading to deactivation or suppression of the system, the CDCF shall be able to prevent lane departure by crossing of visible lane markings in the scenarios shown in the following table by more than a DTLM of – 0.3 m:

 - (a) For lateral departure velocities in the range of the 0.2 m/s to 0.5 m/s for vehicle speeds up 100 km/h and for lateral departure velocities in the range of 0.2 m/s to 0.3 m/s for vehicle speeds greater than 100 km/h and up to 130 km/h (or the maximum vehicle speed if it is below 130 km/h);
 - (b) On straight, flat and dry roads;
 - (c) For solid lane markings in line with one of those described in Annex 3 (Visible lane marking identification) to UN Regulation No 130;
 - (d) With the markings being in good condition and of a material conforming to the standard for visible markings of that contracting party;
 - (e) In all illumination conditions without blinding of the sensors (e.g. direct blinding sunlight) and with activated passing-beam (dipped-beam) headlamps if necessary;
 - (f) In absence of weather conditions affecting the dynamic performance of the vehicle (e.g. no storm, not below 5 °C) or the visibility of lane markings (e.g. no fog).

No.	Scenario description
1.	Solid line – departure to right side of vehicle 
2.	Solid Line – Departure to left of vehicle 

It is recognized that the performances required for the scenarios in this table may not be fully achieved in other conditions than those listed above. However, the system shall not unreasonably switch the control strategy in these other conditions. This shall be demonstrated in accordance with Annex 3 of this Regulation.

The lane keep capability shall be tested in accordance with the relevant vehicle test(s) specified in paragraph 8.

- 6.6.3. Steering override
 - 6.6.3.1. The steering control effort necessary to override the directional control provided by the system shall not exceed 50 N. Significant loss of steering support once overridden shall not happen suddenly.
 - 6.6.3.2. For CDCF systems which do not act on the steering itself (e.g. differential braking type CDCF), the steering input shall not exceed 25 degrees.
 - 6.6.3.3. The steering override control effort shall be tested in accordance with the relevant vehicle test(s) specified in paragraph 8.
- 6.6.4. CDCF warning indication
 - 6.6.4.1. Every CDCF intervention shall immediately be indicated to the driver by a visual warning signal which is displayed for at least 1 second or as long as the intervention exists, whichever is longer. The visual signal may be the flashing of the failure warning signal specified in paragraph 6.1.1.
 - 6.6.4.1.1. In the case of an intervention longer than 10 seconds, an acoustic warning signal shall be provided until the end of the intervention unless there is a driver action which indicates an intention to depart from the lane.
 - 6.6.4.1.2. In the case of two or more consecutive interventions within a rolling interval of 180 seconds and in the absence of a steering input by the driver during this intervention, an acoustic warning signal shall be provided by the system during the second and any further intervention within a rolling interval of 180 seconds. Starting with the third intervention (and subsequent interventions) the acoustic warning signal shall continue for at least 10 seconds longer than the previous warning signal.
 - 6.6.4.2. The requirements in paragraph 6.6.4.1.1 and 6.6.4.1.2 shall be tested in accordance with the relevant vehicle test(s) specified in paragraph 8.

7. Test requirements for Lane Departure Warning Systems (LDWS)

7.1. General provisions

Vehicles fitted with LDWS shall fulfil the appropriate tests requirements of this point

7.2. Testing conditions

The tests shall be performed:

- (a) On a flat and dry asphalt or concrete road type surface, which may not contain any irregularities (e.g. large dips or cracks, manhole covers or reflective studs) within a lateral distance of 3.0 m to either side of the centre of the test lane and with a longitudinal distance of 30 m ahead of the subject vehicle from the point after the test is complete.
- (b) In ambient illumination conditions of at least 2000 lux without blinding of the sensors (e.g. direct blinding sunlight) and with activated low beam head lamps if necessary.
- (c) In ambient air temperatures between 5 °C and 45 °C.
- (d) In the absence of weather conditions affecting the visibility of lane markings, e.g. fog.

At the request of the manufacturer and with the agreement of the Technical Service tests may be conducted under deviating test conditions (suboptimal conditions, e.g. on a not dry surface; below the specified minimum ambient temperature), whilst the performance requirements are still to be met.

7.2.1. Lane markings

The solid line and dashed lane markings on the road used for the tests shall be in line with one of those described in Annex 3 (Visible lane marking identification) to UN Regulation No 130. The markings shall be in good condition and of a material conforming to the standard for visible lane markings. The lane-marking layout used for the tests shall be recorded in the test report.

The width of the lane (measured between the lane markings) shall be a minimum of 3.5 m for the purpose of the tests of this point. The vehicle manufacturer shall demonstrate, through the use of documentation, compliance with all other lane markings identified in Annex 3 (Visible lane marking identification) to UN Regulation No 130. Any of such documentation shall be appended to the test report.

7.2.2. Subject vehicle conditions

7.2.2.1. Test mass

The subject vehicle shall be tested in a load condition agreed between the manufacturer and the Technical Service. No load alteration shall be made once the test procedure has begun. The vehicle manufacturer shall demonstrate, through the use of documentation, that the system works at all load conditions.

7.2.2.2. The subject vehicle shall be tested at the tyre pressures recommended by the vehicle manufacturer.

7.2.2.3. Where the LDWS is equipped with a user-adjustable warning threshold, the tests specified in paragraph 7.3 shall be performed with the warning threshold set at its maximum lane departure setting. No alteration shall be made once the test procedure has begun.

7.2.2.4. Pre-test conditioning

If requested by the vehicle manufacturer the vehicle can be driven to calibrate the sensor system up to a maximum of 100 km on a mixture of urban and rural roads with other traffic and roadside furniture.

7.3. Test procedures

7.3.1. Visual warning signal verification test

With the vehicle stationary check that the visual warning signal(s) comply with the requirements of paragraph 6.5.3.2.

7.3.2. Lane departure warning test

7.3.2.1. Drive the vehicle at a speed of 70 km/h $\pm$ 3 km/h into the centre of the test lane in a smooth manner so that the attitude of the vehicle is stable.

Maintaining the prescribed speed, gently drift the vehicle, either to the left or the right, with a lateral departure velocity of between 0.1 m/s and 0.5 m/s so that the vehicle crosses the lane marking.

Repeat the test at a different rate of departure within the range 0.1 m/s and 0.5 m/s. Repeat the above tests drifting in the opposite direction.

7.3.2.2. The test requirements are fulfilled if the LDWS provides the lane departure warning indication mentioned in paragraph 6.5.3.1 above at the latest when the DLTM is $\pm$ 0.3 m.

7.3.2.3. In addition, the vehicle manufacturer shall demonstrate to the satisfaction of the Technical Service that the requirements for the whole speed range and lateral departure velocity range are fulfilled. This may be achieved on the basis of appropriate documentation appended to the test report.

7.3.3. Manual deactivation test

7.3.3.1. If the vehicle is equipped with means to manually deactivate the ELKS (LDWS), initiate the powertrain and deactivate the ELKS (LDWS). The warning signal specified in paragraph 6.2.3 shall be activated.

Deactivate the powertrain. Initiate the powertrain and verify that the previously activated warning signal is not reactivated, thereby indicating that the ELKS (LDWS) has been reinstated as specified in paragraph 6.2.1.1.

8. Test requirements for Corrective Directional Control Function (CDCF)

8.1. General provisions

Vehicles fitted with CDCF shall fulfil the appropriate tests requirements of this point.

8.2. Testing conditions

The tests shall be performed:

- (a) On a flat and dry asphalt or concrete road type surface, which may not contain any irregularities (e.g. large dips or cracks, manhole covers or reflective studs) within a lateral distance of 3.0 m to either side of the centre of the test lane and with a longitudinal distance of 30 m ahead of the subject vehicle from the point after the test is complete.
- (b) In ambient illumination conditions of at least 2000 lux without blinding of the sensors (e.g. direct blinding sunlight) and with activated low beam head lamps if necessary.
- (c) In ambient air temperatures between 5 °C and 45 °C.

- (d) In the absence of weather conditions affecting the dynamic performance of the vehicle (e.g. no storm, not below 5 °C) or the visibility of lane markings (e.g. fog).

At the request of the manufacturer and with the agreement of the Technical Service tests may be conducted under deviating test conditions (suboptimal conditions, e.g. on a not dry surface; below the specified minimum ambient temperature), whilst the performance requirements are still to be met.

8.2.1. Lane markings

The solid lane marking on the road used for the tests shall be in line with one of those described in Annex 3 (Visible lane marking identification) to UN Regulation No 130. The marking shall be in good condition and of a material conforming to the standard for visible lane markings. The lane-marking used for the tests shall be recorded in the test report.

The solid lane marking shall be a minimum of 3.5 m distance from any other lane markings, for the purpose of the tests of this point. The vehicle manufacturer shall demonstrate, through the use of documentation, compliance with all other solid lane markings identified in Annex 3 (Visible lane marking identification) to UN Regulation No 130. Any of such documentation shall be appended to the test report.

8.2.2. Subject vehicle conditions

8.2.2.1. Test mass

The subject vehicle shall be tested in a load condition agreed between the manufacturer and the Technical Service. No load alteration shall be made once the test procedure has begun. The vehicle manufacturer shall demonstrate, through the use of documentation, that the system works at all load conditions.

8.2.2.2. The subject vehicle shall be tested at the tyre pressures recommended by the vehicle manufacturer.

8.2.2.3. Where the CDCF is equipped with a user-adjustable timing threshold, the test specified in paragraph 8.3.3 shall be performed with the timing threshold set at its latest setting for system intervention. No alteration shall be made once the test procedure has begun.

8.2.2.4. Pre-test conditioning

If requested by the vehicle manufacturer the vehicle can be driven to calibrate the sensor system up to a maximum of 100 km on a mixture of urban and rural roads with other traffic and roadside furniture.

8.3. Tests procedures

8.3.1. Warning indication test

8.3.1.1. The subject vehicle shall be driven with an activated CDCF on a road with solid lane markings on at least one side of the lane.

The test conditions and the subject vehicle test speed shall be within the operating range of the system.

During the test, the duration of the CDCF interventions and of the visual and acoustic warning signals shall be recorded.

In the case referred to in paragraph 6.6.4.1.1, the subject vehicle shall be driven such that it attempts to leave the lane and causes CDCF intervention to be maintained for a period longer than 10 seconds. If such a test cannot be practically achieved due to e.g. the limitations of the test facilities, with the consent of the Type Approval Authority this requirement may be fulfilled through the use of documentation.

The test requirements are fulfilled if the acoustic warning is provided no later than 10 seconds after the beginning of the intervention.

In the case referred to in paragraph 6.6.4.1.2, the subject vehicle shall be driven in such a way that it attempts to leave the lane and causes at least three interventions of the system within a rolling interval of 180 seconds.

The test requirements are fulfilled if all the following conditions are met:

- (a) A visual warning signal is provided for each intervention, as long as the intervention exists;
- (b) An acoustic warning signal is provided at the second and third intervention;
- (c) The acoustic warning signal at the third intervention is at least 10 s longer than the one at the second intervention.

8.3.1.2. In addition, the manufacturer shall demonstrate to the satisfaction of the Technical Service that the requirements defined in paragraph 6.6.4.1.1 and 6.6.4.1.2 are fulfilled in the whole range of CDCF operation. This may be achieved on the basis of appropriate documentation appended to the test report.

8.3.2. Steering override test

8.3.2.1. The subject vehicle shall be driven with an activated CDCF on a road with solid lane markings on each side of the lane.

The test conditions and the subject vehicle test speed shall be within the operating range of the system.

The vehicle shall be driven such that it attempts to leave the lane and causes CDCF intervention. During the intervention, the driver shall apply the steering control effort necessary to override the intervention.

The force and steering input applied by the driver on the steering control to override the intervention shall be recorded.

The test requirements are fulfilled if:

- (a) The force applied by the driver on the steering control to override the intervention does not exceed 50 N.
- (b) There is no sudden loss of significant steering support once CDCF is overridden.
- (c) For ELKS that do not act on the steering itself (e.g. differential braking type CDCF), the steering input does not exceed 25 degrees.

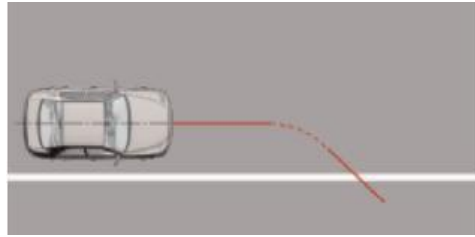
8.3.2.2. In addition, the manufacturer shall demonstrate to the satisfaction of the Technical Service that the requirements defined in paragraph 6.6.4 are fulfilled in the whole range of CDCF operation. This may be achieved on the basis of appropriate documentation appended to the test report.

8.3.3. Lane keep test

8.3.3.1. The CDCF shall be tested for Test Scenarios Nos. 1 and 2 described in paragraph 6.6.2.

8.3.3.1.1. Tests for all scenarios shall be performed with lateral velocities of 0.2 m/s and 0.5 m/s.

8.3.3.1.2. A test path shall be driven which consists of an initial straight path parallel to the solid lane marking being tested, followed by a fixed radius curve to apply a known lateral velocity and yaw to the subject vehicle, followed again by a straight path without any force applied on the steering control (e.g. by removing the hands from the steering control).



- 8.3.3.1.3. The subject vehicle speed during the test up to the point of system intervention shall be 72 km/h $\pm$ 1 km/h.

The curve of fixed radius driven to apply the lateral velocity required shall have a radius 1,200 m or more.

The lateral velocity required shall be achieved to a tolerance of $\pm$ 0.05 m/s.

The vehicle manufacturer shall provide information describing the radius of the curve to be driven and the location when the closed loop path and/or speed control shall be ended so as to ensure a free drifting in order not to interfere an automatic suppression according to paragraph 6.3.1.

- 8.3.3.2. The test requirements are fulfilled if the subject vehicle does not cross the lane marking by a DTLM of more than $-$ 0.3 m.

- 8.3.3.3. In addition, the vehicle manufacturer shall demonstrate to the satisfaction of the Technical Service that the requirements for the whole speed range and lateral departure velocity range are fulfilled. This may be achieved on the basis of appropriate documentation appended to the test report.

9. Modification of vehicle type and extension of approval

- 9.1. Every modification of the vehicle type as defined in paragraph 2.1 of this Regulation shall be notified to the Type Approval Authority which approved the vehicle type. The Type Approval Authority shall then either:

- (a) 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;
- (b) 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;
- (c) Decide, in consultation with the manufacturer, that a new type approval is to be granted; or
- (d) Apply the procedure contained in paragraph 9.1.1. (Revision) and, if applicable, the procedure contained in paragraph 9.1.2. (Extension).

9.1.1. Revision

When particulars recorded in the information documents have changed and the Type Approval Authority considers that the modifications made are unlikely to have appreciable adverse effects, the modification shall be designated a "revision".

In such a case, the Type Approval Authority shall issue the revised pages of the information documents as necessary, marking each revised page to show clearly the nature of the modification and the date of re-issue.

A consolidated, updated version of the information documents, accompanied by a detailed description of the modification, shall be deemed to meet this requirement.

9.1.2. Extension

The modification shall be designated an "extension" if, in addition to the change of the particulars recorded in the information documents,

- (a) Further inspections or tests are required; or
- (b) Any information on the communication document (with the exception of its attachments) has changed; or
- (c) Approval to a later series of amendments is requested after its entry into force.

9.2. 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 UN Regulation. In addition, the index to the information documents and to the test reports, attached to the communication document of Annex 1, shall be amended accordingly to show the date of the most recent revision or extension.

9.3. 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 UN Regulation. It shall assign a serial number to each extension, to be known as the extension number.

10. Conformity of production

10.1. Procedures for the conformity of production shall conform to the general provisions defined in Article 2 and Schedule 1 to the Agreement (E/ECE/TRANS/505/Rev.3) and meet the following requirements:

10.2. A vehicle approved pursuant to this UN Regulation shall be so manufactured as to conform to the type approved by meeting the requirements of paragraphs 5 and 6 above.

10.3. The Type Approval Authority which has granted the approval may at any time verify the conformity of control methods applicable to each production unit. The normal frequency of such inspections shall be once every two years.

10.4. The approval granted in respect of a vehicle type pursuant to this UN Regulation may be withdrawn if the requirements laid down in paragraph 5 and 6, above are not complied with.

10.5. If a Contracting Party withdraws an approval, it had previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation by sending them a communication form conforming to the model in Annex 1 to this UN Regulation.

11. Penalties for non-conformity of production

11.1. The approval granted in respect of a vehicle type pursuant to this UN Regulation may be withdrawn, if the requirements laid down in paragraph 10 above are not complied with.

11.2. If a Contracting Party withdraws an approval it had previously granted, it shall forthwith so notify the other Contracting Parties applying this UN Regulation by sending them a communication form conforming to the model in Annex 1 to this UN Regulation.

12. Production definitively discontinued

- 12.1 If the holder of the approval completely ceases to manufacture a type of vehicle approved in accordance with this UN Regulation, they shall so inform the Approval Authority which granted the approval, which in turn shall forthwith inform the other Contracting Parties to the Agreement applying this Regulation by means of a communication form conforming to the model in Annex 1 to this UN Regulation.
- 12.2. The production is not considered definitely discontinued if the vehicle manufacturer intends to obtain further approvals for software updates for vehicles already registered in the market.

13. Names and addresses of the Technical Services responsible for conducting approval tests and of Type Approval Authorities

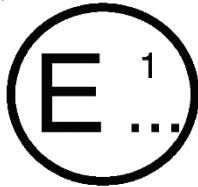
- 13.1. The Contracting Parties to the Agreement applying this UN Regulation shall communicate to the United Nations Secretariat⁴ the names and addresses of the Technical Services responsible for conducting approval tests and of the Type Approval Authorities which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval are to be sent.

⁴ Through the online platform ("343 Application") provided by UNECE and dedicated to the exchange of such information https://apps.unece.org/WP29_application/

Annex 1

Communication

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



issued by :

(Name of administration)⁴

.....
.....
.....

Concerning: ⁶ Approval granted
 Approval extended
 Approval refused
 Approval withdrawn
 Production definitively discontinued

of a type of vehicle with regard to the ELKS pursuant to Regulation No. XXX

Approval No.: Extension No.:

1. Trademark:
2. Type and trade name(s):
3. Name and address of manufacturer:
4. If applicable, name and address of manufacturer's representative:
5. Brief description of vehicle:
6. Date of submission of vehicle for approval:
7. Technical Service performing the approval tests:
8. Date of report issued by that Service:
9. Number of report issued by that Service:
10. Approval with regard to the ELKS is granted/refused:²
11. Place:
12. Date:
13. Signature:
14. Annexed to this communication are the following documents, bearing the approval number indicated above:
15. Any remarks:

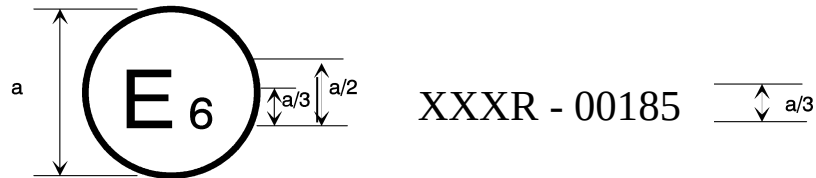
⁵ Distinguishing number of the country which has granted/extended/refused/withdrawn an approval (see approval provisions in the Regulation).

⁶ Strike out what does not apply.

Annex 2

Arrangements of approval marks

(see paragraphs 4.4. to 4.4.2. of this Regulation)



$a = 8 \text{ mm min}$

The above approval mark affixed to a vehicle shows that the vehicle type concerned has been approved in Belgium (E 6) with regard to the ELKS pursuant to Regulation No. XXX. The first two digits of the approval number indicate that the approval was granted in accordance with the requirements of Regulation No. XXX in its original form.

Annex 3

Special requirements to be applied to the safety aspects of electronic control systems

1. General

This annex defines the special requirements for documentation, fault strategy and verification with respect to the safety aspects of Electronic System(s) (paragraph 2.3.) and complex electronic control systems (paragraph 2.4. below) as far as this Regulation is concerned.

This annex shall also apply to safety related functions identified in this Regulation which are controlled by Electronic System(s) as far as this Regulation is concerned.

This annex does not specify the performance criteria for "the system" but covers the methodology applied to the design process and the information which shall be disclosed to the Technical Service, for type approval purposes.

This information shall show that "the system" respects, under non-fault and fault conditions, all the appropriate performance requirements specified elsewhere in this Regulation.

2. Definitions

For the purposes of this annex,

2.1. "The System" means an electronic control system or complex electronic control system that provides or forms part of the control transmission of a function to which this Regulation applies. This also includes any other system covered in the scope of this Regulation, as well as transmission links to or from other systems that are outside the scope of this Regulation, that acts on a function to which this Regulation applies.

2.2. "*Safety concept*" is a description of the measures designed into the system, for example within the electronic units, so as to address system integrity and thereby ensure safe operation under fault and non-fault conditions, including in the event of an electrical failure.

The possibility of a fall-back to partial operation or even to a back-up system for vital vehicle functions may be a part of the safety concept.

2.3. "*Electronic control system*" means a combination of units, designed to co-operate in the production of the stated vehicle control function by electronic data processing.

Such systems, commonly controlled by software, are built from discrete functional components such as sensors, electronic control units and actuators and connected by transmission links. They may include mechanical, electromechanical, electro-pneumatic or electro-hydraulic elements.

"*The system*", referred to herein, is the one for which type approval is being sought.

2.4. "*Complex electronic control systems*" are those electronic control systems in which a function may be over-ridden by a higher-level electronic control system/function.

A function which is over-ridden becomes part of the complex electronic control system, as well as any overriding system/function within the scope of this

- Regulation. The transmission links to and from overriding systems/function outside of the scope of this Regulation shall also be included.
- 2.5. "*Higher-level control*" systems/functions are those which employ additional processing and/or sensing provisions to modify vehicle behaviour by commanding variations in the normal function(s) of the vehicle control system.
- This allows complex systems to automatically change their objectives with a priority which depends on the sensed circumstances.
- 2.6. "*Units*" are the smallest divisions of system components which will be considered in this annex, since these combinations of components will be treated as single entities for purposes of identification, analysis or replacement.
- 2.7. "*Transmission links*" are the means used for inter-connecting distributed units for the purpose of conveying signals, operating data or an energy supply.
- This equipment is generally electrical but may, in some part, be optical, pneumatic, hydraulic or mechanical.
- 2.8. "*Range of control*" refers to an output variable and defines the range over which the system is likely to exercise control.
- 2.9. "*Boundary of functional operation*" defines the boundaries of the external physical limits within which the system is able to maintain control.
- 2.10. "*Control strategy*" means a strategy to ensure robust and safe operation of the function(s) of "The System" in response to the input from the vehicle or the driver.
- This may include the automatic deactivation of a function or temporary performance restrictions.
- 2.11. "*Safety Related Function*" means a function of "The System" that is capable of changing the dynamic behaviour of the vehicle. "The System" may be capable of performing more than one safety related function.
3. Documentation
- 3.1. Requirements
- The manufacturer shall provide a documentation package which gives access to the basic design of "the system" and the means by which it is linked to other vehicle systems or by which it directly controls output variables.
- The function(s) of "the system", including the control strategies, and the safety concept, as laid down by the manufacturer, shall be explained.
- Documentation shall be brief yet provide evidence that the design and development has had the benefit of expertise from all the system fields which are involved.
- For periodic technical inspections, the documentation shall describe how the current operational status of "the system" can be checked.
- The Technical Service shall assess the documentation package, as specified in paragraph 3.4., to show that "The System":
- (a) Is designed to operate, under fault conditions, in such a way that it does not induce safety critical risks,
 - (b) Implements strategies which do not, under non-fault conditions, prejudice the safe operation of systems which are subject to the prescriptions of this Regulation; and,
 - (c) Respects, under non-fault and fault conditions, all the appropriate performance requirements specified elsewhere in this Regulation; and,

- (d) Was developed according to the development process/method chosen by the manufacturer according to paragraph 3.4.4.
- 3.1.1. Documentation shall be made available in two parts:
 - (a) The formal documentation package for the approval, containing the material listed in paragraph 3. (with the exception of that of paragraph 3.4.4. below) which shall be supplied to the Technical Service at the time of submission of the type-approval application. This documentation package shall be used by the Technical Service as the basic reference for the verification process set out in paragraph 4. of this annex. The Technical Service shall ensure that this documentation package remains available for a period determined in agreement with the Approval Authority. This period shall be at least 10 years counted from the time when production of the vehicle is definitely discontinued.
 - (b) Additional confidential material and analysis data (intellectual property) of paragraph 3.4.4., which shall be retained by the manufacturer, but made open for inspection (e.g., on-site in the engineering facilities of the manufacturer) at the time of type approval. The manufacturer shall ensure that this material and analysis data remains available for a period of 10 years counted from the time when production of the vehicle is definitely discontinued.
- 3.2. Description of the functions of "the system", including control strategies.

A description shall be provided which gives a simple explanation of all the functions, including control strategies, of "the system" and the methods employed to achieve the objectives, including a statement of the mechanism(s) by which control is exercised.

Any described function that can be over-ridden shall be identified and a further description of the changed rationale of the function's operation provided.
- 3.2.1. A list of all input and sensed variables shall be provided and the working range of these defined, along with a description of how each variable affects system behaviour.
- 3.2.2. A list of all output variables which are controlled by "the system" shall be provided and an explanation given, in each case, of whether the control is direct or via another vehicle system. The range of control (paragraph 2.8.) exercised on each such variable shall be defined.
- 3.2.3. Limits defining the boundaries of functional operation (paragraph 2.9. above) shall be stated where appropriate to system performance.
- 3.3. System layout and schematics
 - 3.3.1. Inventory of components

A list shall be provided, collating all the units of "the system" and mentioning the other vehicle systems which are needed to achieve the control function in question.

An outline schematic showing these units in combination shall be provided with both the equipment distribution and the interconnections made clear.
 - 3.3.2. Functions of the units

The function of each unit of "the system" shall be outlined and the signals linking it with other units or with other vehicle systems shall be shown. This may be provided by a labelled block diagram or other schematic, or by a description aided by such a diagram.
 - 3.3.3. Interconnections

Interconnections within "the system" shall be shown by a circuit diagram for the electrical transmission links, by an optical-fibre diagram for optical links, by a piping diagram for pneumatic or hydraulic transmission equipment and by a simplified diagrammatic layout for mechanical linkages. The transmission links both to and from other systems shall also be shown.

3.3.4. Signal flow and priorities

There shall be a clear correspondence between these transmission links and the signals carried between units.

Priorities of signals on multiplexed data paths shall be stated, wherever priority may be an issue affecting performance or safety as far as this Regulation is concerned.

3.3.5. Identification of units

Each unit shall be clearly and unambiguously identifiable (e.g. by marking for hardware and marking or software output for software content) to provide corresponding hardware and documentation association.

Where functions are combined within a single unit or indeed within a single computer, but shown in multiple blocks in the block diagram for clarity and ease of explanation, only a single hardware identification marking shall be used.

The manufacturer shall, by the use of this identification, affirm that the equipment supplied conforms to the corresponding document.

3.3.5.1. The identification defines the hardware and software version and, where the latter changes such as to alter the function of the unit as far as this Regulation is concerned, this identification shall also be changed.

3.4. Safety concept of the manufacturer

3.4.1. The manufacturer shall provide a statement which affirms that the strategy chosen to achieve "the system" objectives will not, under non-fault conditions, prejudice the safe operation of systems which are subject to the prescriptions of this Regulation.

The vehicle manufacturer shall supplement this statement by an explanation showing in overall terms how the chosen strategy ensures that "The System" objectives do not prejudice the safe operation of the systems referred above, and by a description of the part of the validation plan supporting the statement.

The Technical Service shall perform an assessment to establish that the vehicle manufacturer's explanation of the chosen strategy is understandable, logical and that the validation plan is suitable and has been completed.

The Technical Service may perform tests, or may require tests to be performed, as specified in paragraph 4. below, to verify that "the system" operates as per the chosen strategy.

3.4.2. In respect of software employed in "the system", the outline architecture shall be explained and the design methods and tools used shall be identified. The manufacturer shall show evidence of the means by which they determined the realisation of the system logic, during the design and development process.

3.4.3. The manufacturer shall provide the technical authorities with an explanation of the design provisions built into "the system" so as to generate safe operation under fault conditions. Possible design provisions for failure in "the system" are for example:

- (a) Fall-back to operation using a partial system;
- (b) Change-over to a separate back-up system;
- (c) Removal of the high-level function.

In case of a failure, the driver shall be warned for example by warning signal or message display. When the system is not deactivated by the driver, e.g. by turning the ignition (run) switch to "off", or by switching off that particular function if a special switch is provided for that purpose, the warning shall be present as long as the fault condition persists.

- 3.4.3.1. If the chosen provision selects a partial performance mode of operation under certain fault conditions, then these conditions shall be stated and the resulting limits of effectiveness defined.
- 3.4.3.2. If the chosen provision selects a second (back-up) means to realise the vehicle control system objective, the principles of the change-over mechanism, the logic and level of redundancy and any built-in back-up checking features shall be explained and the resulting limits of back-up effectiveness defined.
- 3.4.3.3. If the chosen provision selects the removal of the Higher-Level Function, all the corresponding output control signals associated with this function shall be inhibited, and in such a manner as to limit the transition disturbance.
- 3.4.4. The documentation shall be supported, by an analysis which shows, in overall terms, how the system will behave on the occurrence of any fault identified by the procedure below which will have a bearing on vehicle control, performance, or safety.

The analytical approach(es), chosen by the manufacturer, shall be established and maintained by the manufacturer and shall be made open for inspection by the Technical Service at the time of the type-approval.

The Technical Service shall perform an assessment of the application of the analytical approach(es). The assessment shall include:

- (a) Inspection of the safety approach at the concept (vehicle) level with confirmation that it includes consideration of interactions with other vehicle systems. This approach may be based on a Hazard / Risk analysis appropriate to system safety.
- (b) Inspection of the safety approach at the system level. This approach may be based on a Failure Mode and Effect Analysis (FMEA), a Fault Tree Analysis (FTA) or any similar process appropriate to system safety.
- (c) Inspection of the validation plans and results. This validation may use, for example, Hardware in the Loop (HIL) testing, vehicle on-road operational testing, or any means appropriate for validation.

The assessment shall consist of checks of hazards and faults chosen by the Technical Service to establish that the manufacturer's explanation of the safety concept is understandable, logical and that the validation plan is suitable and has been completed.

The Technical Service may perform tests, or may require tests to be performed, as specified in paragraph 4. below, to verify the safety concept.

- 3.4.4.1. This documentation shall itemize the parameters being monitored and shall set out, for each fault condition of the type defined in paragraph 3.4.4. above, the warning signal to be given to the driver and/or to service/technical inspection personnel.
- 3.4.4.2. Where this Regulation contains particular requirements for the operation of "The System" under different environmental conditions, this documentation shall describe the measures in place to ensure compliance with those requirements.
- 4. Verification and test
 - 4.1. The functional operation of "the system", as laid out in the documents required in paragraph 3. above, shall be tested as follows:
 - 4.1.1. Verification of the function of "the system"

The Technical Service shall verify "The System" under non-fault conditions by testing a number of selected functions from those described by the manufacturer in paragraph 3.2. above.

The verification of the performance of those selected functions shall be conducted following the manufacturer's test procedures unless a test procedure is specified in this Regulation.

For cases where the system is subject to input signal(s) from systems outside the scope of this Regulation, the test shall be conducted using the test procedure of the relevant UN regulation, or by another means that generates the relevant input signal(s), (e.g. simulation).

For complex electronic systems, these tests shall include scenarios whereby a declared function is overridden.

- 4.1.1.1. The verification results shall correspond with the description, including the control strategies, provided by the manufacturer in paragraph 3.2.

- 4.1.2. Verification of the safety concept of paragraph 3.4. above

The reaction of "the system" shall be checked under the influence of a failure in any individual unit by applying corresponding output signals to electrical units or mechanical elements in order to simulate the effects of internal faults within the unit.

The Technical Service shall conduct this check for at least one individual unit but shall not check the reaction of "The System" to multiple simultaneous failures of individual units.

The Technical Service shall verify that these tests include aspects that may have an impact on vehicle controllability and user information (HMI aspects).

- 4.1.2.1. The verification results shall correspond with the documented summary of the failure analysis, to a level of overall effect such that the safety concept and execution are confirmed as being adequate.

- 4.2. Simulation tools and mathematical models for verification of the safety concept may be used in accordance with Schedule 8 of Revision 3 of the 1958 Agreement, in particular for scenarios that are difficult on a test track or in real driving conditions. Manufacturers shall demonstrate the scope of the simulation tool, its validity for the scenario concerned as well as the validation performed for the simulation tool chain (correlation of the outcome with physical tests).

- 5. Reporting by Technical Service

Reporting of the assessment by the Technical Service shall be performed in such a manner that allows traceability, e.g., versions of documents inspected are coded and listed in the records of the Technical Service.

An example of a possible layout for the assessment form from the Technical Service to the Type Approval Authority is given in Appendix 1 to this Annex.

Annex 3 – Appendix 1

Model assessment form for electronic, and/or complex electronic, control systems

Test report No:

1. Identification
 - 1.1. Vehicle make:
 - 1.2. Type:
 - 1.3. Means of identification of type if marked on the vehicle:
 - 1.4. Location of that marking:
 - 1.5. Manufacturer's name and address:
 - 1.6. If applicable, name and address of manufacturer's representative:
 - 1.7. Manufacturer's formal documentation package:
 - Documentation reference No:
 - Date of original issue:
 - Date of latest update:
2. Test vehicle(s)/system(s) description
 - 2.1. General description:
 - 2.2. Description of the functions of "The System", including control strategies (Annex 3, paragraph 3.2.):
 - 2.2.1. List of input and sensed variables and their working range including a description the effect of the variable on system behaviour (Annex 3, paragraph 3.2.1.):
 - 2.2.2. List of output variables and their range of control (Annex 3, paragraph 3.2.2.):
 - 2.2.2.1. Directly controlled:
 - 2.2.2.2. Controlled via other vehicle systems:
 - 2.2.3. Boundaries of functional operation (Annex 3, paragraph 3.2.3.):
 - 2.3. Description System layout and schematics (Annex 3, paragraph 3.3.):
 - 2.3.1. Inventory of components (Annex 3, paragraph 3.3.1.):
 - 2.3.2. Functions of the units (Annex 3, paragraph 3.3.2.):
 - 2.3.3. Interconnections (Annex 3, paragraph 3.3.3.):
 - 2.3.4. Signal flow and priorities (Annex 3, paragraph 3.3.4.):
 - 2.3.5. Identification of units (hardware & software) (Annex 3, paragraph 3.3.5.):
3. Manufacturer's safety concept.

- 3.1. Manufacturer's declaration (Annex 3, paragraph 3.4.1.):
The manufacturer(s) affirm(s) that the strategy chosen to achieve "The System", objectives will not, under non-fault conditions, prejudice the safe operation of the vehicle.
- 3.2. Software (outline architecture, software design methods and tools used) (Annex 3, paragraph 3.4.2.):
- 3.3. Explanation of design provisions built into "The System" under fault conditions (Annex 3, paragraph 3.4.3.):
- 3.4. Documented analyses of the behaviour of "The System" under individual fault conditions (Annex 3, paragraph 3.4.4.1.):
- 3.4.1. Parameters monitored:
- 3.4.2. Warning signals generated:
- 3.5. Description of the measures in place for environmental conditions (Annex 3, paragraph 3.4.4.2.):
- 3.6. Provisions for the periodic technical inspection of "The System" (Annex 3, paragraph 3.1.).
Description of the method by which the operational status of the system can be checked:
4. Verification and test.
- 4.1. Verification of the function of "The System" (Annex 3, paragraph 4.1.1.):
 - 4.1.1. List of the selected functions and a description of the test procedures used:
 - 4.1.2. Test results verified according to Annex 3, paragraph 4.1.1.1. Yes/No.
- 4.2. Verification of the system safety concept (Annex 3, paragraph 4.1.2.):
 - 4.2.1. Unit(s) tested and their function:
 - 4.2.2. Simulated fault(s):
 - 4.2.3. Test results verified according to Annex 3, paragraph 4.1.2. Yes/No.
- 4.3. Date of test:
- 4.4. This test has been carried out and the results reported in accordance with Annex 3 to UN Regulation No. XX as last amended by the series of amendments. Technical Service carrying out the test:
Signed:Date:
- 4.5. Comments:.....