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**PROPOSAL FOR A NEW DRAFT REGULATION  
UNIFORM TECHNICAL PRESCRIPTIONS CONCERNING THE APPROVAL OF  
COMPLEX ELECTRONIC CONTROL SYSTEMS AFFECTING THE DIRECT VEHICLE  
CONTROL BY THE DRIVER**

Transmitted by the expert from Germany

Note: The text reproduced below was prepared by the expert from Germany in order to establish a common Regulation for the approval of vehicles or their electrical sub-assemblies with regard to complex electronic vehicle control systems beside the existing Regulations, for example Regulation No. 13 –Brakes–, which already incorporate measures for electronic control system(s). The proposal also considered the approval of electrical/electronic sub-assembly as a “Component” or as a “Technical Unit” with regard to safety aspects of complex electronic vehicle control systems in so far as the driver’s direct control of vehicle dynamics is affected. The proposed text contains all elements of the current text of Regulation No. 13, annex 18 and Regulation No. 10. New paragraphs are marked in ***cursive bold formation*** letters.

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Note: This document is distributed to the Experts on Brakes and Running Gear only.

Regulation No. XXX

PROPOSAL FOR A NEW DRAFT REGULATION  
UNIFORM TECHNICAL PRESCRIPTIONS CONCERNING THE APPROVAL OF  
COMPLEX ELECTRONIC CONTROL SYSTEMS AFFECTING THE DIRECT VEHICLE  
CONTROL BY THE DRIVER

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ANNEXES

- Annex 1 - Communication concerning the approval or extension or refusal or withdrawal of approval or production definitely discontinued of a vehicle or ESA type with regard to safety aspects of complex electronic vehicle control systems to Regulation No. XXX
- Annex 2 - Examples of arrangements of the approval marks
- Annex 3 - Requirements to be applied to the safety aspects of complex electronic vehicle control systems

## 1. SCOPE

### 1.1. GENERAL

This **Regulation** defines the requirements for documentation, fault strategy and verification with respect to the safety aspects of Complex Electronic Vehicle Control Systems (defined in paragraph 2.5. below) as far as this Regulation is concerned.

This **Regulation** may also define the safety related functions which are controlled by electronic systems(s).

This **Regulation** 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 normal and fault conditions, all the appropriate performance requirements specified **for the system**.

- 1.2. This Regulation is applicable only if referred to in another Regulation or if requested by the manufacturer. It applies to electrical/electronic sub-assemblies or wheeled vehicles, equipped with complex electronic vehicle systems where the driver's direct control of vehicle dynamics is affected.***

## 2. DEFINITIONS

For the purposes of this Regulation:

- 2.1. "Approval of a vehicle or an Electrical sub-assembly" means approval of wheeled vehicles (hereinafter referred to as vehicle(s)) as supplied by the vehicle manufacturer and of components or separate technical units intended for fitment in vehicles with regard to safety aspects of complex electronic vehicle control systems.***
- 2.2. "Electrical sub-assembly (ESA)" means an electronic device or set of devices intended to be part of a vehicle, together with any associated connections and interactions, which performs one or more specialized functions. An ESA may be approved at the request of a manufacturer as either a "component" or a "separate technical unit".***
- 2.3. "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 even 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.

- 2.4. "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.

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

- 2.5. "Complex Electronic Vehicle Control Systems (CEVCSs)" are those electronic control systems which are subject to a hierarchy of control in which a controlled function may be over-ridden by a higher level electronic control system/function.

A function which is over-ridden becomes part of the complex system.

- 2.6. "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.

- 2.7. "Units" are the smallest divisions of system components, which will be considered in this Regulation, since these combinations of components will be treated as single entities for purposes of identification, analysis or replacement.

- 2.8. "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, hydraulic *or optical*.

- 2.9. "Range of Control" refers to an output variable and defines the range over which the system is likely to exercise control.

- 2.10. "Boundary of Functional Operation" defines the boundaries of the external physical limits within which the system is able to maintain control.

- 2.11. "Vehicle type" *or* "ESA type" in relation to CEVCSs, means systems which do not differ essentially in such respects as:

2.11.1. *the general structure of the complex electronic system and the internal structure of its components, including software;*

2.11.2.1. *the function performed by the complex electronic system;*

2.11.3. *the internal function of the complex electronic system.*

3. APPLICATION FOR APPROVAL

3.1. Approval of a vehicle type

3.1.1. The application for approval of a vehicle type, with regard to its **CEVCS**, shall be submitted by the vehicle manufacturer or by his duly accredited representative.

3.1.2. The information document shall include the documentation as shown in annex 3, paragraph 1.1.1.a.

3.1.3. The vehicle manufacturer shall draw up a schedule describing all projected combinations of relevant systems.

3.1.4. A vehicle representative of the type to be approved shall be selected from this schedule by mutual agreement between the manufacturer and the competent authority. The choice of vehicle shall be based on the **CEVCSs** offered by the manufacturer. One or more vehicles may be selected from this schedule if it is considered by mutual agreement between the manufacturer and the competent authority that different systems are included which are likely to have an effect on the **CEVCSs** behaviour.

3.1.5. The choice of the vehicle(s) in conformity with paragraph 3.1.4. above shall be limited to system combinations intended for actual production.

3.2. ESA type approval

3.2.1. The application for approval of a type of ESA with regard to its **CEVCSs** shall be submitted by the vehicle manufacturer or by the manufacturer of the ESA.

3.2.2. The information document shall include the documentation as shown in annex 3, paragraph 1.1.1.a.

3.2.3. ***A sample of the ESA system representative of the type to be approved shall be provided, if necessary, after discussion with the manufacturer on, e.g., possible variations in the number or function of components (software, hardware), number or function of sensors and/or actuators. If the technical service deems it necessary, it may select a further sample.***

3.2.4. The sample(s) must be clearly and indelibly marked with the manufacturer's trade name or mark and the type designation.

3.2.5. Where applicable, any restrictions on use should be identified.  
Any such restrictions should be included in annex 1B.

4. APPROVAL

4.1. Type approval procedures

4.1.1. Type approval of a vehicle

The following alternative procedures for vehicle type approval may be used at the discretion of the vehicle manufacturer.

4.1.1.1. Approval of a vehicle

A vehicle may be type approved directly by following the provisions laid down in paragraph 6. of this Regulation. If this procedure is chosen by a vehicle manufacturer, no separate testing of *CEVCSs* as ESAs is required.

4.1.1.2. Approval of vehicle type by testing of individual Electrical Sub-assembly Systems

A vehicle manufacturer may obtain approval for the vehicle by demonstrating to the approval authority that all the relevant *CEVCSs* (see paragraph 3.1.3. of this Regulation) have been approved in accordance with this Regulation and have been installed in accordance with any conditions attached thereto.

4.1.2. Type approval of an Electrical Sub-assembly Systems

Type approval may be granted to an ESA to be fitted either to any vehicle type or to a specific vehicle type or types requested by the manufacturer. ESAs involved in the direct control of vehicles will normally receive type approval by agreement with the vehicle manufacturer.

4.2. Granting of type approval

4.2.1. Vehicle

4.2.1.1. If the representative vehicle fulfils the requirements of paragraph 6. of this Regulation, type approval shall be granted.

4.2.1.2. A model of communication form for type approval is contained in annex 1A.

4.2.2. Electrical Sub-assembly Systems

4.2.2.1. If the representative ESA system(s) fulfil(s) the requirements of paragraph 6. of this Regulation, type approval shall be granted.

4.2.2.2. A model of communication form for type approval is contained in annex 1B.

4.2.3. In order to draw up the communication forms referred to in paragraph 4.2.1.2. or 4.2.2.2. above, the competent authority of the Contracting Party granting the approval may use a report prepared or approved by a recognized laboratory or in accordance with the provisions of this Regulation.

4.3. Approval, or refusal of approval, of a type of vehicle or ESA in accordance with this Regulation shall be notified to the Parties to the Agreement applying this Regulation

on a form conforming to the model in annex 1A or 1B of this Regulation, accompanied by the documentation as required in annex 3 supplied by the applicant in a format not larger than A4 (210 x 297 mm) or folded to those dimensions.

#### 4.4. MARKINGS

4.4.1. An approval number shall be assigned to each vehicle or ESA type approved. The first two digits of this number (at present 00) shall indicate the series of amendments corresponding to the most recent essential technical amendments made to the Regulation at the date of approval. A Contracting Party may not assign the same approval number to another type of vehicle or ESA.

4.4.2. Presence of markings

4.4.2.1. Vehicle

An approval mark described in paragraph 4.4.3. below shall be affixed to every vehicle conforming to a type approved under this Regulation.

4.4.2.2. *Electrical Sub-assembly Systems*

An approval mark described in paragraph 4.4.3. below shall be affixed to every ESA *(if possible to its main component(s))* conforming to a type approved under this Regulation.

No marking is required for systems built into vehicles which are approved as units *(components only for fitting in vehicles in production or repair, not for separate sale)*.

4.4.3. An international approval mark must be affixed, in a conspicuous and easily accessible place specified on the approval communication form, on each vehicle conforming to the type approved under this Regulation. This mark shall comprise:

4.4.3.1. A circle containing the letter "E", followed by the distinguishing number of the country granting the approval. 1/

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1/ 1 for Germany, 2 for France, 3 for Italy, 4 for the Netherlands, 5 for Sweden, 6 for Belgium, 7 for Hungary, 8 for the Czech Republic, 9 for Spain, 10 for Yugoslavia, 11 for the United Kingdom, 12 for Austria, 13 for Luxembourg, 14 for Switzerland, 15 (vacant), 16 for Norway, 17 for Finland, 18 for Denmark, 19 for Romania, 20 for Poland, 21 for Portugal, 22 for the Russian Federation, 23 for Greece, 24 for Ireland, 25 for Croatia, 26 for Slovenia, 27 for Slovakia, 28 for Belarus, 29 for Estonia, 30 (vacant), 31 for Bosnia and Herzegovina, 32 for Latvia, 33 (vacant), 34 for Bulgaria, 35 (vacant), 36 for Lithuania, 37 for Turkey, 38 (vacant), 39 for Azerbaijan, 40 for The former Yugoslav Republic of Macedonia, 41 (vacant), 42 for the European Community (Approvals are granted by its Member States using their respective ECE symbol), 43 for Japan, 44 (vacant), 45 for Australia, 46 for Ukraine, 47 for Republic of South Africa, and 49 for New Zealand. Subsequent numbers shall be assigned to other countries in the chronological order in which they ratify or accede to the Agreement Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions, and the numbers thus assigned shall be

4.3.2. The number of this Regulation, followed by the letter "R", a dash and the approval number to the right of the circle specified in paragraph 4.4.3.1.

4.4.4. Examples of the type-approval marks are shown in annex 2 to this Regulation.

4.4.5. Markings on ESAs in conformity with paragraph 4.4.3. above need not be visible when the ESA is installed in the vehicle.

## 5. SPECIFICATIONS

**5.1. *The requirements as shown in annex 3 shall be fulfilled.***

## 6. TESTS

**6.1. *The requirements as shown in annex 3, paragraph 2. to this Regulation shall be fulfilled.***

## 7. AMENDMENT OR EXTENSION OF TYPE APPROVAL OF A VEHICLE OR ELECTRONICAL SUB-ASSEMBLY SYSTEM

7.1. Where a vehicle manufacturer has obtained type approval for a vehicle and wishes to fit an additional or substitutional **CEVCS** which has already received approval under this Regulation, and which will be installed in accordance with any conditions attached thereto, the vehicle approval may be extended without further testing. The additional or substitutional **CEVCS** shall be considered as part of the vehicle for conformity of production purposes.

7.2. Where the additional or substitutional part(s) has (have) not received approval pursuant to this Regulation, and if testing is considered necessary, the whole vehicle shall be deemed to conform if the new or revised part(s) can be shown to conform to the relevant requirements of paragraph 5. of if, in a comparative test, the new part can be shown not to be likely to adversely affect the conformity of the vehicle type.

7.3. Every modification of the vehicle or ESA type with regard to the characteristics in Annexes 1A and 1B to this Regulation shall be notified to the administrative department which granted approval of the vehicle type. This department may then either:

7.3.1. consider that the modifications made are unlikely to have an appreciable adverse effect and that in any case the vehicle or ESA still meets the requirements; or

7.3.2. require a further test report from the technical service responsible for conducting the tests.

7.4. Notice of conformation of approval or of refusal of approval, accompanied by particulars of the modifications, shall be communicated by the procedure indicated



in paragraph 4. above to the Contracting Parties to the Agreement which apply this Regulation.

- 7.5 The competent authority issuing the extension of approval shall assign a series number to each communication form drawn up for such an extension and inform thereof the other Contracting Parties to the 1958 Agreement by means of a communication form conforming to the models in annexes 1A and 1B to this Regulation.

## 8. CONFORMITY OF PRODUCTION

- 8.1. Vehicles or components or ESAs approved under this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements set forth in paragraph 5. above.

- 8.2. Conformity of production of the vehicle or component or separate technical unit shall be checked on the basis of the data contained in the communication form(s) for type approval set out in annex 1A and/or 1B of this Regulation.

- 8.3. If the competent authority is not satisfied with the checking procedure of the manufacturer, then paragraph 8.3.1. below shall apply.

- 8.3.1. When the conformity of a vehicle, component or ESA taken from the series is being verified, production shall be deemed to conform to the requirements of this Regulation, *especially shall be considered the unambiguity of identification markings*.

## 9. PENALTIES FOR NON-CONFORMITY OF PRODUCTION

- 9.1. The approval granted in respect of a type of vehicle, component or separate technical unit pursuant to this Regulation may be withdrawn if the requirements laid down in paragraph 6. above are not complied with or if the selected vehicles fail to pass the tests provided for in paragraph 6. above.

- 9.2. If a Contracting Party to the Agreement which applies this Regulation withdraws an approval it has previously granted, it shall forthwith notify the other Contracting Parties applying this Regulation thereof by means of a communication form conforming to the model in annexes 1A and 1B to this Regulation.

## 10. PRODUCTION DEFINITELY DISCONTINUED

If the holder of an approval completely ceases to manufacture a type of vehicle or ESA approved in accordance with this Regulation, he shall so inform the authority which granted the approval. Upon receiving the relevant communication, that authority shall inform thereof the other Parties to the 1958 Agreement which apply this Regulation, by means of a communication form conforming to the model in

annexes 1A and 1B to this Regulation.

11. NAMES AND ADDRESSES OF TECHNICAL SERVICES CONDUCTING APPROVAL TESTS AND ADMINISTRATIVE DEPARTMENTS

The Parties to the 1958 Agreement applying this Regulation shall communicate to the United Nations Secretariat the names and addresses of the technical services conducting approval tests and of the administrative departments which grant approvals and to which forms certifying approval or extension, refusal or withdrawal of approval, issued in other countries, are to be sent.

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Annex 1A

COMMUNICATION

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



Issued by: Name of administration:

.....  
.....

Concerning: 2/ APPROVAL GRANTED  
APPROVAL EXTENDED  
APPROVAL REFUSED  
APPROVAL WITHDRAWN  
PRODUCTION DEFINITELY DISCONTINUED

of a type of vehicle/component/separate technical unit 2/ with regard to Regulation No. XXX.

Approval number: .....

Extension No.: .....

1. Make (trade name of manufacturer):
2. Type and general commercial description(s):
3. Means of identification of type, if marked on the vehicle/component/separate technical unit 2/
  - 3.1. Location of that marking:
4. Category of vehicle:
5. Name and address of manufacturer:
6. In the case of components and separate technical units, location and method of affixing of the approval mark:

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1/ Distinguishing number of the country which issued/extended/refused/withdrew approval (see Regulation provisions on approval).

2/ Strike out what does not apply.

7. Address(es) of assembly plant(s): .....
8. Additional information (where applicable): See appendix
9. Technical service responsible for carrying out the tests:.....
10. Date of test report: .....
11. Number of test report:.....
12. Remarks (if any): See appendix
13. Place: .....
14. Date:.....
15. Signature:.....
16. The index to the information package lodged with the approval authority, which may be obtained on request is attached

\* \* \*

Appendix to type-approval communication form No. ....  
concerning the type-approval of a vehicle under Regulation No. XXX

1. Additional information
  3. Special devices for the purpose of annex 3 to this Regulation (if applicable) (e.g. ....):
  3. Electrical system rated voltage: V. pos/neg ground 2/
  4. Type of bodywork:
  5. List of complex electronic vehicle control systems installed in the tested vehicle(s) not limited to the items in the information document:
  6. Approved/accredited laboratory (for the purpose of this Regulation) responsible for carrying out the tests:
  7. Remarks: (e.g. valid for both left-hand drive and right-hand drive vehicles)
-

Annex 1B

COMMUNICATION

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



Issued by: Name of administration:

.....  
.....

Concerning: 2/ APPROVAL GRANTED  
APPROVAL EXTENDED  
APPROVAL REFUSED  
APPROVAL WITHDRAWN  
PRODUCTION DEFINITELY DISCONTINUED

of a type of electronic sub-assembly (ESA) with regard to Regulation No. XXX.

Approval No.:.....

Extension No. ....

1. Make (trade name of manufacturer): .....
2. Type and general commercial description(s): .....
3. Means of identification of type, if marked on the vehicle/component/ separate technical unit: 2/
- 3.1. Location of that marking: .....
4. Category of vehicle:.....
5. Name and address of manufacturer: .....

1/ Distinguishing number of the country which issued/extended/refused/withdrew approval (see Regulation provisions on approval).

2/ Strike out what does not apply.

6. In the case of components and separate technical units, location and method of affixing of the ECE approval mark: .....
7. Address(es) of assembly plant(s): .....
8. Additional information (where applicable): See appendix
9. Technical service responsible for carrying out the tests:.....
10. Date of test report: .....
11. No. of test report: .....
12. Remarks (if any): See appendix
13. Place: .....
14. Date:.....
15. Signature:.....
16. The index to the information package lodged with the approval authority, which may be obtained on request, is attached.

\* \* \*

Appendix to type-approval communication form No. ....  
Concerning the type-approval of an electrical/electronic sub-assembly under  
Regulation No. XXX.

1. Additional information
  - 1.1. Electrical system rated voltage: V. pos/neg ground 2/
  - 1.2. This ESA can be used on any vehicle type with the following restrictions:  
yes/no 2/
    - 1.2.1. Installation and / or connection conditions, if any:
    - 1.2.2. Use or other conditions, if any:

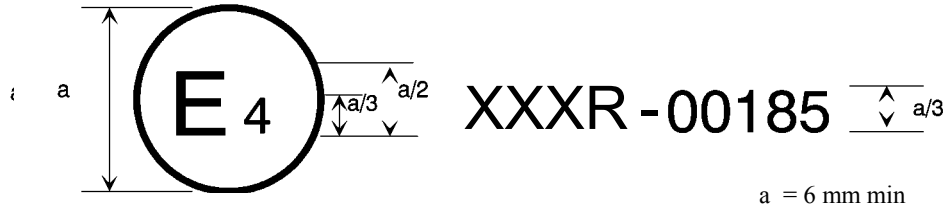
- 1.3. This ESA can be used only on the following vehicle types:
    - 1.3.1. Installation conditions, if any:
    - 1.3.2. Use or other conditions, if any:
  - 1.5. Approved/accredited laboratory (for the purpose of this Regulation) responsible for carrying out the test: .....
  - 2. Remarks: .....
-

Annex 2

EXAMPLES OF THE ARRANGEMENTS OF THE APPROVAL MARKS

Model A

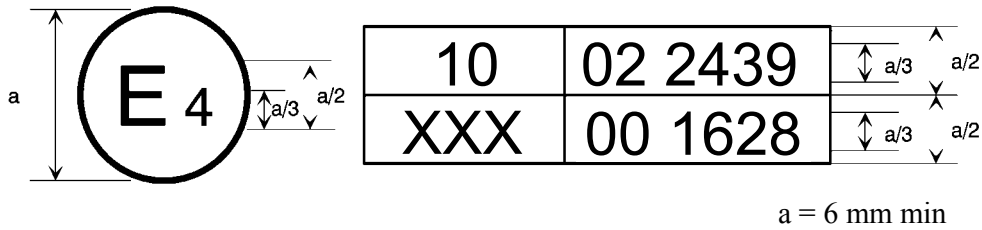
(See paragraph 4. of this Regulation)



The above approval mark affixed to a vehicle or ESA shows that the vehicle type concerned has, with regard to CEVCSs, been approved in the Netherlands (E 4) pursuant to Regulation No. XXX under approval No. 00185. The approval number indicates that the approval was granted according to the requirements of Regulation No. XXX in its original version (00).

Model B

(See paragraph 4. of this Regulation)



The CEVCS or vehicle bearing the above approval mark has been approved in the Netherlands (E 4) pursuant to Regulations Nos. 10 and XXX \*/ under approval number 1628, meeting the requirements of this Regulation in its original version (00). The Regulation No. 10. included the 02 series of amendments.

Note: The approval number and additional symbols shall be placed close to the circle and either above or below the letter 'E', or to the right or left of that letter. The digits of the approval number shall be on the same side of the letter 'E' and face in the same direction. The use of Roman numerals as approval numbers should be avoided so as to prevent any confusion with other symbols.

\*/ The first number is given merely as an example.



Annex 3

REQUIREMENTS TO BE APPLIED TO THE SAFETY ASPECTS  
OF COMPLEX ELECTRONIC VEHICLE CONTROL SYSTEMS

1. DOCUMENTATION

1.1. 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.

1.1.1. Documentation shall be made available in two parts:

- a) The formal documentation package for the approval, containing the material listed in paragraph 1. of this regulation (with the exception of that of paragraph 1.4.4. of this annex) which shall be supplied to the technical service at the time of submission of the type approval application. This will be taken as the basic reference for the verification process set out in paragraph 2. of this annex.
- b) Additional material and analysis data of paragraph 1.4.4. of this annex, which shall be retained by the manufacturer, but made open for inspection at the time of Type Approval.

1.2. 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.

1.2.1. A list of all input and sensed variables shall be provided and the working range of these defined.

1.2.2. 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 2.9. of this regulation) exercised on each such variable shall be defined.

1.2.3. Limits defining the boundaries of functional operation (paragraph 2.10. of this regulation) shall be stated where appropriate to system performance.

### 1.3. System layout and schematics

#### 1.3.1. 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.

#### 1.3.2. 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.

#### 1.3.3. 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.

#### 1.3.4. 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.

#### 1.3.5. Identification of units

Each Unit shall be clearly and unambiguously identifiable (e.g. by marking and/or software output) 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 identification shall be used.

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

- 1.3.5.1. 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.

#### 1.4. Safety concept of the manufacturer

- 1.4.1. 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.

- 1.4.2. 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 be prepared, if required, to show some evidence of the means by which they determined the realisation of the system logic, during the design and development process.

- 1.4.3. 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.

- 1.4.3.1. 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.

- 1.4.3.2. 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.

1.4.3.3. 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.

1.4.4. The documentation shall be supported, by an analysis which shows, in overall terms, how the system will behave on the occurrence of any one of those specified faults which will have a bearing on vehicle control performance or safety.

This may be based on a Failure Mode and Effect Analysis (FMEA), a Fault Tree Analysis (FTA) or any similar process appropriate to system safety considerations.

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.

1.4.4.1. This documentation shall itemise the parameters being monitored and shall set out, for each fault condition of the type defined in paragraph 1.4.4. above, the warning signal to be given to the driver and/or to service/technical inspection personnel.

## 2. VERIFICATION AND TEST

2.1. The functional operation of "The System", as laid out in the documents required in paragraph 1. of this annex, shall be tested as follows:

2.1.1. Verification of the Function of "The System".

As the means of establishing the normal operational levels, verification of the performance of the vehicle system under non-fault conditions shall be conducted against the manufacturer's basic benchmark specification unless this is subject to a specified performance test as part of the approval procedure of another Regulation.

2.1.2. Verification of the Safety Concept of paragraph 1.4. of this annex

The reaction of "The System" shall, at the discretion of the type approval authority, 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.

2.1.2.1 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.

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