

UN Regulation No. xxx**Uniform provisions concerning the approval of motor vehicles with regard to the Acceleration Control for Pedal Error (ACPE) systems****Contents**

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0. Introduction (not legally binding)

This regulation has the intention of providing the interested contracting parties with international harmonized technical provisions for Accelerator Control Pedal error (ACPE) systems fitted on vehicles of category M1.

The system shall automatically limit unintended acceleration of the vehicle when it has detected that the driver may have confused the brake pedal with the accelerator pedal, whether the vehicle is driving forward or backward, with the intention of avoiding or mitigating the severity of a collision with an obstacle or a pedestrian. The system shall simultaneously provide the driver with an appropriate warning.

The scenarios focused by the regulation are primary situations with a stationary ego vehicle.

The regulation could evolve in the future to include scenarios with an ego vehicle driving at very low speed like in parking situations.

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

During any action taken by the system, the driver can, at any time through a conscious action, e.g. by maintaining the accelerator control application, take control and interrupt the intervention of the system.

The ACPE system must be designed to accommodate any potential conflict with another system, called AEBS (Advanced Emergency Braking Systems - UN Regulation No.152), whose purpose is to activate the vehicle braking system to decelerate the vehicle when an imminent forward collision is detected. [The AEBS must be equipped with a means to let the driver take back control and interrupt the system when the driver evaluates it necessary. An example of such interruption means is the accelerator control kick-down whose ACPE could misinterpret as a pedal confusion. The ACPE would then command a vehicle deceleration while the driver would command a vehicle acceleration. This conflict between AEBS and ACPE does not exist in the scenario of a stationary vehicle i.e. for the original text of this regulation.]

[Some configurations of vehicle, responding to some in-use requirements, may jeopardise the functioning robustness of the ACPE, for example when some necessary additional equipment prevents the optimum location of the sensors. An example of such configuration is a wheelchair-adapted vehicle. For such kinds of configuration, the Type approval Authority may decide to exempt the vehicle from a certain part of the requirements, e.g. from compliance with rearward ACPE.]

[The regulation intends to be technology neutral in order to foresight freedom for Industry to propose new technologies and help streamline the functioning of the vehicles. In this regard, the regulation covers any accelerator control misapplication detection design, as for example the accelerator depressing speed detection and the accelerator pedal force detection.]

The ACPE could suit some light trucks (N1 category) in some circumstances and the contracting parties are encouraged to develop accidentology that can justify the fitting of ACPE on that vehicle category. However, the inclusion of performance requirements adapted to the N1 category might be programmed for a potential later stage of the development of the regulation. Nothing in this regulation prevents contracting parties from nationally mandating the fitting of ACPE on N1 category vehicles approved in accordance with the technical requirements of this Regulation.

Equally, the regulation could be updated in a subsequent phase to accommodate secondary collisions.

1. Scope

- 1.1. This UN Regulation applies to the type approval of vehicles of Category M1 equipped with automatic transmission with regard to their Acceleration Control for Pedal Error systems (ACPE).
- 1.2. At the request of a manufacturer, vehicles of other categories may be approved under this Regulation.
- 1.3. Vehicles where installation of means of forward and/or rear detection is incompatible with their on-road use may be exempted from the relevant requirements (forward and/or rear direction) of this Regulation, subject to the decision of the Type Approval Authority.

2. Definitions

For the purposes of this Regulation:

- 2.1. "Acceleration Control for Pedal Error (ACPE)" means a system to detect misapplication of the accelerator control by the driver and to control unintended acceleration.
- 2.1.1. "Vehicle Type with Regard to its ACPE" means a category of vehicles which do not differ in such essential aspects as:
- (a) Vehicle features which significantly influence the performances of ACPE;
 - (b) The type and design of ACPE.
- 2.3. "Common space" means an area on which two or more information functions (e.g. symbol) may be displayed but not simultaneously.
- 2.4. Reserved
- 2.5. "Dry road affording good adhesion" means a road with a sufficient nominal Peak Braking Coefficient (PBC) that would permit:
- (a) A mean fully developed deceleration of at least 9 m/s²; or
 - (b) The design maximum deceleration of the relevant vehicle;
- whichever is lower.
- 2.6. "Sufficient nominal Peak Braking Coefficient (PBC)" means a road surface friction coefficient of:
- (a) 0.9, when measured using the American Society for Testing and Materials (ASTM) of E1136-19 standard reference test tyre in accordance with ASTM Method E1337-19 at a speed of 40 mph;
 - (b) 1.017, when measured using either:
 - (i) The American Society for Testing and Materials (ASTM) of F2493-20 standard reference test tyre in accordance with ASTM Method E1337-19 at a speed of 40 mph; or
 - (ii) The k-test method specified in Appendix 2 to Annex 6 of UN Regulation No. 13-H.
- 2.7. "Self-Check" means an integrated function that checks for a system failure on a continuous basis at least while the system is active.
- 2.8. "Obstacle" means a vehicle or wall-like structure.
- 2.9. "Automatic Transmission" means any transmission which does not require the use of a clutch control by the driver in order to shift gears (automatic transmissions include e.g. single gear transmissions, continuously-variable transmissions, transmissions with an automated clutch).

Commented [OF1]: This definition makes the link between 'pedal error' and 'pedal misapplication' used elsewhere in the text.

3. Application for approval

- 3.1. The application for approval of a vehicle type with regard to the ACPE shall be submitted by the vehicle manufacturer or by his authorized representative.
- 3.2. It shall be accompanied by the documents mentioned below in triplicate:
- 3.3. A description of the vehicle type with regard to the items mentioned in paragraph 2.1.1., together with a documentation package which gives access to the basic design of the ACPE and the means by which it is linked to other vehicle systems or by which it directly controls output variables. The numbers and/or symbols identifying the vehicle type shall be specified.
- 3.4. A vehicle representative of the vehicle type to be approved shall be submitted to the Technical Service conducting the approval tests.

4. Approval

- 4.1. If the vehicle type submitted for approval pursuant to this Regulation meets the requirements of paragraph 5. below, approval of that vehicle type shall be granted.
- 4.2. An approval number shall be assigned to each vehicle type approved; its first two digits (00 for the Regulation in its initial 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 shall not assign the same number to the same vehicle type equipped with another type of ACPE, or to another vehicle type.
- 4.3. Notice of approval or of refusal or withdrawal of approval pursuant to this Regulation shall be communicated to the Parties to the Agreement applying this Regulation by means of a form conforming to the model in Annex 1 and photographs and/or plans supplied by the applicant being in a format not exceeding A4 (210 x 297 mm), or folded to that format, and on an appropriate scale.
- 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 conforming to the model described in Annex 2, consisting of:
 - 4.4.1. A circle surrounding the letter "E" followed by the distinguishing number of the country which has granted approval¹;
 - 4.4.2. The number of this Regulation, followed by the letter "R", a dash and the approval number to the right of the circle prescribed in paragraph 4.4.1. above.
- 4.5. If the vehicle conforms to a vehicle type approved under one or more other Regulations annexed to the Agreement, in the country which has granted approval under this Regulation, the symbol prescribed in paragraph 4.4.1. above need not be repeated; in such a case, the Regulation and approval numbers and the additional symbols shall be placed in vertical columns to the right of the symbol prescribed in paragraph 4.4.1. above.
- 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.

5. Specifications

- 5.1 Performance Requirements
 - 5.1.1. **The following performance requirements shall apply to a vehicle with no trailer coupled, with a mass between maximum mass and mass in running order, and whose powertrain management system is properly operational.**

¹ 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.6, Annex 3 - www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html

- (a) The ACPE shall be able to limit unintended acceleration of the vehicle when an accelerator control misapplication by the driver has been detected at least
 - when an obstacle exists in front of the vehicle when intending to go forward, and
 - when an obstacle exists behind the vehicle when intending to go backward.
- (b) An accelerator control application having a velocity of at least 400 %/s over a travel distance of at least 70% of the total travel distance of the accelerator control, and reaching a maximum position of the accelerator control of at least 90%, shall be assessed as an accelerator control misapplication in the context of the paragraph (a) above.
- (c) Notwithstanding paragraph (b) above, in the case of systems that implement force-based triggering of the ACPE, an accelerator control force greater than the triggering threshold shall be considered as accelerator control misapplication. The manufacturer shall justify the triggering method to the satisfaction of the Type approval Authority.

The ACPE shall control acceleration when the vehicle is accelerated from standstill.

The system shall limit vehicle acceleration in order to prevent or mitigate a collision with an obstacle located between 1 m and 1.5 m in front of or behind the vehicle, in the vehicle path, at the time the accelerator control is applied., provided:

- (d) Vehicle external influences allow for the required acceleration inhibition, i.e.:
 - (i) The road is flat, horizontal and dry affording good adhesion;
 - (ii) The weather conditions do not affect the performance of the vehicle (e.g. no storm, not below 0°C);
- (e) The vehicle state itself allows for the required acceleration inhibition, e.g.:
 - (i) The tyres are in an appropriate state and properly inflated;
 - (ii) The brakes if intended to be used are properly operational (brake temperature, pads condition etc.);
 - (iii) There is no severe uneven load distribution;
 - ~~(iv) No trailer is coupled to the motor vehicle and the mass of the motor vehicle is between maximum mass and mass in running order conditions;~~
 - ~~(v) Powertrain management system is properly operational~~
- (f) There are no external influences affecting the physical sensing capabilities, i.e.:
 - (i) The ambient illumination conditions are at least 1000 Lux and there is no extreme blinding of the sensors (e.g. direct blinding sunlight, highly radar-reflective environment);
 - (ii) The target vehicle is not extreme with regard to the Radar Cross Section (RCS) or the shape/silhouette (e.g. below fifth percentile of RCS of all M₁ vehicles)
 - (iii) There are no significant weather conditions affecting the sensing capabilities of the vehicle (e.g. heavy rain, dense fog, snow, dirt);
 - (iv) There are no overhead obstructions close to the vehicle;
- (g) The situation is unambiguous, i.e.:
 - (i) The obstacle is stationary, unobstructed, clearly separated from other objects in the driving direction;
 - (ii) The lateral offset between the centreline of the obstacle and the centreline of the vehicle is not more than [0.2] m
 - (iii) The direction of travel is straight with no curve, and the vehicle is not turning at an intersection and following its lane.

When conditions deviate from those listed above, the system shall not deactivate or unreasonably switch the control strategy. This shall be demonstrated by the manufacturer in accordance with Annex 3 of this Regulation and, if deemed justified, may be followed by testing by the Technical Service in conditions deviating from those listed above or those in paragraph 6. The rationale for and the results of this verification testing shall be appended to the test report.

In the case that a collision is not prevented, the collision speed shall be no greater than 8 km/h higher than the vehicle speed at the point where the triggering conditions specified above are met.

In addition, the collision speed shall not be greater than 70% of that speed the vehicle would have in the same position and under the same circumstances but without any ACPE intervention.

Following any intervention, the vehicle acceleration shall continue to be limited by the ACPE. The intervention may be ended when the obstacle is no longer detected, or the driver has interrupted the function. The Manufacturer shall declare the ACPE continuation conditions to the technical service.

- 5.1.2 The effectiveness of ACPE 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 the 06 or later series of amendments to UN Regulation No. 10.
- 5.1.3 Conformity with the safety aspects of electronic control systems shall be shown by meeting the requirements of Annex 3.
- 5.1.4 The ACPE shall inform the driver of its intervention in accordance with paragraph 5.4.2.
- 5.1.5 Interruption of Acceleration Control by driver
- 5.1.5.1 the ACPE shall provide a means for the driver to interrupt its intervention. This interruption shall be started by any intentional action which indicates that the driver has recognised the situation.
- 5.1.5.2 In the case of interruption by maintaining the accelerator control application, there shall be no rapid increase of acceleration.
- 5.1.5.3 The fulfilment of these requirements shall be documented and demonstrated by the manufacturer to the Approval Authority during the inspection of the safety concept as part of the assessment to Annex 3.
- 5.1.6 The performance requirements shall be verified using the test procedure as described in section 6.

5.2. Deactivation

5.2.1. Short term deactivation

When a vehicle is equipped with a means to manually deactivate the ACPE function, the ACPE system shall be automatically reinstated at the initiation of any new engine start (or run cycle, as relevant).

This requirement does not apply when a new engine start (or run cycle, as relevant) is performed automatically, e.g., the operation of a stop/start system.

A deactivation warning shall be given at least at the time of deactivation.

5.2.2. Long term deactivation

Notwithstanding paragraph 5.2.1, when a vehicle is equipped with a means to manually deactivate the ACPE system, and the system is not reinstated at the initiation of each engine start (or run cycle, as relevant), either:

- (a) A constant optical warning signal shall inform the driver that the ACPE system has been deactivated. The yellow warning signal specified in paragraph 5.4.3. may be used for this purpose; or

- (b) The driver shall be informed that the ACPE has been deactivated. In this case this information shall be given for a minimum of 10 seconds or until driver confirmation.

This information shall be given at least either every 7 days or every 10 engine starts (or run cycles, as relevant), not counting when a new engine start (or run cycle, as relevant) is performed automatically, e.g. the operation of a stop/start system. This information shall be distinct from the failure warning signal specified in paragraph 5.4.3.

[In case only one direction of operation (forward or backward) of the system is deactivated the driver shall be informed of this condition at least when the corresponding driving direction is selected.]

The long-term deactivation process shall be designed in such a way that deactivation shall not be possible with less than two deliberate actions.

5.2.3. Automatic deactivation

5.2.3.1. When the vehicle is equipped with a means to automatically deactivate the ACPE function, for instance in situations such as carrying a bicycle rack or towing a trailer, the following conditions shall apply as appropriate:

5.2.3.1.1. The vehicle manufacturer shall provide a list of situations and corresponding criteria where the ACPE is automatically deactivated to the technical service at the time of type approval and it shall be annexed to the test report.

5.2.3.1.2. The ACPE system shall be automatically reactivated as soon as the conditions that led to the automatic deactivation are not present anymore.

[5.2.3.1.3. A deactivation warning shall be given at least at the time of deactivation.]

5.2.3.2. While an Automated Driving System is in control of the vehicle, or an Advanced Driver-Assistance System is in active mode (e.g. ALKS or ACSF category A is active), the ACPE system may be suspended or its control strategies adapted without indication to the driver, as long as it remains ensured that the vehicle provides at least the same acceleration suppression capabilities as the ACPE system during manual operation.]

5.3 Failure detection / self-check

5.3.1. A failure warning shall be given to the driver when there is a failure in the ACPE that prevents the requirements of this Regulation being met. The warning shall be as specified in paragraph 5.4.3.

5.3.1.1. It is not required to provide the driver with a failure warning signal to indicate that the ACPE is temporarily not available, for example due to inclement weather conditions.

5.3.2. There shall not be an appreciable time interval between each ACPE self-check.

5.3.3. A failure warning shall also be given to the driver in the case of a detected non-electrical failure condition (e.g. sensor blindness or sensor misalignment).

5.3.4. If the vehicle speed is greater than 10 km/h at the time a failure is detected, the warning signal shall be given not later than the next time the vehicle speed is below 10 km/h.

5.4. Warning signals

5.4.1. General

5.4.1.1. The optical 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.

Commented [OF2]: This is to avoid any ambiguity as to whether the ADAS is actually intervening (reference to para. 2.18.1. of the new regulation on DCAS).

Commented [OF3]: This provision is redundant with those of UN R121. A simple reference to that regulation may be sufficient to avoid double regulation.

- 5.4.1.2 Each ACPE optical warning signal shall be activated either when the engine start (or run, as relevant) switch is turned to the "on" (run) position or when the engine start (or run, as relevant) switch is in a position between the "on" (run) and "start" position that is designated by the manufacturer as a check position (initial system (power-on)). This requirement does not apply to warning signals shown in a common space.
- 5.4.2. Intervention warning signal
- The intervention warning shall be given by an optical signal. In addition, a haptic or acoustic signal shall be provided to the driver, unless such a signal is already being provided by another vehicle system comprising an object detection capability (e.g. parking distance warning).
- The optical warning signal may be the flashing of the failure warning signal.
- A description of the warning indication presented to the driver shall be provided by the vehicle manufacturer at the time of type-approval and recorded in the test report.
- 5.4.3. Failure warning signal
- The failure warning shall be given by a constant yellow optical signal.
- 5.5. Provisions for the Periodic Technical Inspection
- 5.5.1. At a Periodic Technical Inspection, it shall be possible to confirm the correct operational status of the ACPE by a visible observation of the failure warning signal status. Following a "power-ON" and any bulb check, the failure warning signal shall remain illuminated if any failure was present at the end of the previous engine start (or run, as relevant) cycle, unless this failure is detected to be no longer present.
- 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.
- 5.5.2. 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 ACPE is available.

6. Test procedure

- 6.1 Test surface and environment conditions
- 6.1.1 The test shall be performed on a flat, dry, concrete or asphalt road affording good adhesion.
- 6.1.2 The test surface has a consistent slope between level and 1 per cent.
- 6.1.3 The ambient temperature shall be between 0°C and 45°C.
- 6.1.4 The horizontal visibility range shall allow the target to be observed throughout the test.
- 6.1.5 The tests shall be performed when there is no wind liable to affect the results.
- 6.1.6 Natural ambient illumination must be homogeneous in the test area and in excess of 1000 lux. It should be ensured that testing is not performed whilst driving towards, or away from the sun at a low angle.
- 6.1.7 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.

Commented [OF4]: In a 1.5 m distance, I hope this fine, even in London 😊

6.2 Test Vehicle

6.2.1 Pre-Test Conditioning

If requested by the vehicle manufacturer:

- (a) The vehicle can be driven a maximum of 100 km on a mixture of urban and rural roads with other traffic and roadside furniture to initialise the sensor system.
- (b) The vehicle can undergo a sequence of brake activations in order to ensure the service brake system is bedded in prior to the test.
- [(c) The average temperature of the service brakes on the hottest axle of the vehicle, measured inside the brake linings or on the braking path of the disc or drum, is between 65 and 100°C prior to each test run.] *Ready for deletion after Industry internal consultation.*

Details of the pre-test condition strategy requested by the vehicle manufacturer shall be identified and recorded in the vehicle type approval documentation.

6.2.2 Prior to any testing, it shall be ensured that the ACPE is switched on and ready to function.

6.2.3 Test mass

The vehicle shall be tested:

- (a) At the minimum mass (mass in running order with an additional mass of maximum 125 kg);
- (b) If this is deemed justified, the technical service may test at any other mass up to the technically permissible maximum laden mass as defined by the manufacturer. No alteration shall be made once the test procedure has begun.

6.3 Test Targets

6.3.1 The target used for the vehicle detection tests shall be a regular high-volume series production passenger car of Category M1 or alternatively a "soft target" representative of a passenger vehicle in terms of its identification characteristics applicable to the sensor system of the ACPE under test according to either ISO 19206-1:2018 or ISO 19206-3:2021 at the choice of the manufacturer.

6.4 Accelerator control misapplication test

The subject vehicle shall be placed in a situation where it is stationary, a forward or respectively a reverse gear shall be engaged, and the vehicle maintained in a stationary condition using the service brake control.

At least two tests shall be performed in each direction. The test target shall be positioned at a distance of 1.0 +0.1/-0.0 m and 1.5 +0.0/-0.1 m from the vehicle at the start of accelerator control input.

If this is deemed justified, the technical service may test any other vehicle-to-obstacle distances within the prescribed range as defined in paragraph 5.1.1. (see also paragraph 6.5.)

The lateral offset between the centreline of the target and the centreline of the vehicle shall be between 0 and [0.2] m.

The service brake control shall be released as soon as the accelerator control shall be applied so as to reach 100 % of the total travel distance of the accelerator control within 0,25 seconds. In case of ACPE using the application force as a triggering criterion, a sufficient force at a sufficient rate shall be applied, as specified by the manufacturer.

The test procedure shall be as follows:

Commented [OF5]: The text must specify '100% of something'

The test procedure shall be performed with and without an expected ACPE intervention (i.e. with no target) both in a forward and rearward direction and at least with the vehicle situated 1.0 m (+0.1 m tolerance) and 1.5 m (-0.1 m tolerance) from the target position at the start of the test (minimum of 8 tests as detailed in Table 1).

Driving direction	Distance to target / Distance to speed measuring point (m)	Tolerance on the longitudinal distance (m)	Tolerance on the lateral (offset) distance (m)	Presence of target
Forward	1.0	+ 0.1	+/-[0.20]	Yes
Forward	1.0	+ 0.1	N/A	No *
Forward	1.5	-0.1	+/-[0.20]	Yes
Forward	1.5	-0.1	N/A	No *
Rearward	1.0	+ 0.1	+/-[0.20]	Yes
Rearward	1.0	+ 0.1	N/A	No **
Rearward	1.5	-0.1	+/-[0.20]	Yes
Rearward	1.5	-0.1	N/A	No **

Table 1

* These tests may be combined

** These tests may be combined

The procedure for each test shall be as follows:

- (a) Position the vehicle at a distance to the target or speed measurement point as defined in Table 1.
- (b) Hold the vehicle stationary and select the corresponding driving direction.
- (c) Accelerate the vehicle, whilst maintaining the steering control in the neutral position, by operating the accelerator control in order to achieve the relevant triggering conditions (as outlined in Paragraph 5.1.1.) before the vehicle reaches a speed of 0.5 km/h.
- (d) Record the speed at the collision point (if applicable) or the speed at the respective speed measurement point.

Before the test is started the vehicle may either be driven for a distance of up to 20 m to the start position and/or the engine may be switched "off" and "on", if requested by the manufacturer.

6.5. If this is deemed justified, the Technical Service may test in any test condition within the conditions specified in paragraph 5.1 during the tests as described in paragraph 6.4.

7. Modification of vehicle type and extension of approval

7.1. Every modification of the vehicle type as defined in paragraph 2.1.1. above 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 which apply 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. Procedures concerning conformity of production shall comply with those set out in the 1958 Agreement, Schedule 1 (E/ECE/TRANS/505/Rev.3) and meet the following requirements:
- 8.2. A vehicle approved pursuant to this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements of paragraph 5. above;
- 8.3. The Type Approval Authority which has granted 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.

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, above are not complied with.
- 9.2. 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 Regulation.

10. Names and Addresses of Technical Series Responsible for Conducting Approval Tests and of Type Approval Authorities

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 Type 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 Regulation.

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

The Contracting Parties to the Agreement applying this Regulation shall communicate to the United Nations Secretariat² 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.

Annex 1

Communication

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

² The UNECE secretariats provides the online platform ("343 Application") for exchange of such information with the secretariat: <https://www.unece.org/trans/main/wp29/datasharing.html>



issued by : (Name of administration)

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

- ³Concerning: ⁴
- Approval granted
 - Approval extended
 - Approval refused
 - Approval withdrawn
 - Production definitively discontinued

of a type of vehicle with regard to the acceleration control for pedal error pursuant to UN Regulation No. XXX

Approval 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 reports issued by that Service:
10. Approval granted/refused/extended/withdrawn: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:

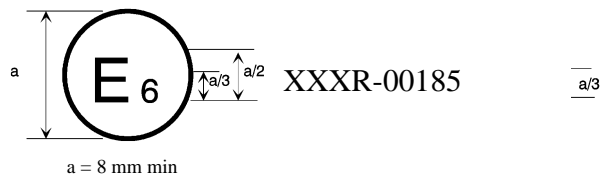
³ Distinguishing number of the country which has granted/extended/refused/withdrawn an approval (see approval provisions in the Regulation).

⁴ Strike out what does not apply.

Annex 2

Arrangements of approval marks

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



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 Acceleration Control for Pedal Error (ACPE) pursuant to UN Regulation No. XXX. The first two digits of the approval number indicate that the approval was granted in accordance with the requirements of UN 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 Complex Electronic Vehicle 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) (paragraph 2.3.) 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 must 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 and that it is designed to operate in such a way that it does not induce safety critical risks.

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, often 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, electro-pneumatic or electro-hydraulic elements.
- 2.4. *Complex Electronic Vehicle Control Systems*" are those electronic control systems in which a function controlled by an electronic system or the driver may be over-ridden by a higher level electronic control system/function. A function which is over-ridden becomes part of the complex 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 Electronic Control*" systems/functions are those which employ additional processing and/or sensing provisions to modify vehicle behaviour by commanding variations in the 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 mechanical, pneumatic or hydraulic.
- 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. "*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" 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 to show that "The System":

- (a) Is designed to operate, under non-fault and fault conditions, in such a way that it does not induce safety critical risks;
- (b) Respects, under non-fault and fault conditions, all the appropriate performance requirements specified elsewhere in this Regulation; and,
- (c) Was developed according to the development process/method declared by the manufacturer.

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.) 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 material and analysis data of paragraph 3.4.4. which shall be retained by the manufacturer, but made open for inspection 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"
- A description shall be provided which gives a simple explanation of all the control functions 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.
- 3.2.2. A list of all output variables which are controlled by "The System" shall be provided and an indication 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.) 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 electric transmission 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, operating data and priorities
- There shall be a clear correspondence between these transmission links and the signals and/or operating data carried between units. Priorities of signals and/or operating data 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 the vehicle.

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 Service 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 individual hazard or fault which will have a bearing on vehicle control performance or safety.

The chosen analytical approach(es) 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 audit 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 shall be based on a Hazard / Risk analysis appropriate to system safety.
- (b) Inspection of the safety approach at the system level. This approach shall 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 shall 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 plans are suitable and have been completed.

The Technical Service may perform or may require to perform tests as specified in paragraph 4. 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. of this annex, the warning signal to be given to the driver and/or to service/technical inspection personnel.

- 3.4.4.2. This documentation shall describe the measures in place to ensure the "The System" does not prejudice the safe operation of the vehicle when the performance of "The System" is affected by environmental conditions e.g. climatic, temperature, dust ingress, water ingress, ice packing.

4. Verification and test

- 4.1. The functional operation of "The System", as laid out in the documents required in paragraph 3., 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 declared by the manufacturer in paragraph 3.2. above.

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

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

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.

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 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 all the control functions of "The System", and methods of operation: ..

2.3. Description of the components and diagrams of the interconnections within "The System":

3. Manufacturer's safety concept

3.1. Description of signal flow and operating data and their priorities:

3.2. Manufacturer's declaration:

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.

3.3. Software outline architecture and the design methods and tools used:

3.4. Explanation of design provisions built into "The System" under fault conditions:

3.5. Documented analyses of the behaviour of "The System" under individual hazard or fault conditions:

3.6. Description of the measures in place for environmental conditions:

3.7. Provisions for the periodic technical inspection of "The System":

3.8. Results of "The System" verification test, as per para. 4.1.1. of Annex 3 to UN Regulation No. XXX:

3.9. Results of safety concept verification test, as per para. 4.1.2. of Annex 3 to UN Regulation No. XXX:

3.10. Date of test:

3.11. This test has been carried out and the results reported in accordance with to UN Regulation No. XXX as last amended by the series of amendments.

Signed: Date:

3.13. Comments:

Submission by Co-Chairs

ACPE-XX-XX

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