

Intermediate Stage after discussion in the ad-hoc working group
"Electronic Steering (EST)" II/2000 on 11th and 12th October 2000

Summary of draft amendments to ECE R79

	Draft	Explanation
Annex 5	Provisions for trailers having hydraulic steering transmissions	"purely" was omitted to open the possibility of combinations of other systems

Insert a new annex 6 to read:

Annex 6	Special requirements to be applied to the safety aspects of complex electronic vehicle control systems	New requirements according to electronic systems (same as for el. brake systems)
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Paragraph 1.2 amend to read:

1.2	It does not cover steering equipment with a purely pneumatic transmission.	"purely electric...purely hydraulic.." omitted
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Paragraph 1.2.1 and 1.2.2 shall be deleted

omitting purely electric or hydraulic transmission

Paragraph 2.3.2 amend to read:

2.3.2	<p>"Steering transmission" means all components arranged between the control and the wheels and which represent a functional link between the latter and the former.</p> <p>The transmission is divided into two <u>independent functions</u>: The control transmission and the <u>energy</u> transmission.</p> <p>Where the term "transmission " is <u>used</u> alone <u>in this regulation</u>, it <u>means</u> both, the control transmission and the <u>energy</u> transmission. A distinction is drawn between mechanical, electrical and hydraulic transmission systems or combinations thereof, according to the means by which the signals and/or <u>energy</u> is transmitted.</p>	<p>Explanation of "control transmission" and "energy transmission"</p>
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Insert new paragraphs 2.3.2.1 and 2.3.2.2 to read:

2.3.2.1 "Control transmission " means all components by means of which signals are transmitted for control of the steering equipment. **Explanation of "control transmission"**

2.3.2.2 "Energy transmission " means all components by means of which the energy required for control/regulation of the steering function of the wheels is transmitted. **Explanation of "energy transmission "**

Paragraph 2.3.4.1, amend to read:

2.3.4.1 "Energy source" means the part of the energy supply, which provides the energy in the required form. **No further restrictions to hydraulic or air systems**

Insert a new paragraph 2.5.1.5 to read:

2.5.1.5 "Main steering system" means the steering equipment of a vehicle which is mainly responsible for determining the direction of travel. **Explanation of "Main steering equipment" additional to the other systems**

2.5.2.~~3~~4 "Additional steering equipment", an independent system by which the steering angle of one or more axle(s) of the steering system can be influenced selectively for manoeuvring purposes. **Special steering equipment for e.g. oversized heavy goods trailers**

Paragraph 2.5.3.4, amend to read:

2.5.3.4 "Auxiliary steering equipment (ASE)" in which the wheels of axle(s) of vehicles of categories M and N are steered in addition to the wheels of the main steering equipment in the same or opposite direction to those of the main steering equipment and/or the steering angle of the front and/or the rear wheels may be adjusted **Explanation in relation to main steering equipment**

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relative to vehicle behaviour.

Insert new paragraph 2.7 to read:

2.7 "Automatically commanded steering" means function within a complex Electronic Control System where actuation of the steering system is made for the purpose of determination of the direction of movement of the vehicle with or without a direct action of the driver, resulting from automatic evaluation of vehicle and/or traffic information. *)

*)Footnote:

Automatically commanded steering will only be approved for systems of lane guidance for urban buses or for traffic below a speed of 50 km/h, manoeuvring or parking operations.

Insert new paragraph 2.8 to read:

2.8 "Corrective steering" means an automatic actuation of the steering system or individual wheels of the system, independent of the driver to assist in maintaining the chosen course or to correct steering errors.

2.9 Connection between towing vehicle and trailer

2.9.1 "Electric control line" means the electrical connection which provides the steering control function to the trailer. It comprises the electrical wiring and connector and includes the parts for data communication and the electrical energy supply for the trailer control transmission.

Explanation of wiring and connections

2.9.2 "Point to point" means a **Clarification of connections**
topology of a communication
network with only two units.
Each unit has an integrated
termination resistor for the
communication line.

Paragraphs 5.1.1 and 5.1.1.2 amend to read:

5.1.1 The steering system shall **Requirements modified**
ensure easy and safe handling **according to electric**
of the vehicle up to its **steering systems**
maximum design speed or in case
of a trailer up to its
technically permitted maximum
speed.
There must be a tendency to
self-centre when tested in
accordance with paragraph 6.2
with the intact steering
equipment.
The vehicle shall meet the
requirements of paragraph 6.2
in the case of motor vehicles
and of paragraph 6.3 in the
case of trailers. If a vehicle
is fitted with an auxiliary
steering system, it shall also
meet the requirements of annex
4. Trailers equipped with
hydraulic steering
transmissions shall comply also
with Annex 5.

5.1.1.2 The steered wheels of the main **Omitting "travel**
steering system must directly **synchronisation"**
follow the steering control
deflection. Verification can be
provided by means of a test as
described under 6.2.5. This
requirement does not apply to
automatically commanded
steering or corrective steering **Inserting "automatically**
or under static conditions. **commanded steering"**

Paragraph 5.1.1.3 amend to read:

5.1.1.3. Automatically commanded **Omitting "time**
steering is permitted only when **synchronisation"**
the driver retains overriding
control.

Paragraph number 5.1.2.1 shall be deleted,
text to be added to 5.1.2.

Formal changing

Paragraphs 5.1.3, 5.1.3.1, 5.1.3.2,
5.1.3.2.1, and 5.1.3.3 amend to
read:

5.1.3 Failures:

5.1.3.1 Should the engine stop or a part of the power assisted steering equipment fails with the exception of those parts listed in paragraph 5.1.4, there shall be no immediate changes in steering angle and the vehicle shall meet the requirements of paragraph 6 for the system with a failure as long as the vehicle can be driven with a speed of at least 10 km/h.

Construction provisions for steering systems
No immediate changes of steering angle in case of failure

5.1.3.2 In case of a failure within the control transmission with the exception of those parts listed in paragraph 5.1.4, it shall be still possible to steer with the performance laid down in paragraph 6 for the intact steering system.

Failure test procedures

5.1.3.2.1 In the event of a failure of the energy supply of the electric control transmission, starting from the nominal value of the energy level, steering shall be guaranteed at least for [50] alternate actuations of the control device for full lock-to-lock turn of the wheels with the performance of the above paragraph. It should be understood that during the above test sufficient energy is available in the energy transmission

Failure test procedures

- [5.1.3.3 In case of a failure within the **To be discussed**
energy transmission, with the
exception of those parts listed
in paragraph 5.1.4, there shall
be no immediate changes in
steering angle and the vehicle
shall meet, at least after [50]
alternate actuations of the
control device for full lock-
to-lock turn of the wheels
statically, the requirements of
paragraph 6.2.6 in case of
motor vehicles and of paragraph
6.3 in case of trailers as long
as the vehicle can be driven
with a speed of at least 10
km/h.]
- [5.1.5 Any fault which impairs the **This paragraph will be**
steering function and is **revised for a general chapter**
not mechanical in nature **"Warning Devices" by Mr.**
must be signalled clearly **Hochleitner**
to the driver. If the
steering effort needed in
failed condition is below
the value of the intact
condition of table shown in
paragraph 6.2, yellow
warning signal may be used.
For steering effort needed
exceeding above values, it
shall be signalled by a red
warning signal. Despite the
requirements of 5.1.1.1 the
deliberate application of
vibration in the steering
system may be used as an
additional indication of a
fault condition in this
system.] **Vibration for the purpose of**
signalling of a steering
equipment fault possible

Insert a new paragraph 5.1.6 to read:

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|-------|---|--|
| 5.1.6 | The effectiveness of the steering equipment, including the electrical control lines shall not be adversely affected by magnetic or electric fields.
<u>Conformity with the technical requirements of</u> regulation No. 10, <u>02 series of amendments *) shall be demonstrated.</u>
<u>*) European Communities Council Directive 72/245/EEC, as revised by Directive 95/54/EC.</u> | General requirements concerning EMC |
|-------|---|--|

Paragraph 5.2.1.1.3 amend to read:

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| 5.2.1.1.3 | Except for ASE, <u>automatically commanded steering and corrective steering, there must be a continuous and monotonic relation between the steering control deflection and the steering angle.</u> | Requirements for automatic steering

<u>(Impuls side stick steering systems not permissible)</u> |
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Paragraph 5.2.3.2 amend to read:

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| 5.2.3.2 | Trailers (with the exception of semi-trailers and centre-axle trailers) which have more than one axle with steered wheels and semi-trailers and centre-axle trailers which have at least one axle with steered wheels must fulfil the conditions given in paragraph 6.3 below. However, for trailers with self-tracking equipment a test under Paragraph 6.3 is not necessary if the axle load ration between the unsteered and the self-tracking axles equals or exceeds 1.6 under all loading conditions.
<u>However for trailers with self-tracking steering equipment, the axle load ratio between unsteered or articulated steered axles and friction-steered axles shall be at least</u> | Formal corrections due to centre-axle trailers and articulated steered axles

Minimum requirements for load ration between unsteered or articulated steered axles and friction steered axles to ensure lateral control and |
|---------|---|---|

1 under all loading conditons. cornering stability

Insert a new paragraph 5.2.3.3 to read:

5.2.3.3 If the towing vehicle of a **General requirements for
vehicle/trailer combinations**
towing vehicle/trailer
combination is driving straight
ahead, the trailer and towing
vehicle must remain aligned in
one line. If alignment is not
retained automatically, the
trailer must be equipped with a
suitable adjustment facility
for maintenance.

Paragraph 5.2.4.2 amend to read:

5.2.4.2 The same energy source may be
used to supply the steering
equipment and systems other
than the braking device if,
when the fluid level in the
storage reservoir drops to a
level liable to cause an
increase in steering effort, an
acoustic or optical warning is
given to the driver; the
satisfactory condition of the
lamp must be easily verifiable
by the driver.
The same requirement also **General clause for the same
energy source for other
systems than the steering
system (priority)**
applies to the connection of
pumps of other systems to the
storage reservoir of the
steering equipment. However the
supply to the steering
equipment shall have priority
over the other systems which
are linked to the same storage
reservoir.

Insert new paragraphs 5.2.4.4 ... 5.3 to
read: **These paragraphs should be
renumbered.**

5.2.4.4 Special provisions for full-
power steering equipment **(Mr. Bauer)
General provisions for
electric steering systems**

5.2.4.4.1 1 Warning signal **New paragraphs concerning
warning devices to be set by
Mr. Hochleitner**
A failure of the power supply,
sensors or other control

elements must be detected by the system and signalled to the driver by a red warning signal. If a symbol is used, it must comply with the relevant symbol as defined in ISO 2575, The warning signal mentioned above shall light up when the electrical equipment of the vehicle (and the steering system) is energised. With the vehicle stationary, the steering system shall verify that none of the specified failures or defects are present before extinguishing the signal. Specified failures or defects which should activate the warning signal mentioned above, but which are not detected under static conditions, shall be stored upon detection and be displayed at startup and at all times when the ignition (start) switch is in the "on" (run) position, as long as the failure or defect persists.

5.2.4.4.2 The requirements of Annex 6 shall be applied to the safety aspects of complex electronic vehicle control systems which provide or form part of the control transmission of the steering function or utilise the steering system for automatically commanded steering or corrective steering However, systems or functions, which use the steering system as the means of achieving a higher level objective, are subject to Annex 6 only insofar as they have direct effect on the steering system. If such systems are provided, they shall not be deactivated during type approval testing of the steering system.

5.2.4.4.3 Connections between the motor vehicle and the trailer

Reference to relevant ISO standards to be clarified by Dr. Bräuninger

The electrical control line shall conform to ISO 11992-1 and 11992-2 and be a point-to-point type using the seven-pin connector ISO 7638:1997. Other information may also be transmitted over this line provided that this conforms to ISO 11992-3:1998 and that braking and steering functions have priority and are maintained in the normal and failed modes. The transmission of other information shall not delay braking or steering functions.

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| [5.3 | Provisions for the periodic technical inspection of steering equipments.] | Paragraphs concerning PTI to be discussed at Dutch, French and UK authorities. |
| [5.3.1 | The steering equipment shall be so designed, that the components of the steering equipment of which the function and efficiency is influenced by wear, corrosion or ageing can easily be checked. These components include in particular all joints and ball heads, drop arms and deflection levers together with their bearings, sleeves as well as steering gear and their bearing mounts.
It shall be possible, without disassembling, to determine the condition, function and operation of the steering equipment by means of visual inspection or, if necessary, with commonly used measuring or test equipment.] | Paragraphs concerning PTI to be discussed at Dutch, French and UK authorities. |
| [5.3.2 | For main steering equipment of motor vehicles and steering equipment of trailers without mechanical transmission between the steering control and the steered wheels, a defined steering control angle shall lead to a defined steering angle, with the vehicle | Paragraphs concerning PTI to be discussed at Dutch, French and UK authorities. |

stationary. Every fault, that affects the steering function, shall lead to a fault indication according to paragraph 2.3.7 of this Regulation.

5.3.2 The main steering equipment of motor vehicles without mechanical transmission between the steering control and the main steered wheels shall have a static performance which generates a predetermined response to a defined steering control angle when stationary.]

Proposal by Mr. Brearley

[5.3.3 The requirements of paragraph 5.3.2 above are considered to be fulfilled when the completeness and operational status of the system can be verified by way of an on-vehicle alphanumeric display. The implemented protection against simple manipulation of this display must be declared during type approval.

Paragraphs concerning PTI to be discussed at Dutch, French and UK authorities.

5.3.3 It shall be possible to verify in a simple way, the correct operational status of the Complex Electronic control system(s) which have control over steering. If special information is needed, this shall be made freely available.]

Proposal by Mr. Brearley

Insert new paragraphs 6.3.5 and 6.3.6 to read:

6.3.5 The requirements of 5.2.3.3 shall also be satisfied with a failure in the steering equipment.

Clarification for stability of vehicle/trailer combinations

6.3.6 The annular ground area swept by the towing vehicle/trailer combination with an intact steering system, driving at no more than 5 km/h in a constant radius circle with the front outer corner of the towing

Special condition for trailer curving under fault condition. This should be explained by the trailer industry (Mr. Schmidt).

vehicle describing a radius of 0,67 x vehicle combination length but not less than 12,5 m is to be measured.
If, with a fault in the in the steering system, the measured swept annular width is >8,3 m, then this must not be an increase of more than 15% compared with the corresponding value measured with the fault free steering system.
This test must be conducted in both clockwise and anti-clockwise directions.

(Editorial corrections by Mr. Brearley)

Amendments to Annex 5

The title shall be amended to read:

Provisions for trailers having hydraulic steering transmissions

Formal corrections omitting "...purely...."

Paragraph 1 amend to read:

1 Vehicles are not required to be fitted with hydraulic steering transmissions.
.....

Omitting "...purely..."

Paragraph 2.1.1 amend to read:

2.1.1 The hydraulic lines of hydraulic transmission must be capable of withstanding a pressure at least four times the maximum normal service pressure (T) specified by the manufacturer.
.....

Omitting "...purely..."

Paragraph 2.4 ... 2.6.1 shall be deleted.

Special requirements for tractor/trailer alignment omitted (general requirements fixed in 5.2.3.3)

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**New requirements to complex electronic systems to be discussed
(The text of this annex is identical with the text of the proposed Annex CEL (also proposed for the ECE - Regulation No. 13 Braking systems as annex 19) and discussed in the ECE - GRRF ad hoc working group EBS II TRANS/WP.29/GRRF/2000/10.):**

Insert a new annex 6, to read:

Annex 6

SPECIAL REQUIREMENTS TO BE APPLIED TO THE SAFETY ASPECTS OF COMPLEX ELECTRONIC VEHICLE 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 2.3. below) as far as this Regulation is concerned.
This annex may also be called, by special paragraphs in this Regulation, for safety related functions which are controlled by electronic system(s).
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 normal and fault conditions, all the appropriate performance requirements specified elsewhere in this Regulation.
2. DEFINITIONS
For the purposes of this annex,
 - 2.1. "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.
 - 2.2. "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.

- 2.3. "Complex electronic vehicle control systems" 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.
- 2.4. "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.
- 2.5. "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.
- 2.6. "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.
- 2.7. "Range of control" refers to an output variable and defines the range over which the system is likely to exercise control.
- 2.8. "Boundary of functional operation" defines the boundaries of the external physical limits within which the system is able to maintain control.

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.

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 will be taken as the basic reference for the verification process set out in paragraph 4. of this annex.
- (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.

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.

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 2.7.) exercised on each such variable shall be defined.

3.2.3. Limits defining the boundaries of functional operation

paragraph 2.8.) 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.

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.
 - 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 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.
 - 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, eg. 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 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.
 - 3.4.4.1. This documentation shall itemise the parameters being monitored and shall set out, for each fault condition of the type defined in paragraph 3.4.4. above, the warning signal to be given to the driver and/or to service/technical inspection personnel.
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"
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 this or another Regulation.
 - 4.1.2. Verification of the safety concept of paragraph 3.4.
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.

- 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.
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B. JUSTIFICATION

In accordance with the current drafting of ECE Regulation 79, with the exception of auxiliary steering equipments and hydraulic trailer steering systems, only such steering systems are able to grant approval in which there is a mechanical connection between the steering control (steering wheel) and the steered wheels. This restriction obstructs technical progress and has therefore been dropped in the presented proposal. A possibility should be created allowing steering forces and/or control functions to be transmitted by hydraulic and/or electrical means. At present, only pneumatic steering transmission are not taken into consideration for compressibility reasons.

Expanding the application range to non-mechanical steering transmission made necessary a series of amendments to the regulation drafting particularly with regard to definitions and requirements. Since, in a similar way as with brake systems, not only electrical transmission facilities but also electronic control functions need to be taken into consideration, wherever possible, reference was made to the corresponding consultation results of the EBS group. It is thus planned to adopt the annex to Regulation 13, concerning the examination of the safety concept of complex electronic systems, also in Regulation 79. In order to ensure compatibility between the towing vehicle and trailer, reference is made to the ISO 11 992 where digital data transmission is defined both for the braking functions as well as for the steering functions.

Full-power control systems provide a far more flexible spectrum to influence the parameters of the steering system. The steering system parameters can be adapted to different driving situations of the vehicle. As the full-power system has no direct connection to the steered wheels, it must be designed with a high level of safety. In case of a failure the functioning of the system has to be preserved.

The energy for the full-power system is derived from energy sources which are either driven directly by the engine of the vehicle or which transform the kinetic energy of the rolling vehicle or another alternative energy source. As a consequence the energy supply is directly connected to the functioning of the engine and the available energy-reservoirs (e.g. electrical batteries, hydraulic reservoirs). The reservoirs always have a restricted capacity, which is sufficient for a limited time only. A means to ensure the driver of the availability of his vehicle systems beyond

the stopping of the energy sources is, to monitor the energy level of the reservoirs, and to warn him well before they are depleted and there is sufficient time left to bring the vehicle into the safe position.

The safe position means a condition, under which the vehicle can be parked in a position in which it is ensured, that the vehicle can be left in a regular way without causing any danger or undue impediment for the environment or for other road users. It is assumed, that the parking of the vehicle in this position is performed by decision and in responsibility of the driver.

If the vehicle is immobilised due to other causes, not directly related to the steering system, it is not reasonable to require that the functionality of the steering system must be maintained beyond that point.
