Amendments to Regulation No 13 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of vehicles of categories M, N and O with regard to braking

11 series of amendments


Incorporating:

11 series of amendments — Date of entry into force: 11 July 2008

Revision 6 — Amendment 1 — Corr 1

Revision 6 — Amendment 1 — Corr 2

Supplement 1 to the 11 series of amendments — Date of entry into force: 22 July 2009

Supplement 2 to the 11 series of amendments — Date of entry into force: 24 October 2009

Corrigendum 2 to the 11 series of amendments — Date of entry into force: 24 June 2009

Supplement 3 to the 11 series of amendments — Date of entry into force: 17 March 2010

Amendments to the list of contents

The title of Annex 16, amend to read:

‘Annex 16 — Compatibility between towing vehicles and trailers with respect to ISO11992 data communications’

Annex 19, insert new Appendices 7 and 8, to read:

‘Annex 19 — Appendix 7 — Vehicle stability function information document

Annex 19 — Appendix 8 — Vehicle stability function test report’

Appendices 7 and 8 (former), renumber as Appendices 9 and 10.

Insert new Annex 21

‘Annex 21 — Special requirements for vehicles equipped with a vehicle stability function

Annex 21 — Appendix 1 — Use of the dynamic stability simulation

Annex 21 — Appendix 2 — Dynamic stability simulation tool and its validation

Annex 21 — Appendix 3 — Vehicle stability function simulation tool test report’
Amendments to the main text of the Regulation


Add new paragraphs 2.34 to 2.36, to read:

‘2.34. “Vehicle Stability Function” means an electronic control function for a vehicle which improves the dynamic stability of the vehicle.

2.34.1. A vehicle stability function includes one or both of the following:

(a) directional control;

(b) roll-over control.

2.34.2. Control functions within a vehicle stability function:

2.34.2.1. “Directional control” means a function within a vehicle stability function that assists the driver, in the event of under-steer and over-steer conditions, within the physical limits of the vehicle in maintaining the direction intended by the driver in the case of a power-driven vehicle, and assists in maintaining the direction of the trailer with that of the towing vehicle in the case of a trailer.

2.34.2.2. “Roll-over control” means a function within a vehicle stability function that reacts to an impending roll-over in order to stabilise the power-driven vehicle or towing vehicle and trailer combination or the trailer during dynamic manoeuvres within the physical limits of the vehicle.

2.35. “Subject trailer” is a trailer representative of the trailer type for which type approval is sought.

2.36. The ‘brake factor (B  F )’ is the input to output amplification ratio of the brake.’

Paragraph 4.2, for ‘(at present 10)’ read ‘(at present 11)’.

Insert a new paragraph 5.1.3.6.1, to read:

‘5.1.3.6.1. The support of messages defined within ISO 11992-2:2003 including Amd.1:2007 is specified within Annex 16 to this Regulation for the towing vehicle and trailer as appropriate.’

Paragraphs 5.1.3.6.1 and 5.1.3.6.2 (former), renumber as paragraphs 5.1.3.6.2 and 5.1.3.6.3 respectively.

Paragraph 5.2.1.30.5, delete the reference to footnote 12 and footnote 12.

Add new paragraph 5.2.1.32, to read (including the insertion of a reference to a new footnote 12 and a new footnote 12):

‘5.2.1.32. Subject to the provisions of paragraph 12.4 to this Regulation, all vehicles of categories M₂, M₃, N₂ and N₃ (12) having no more than 3 axles shall be equipped with a vehicle stability function. This shall include roll-over control and directional control and meet the technical requirements of Annex 21 to this Regulation.

(12) Off-road vehicles, special purpose vehicles (e.g. mobile plant using non standard vehicle chassis — e.g. cranes-, hydrostatic-driven vehicles in which the hydraulic drive system is also used for braking and auxiliary functions), Class I and Class A buses of categories M₂ and M₃, articulated buses and coaches, N₂ tractors for semi-trailer with a gross vehicle mass (GVM) between 3.5 and 7.5 tonnes, shall be excluded from this requirement.’
Paragraph 5.2.2.17.1, amend to read (including the deletion of the note):

‘5.2.2.17.1. Trailers equipped with a vehicle stability function as defined in paragraph 2.34 of this Regulation shall in the event of a failure or defect within the trailer stability function indicate the failure or defect by the separate yellow warning signal specified in paragraph 5.2.1.29.2 above via pin 5 of the ISO 7638:1997 connector.

The warning signal shall be constant and remain displayed as long as the failure or defect persists and the ignition (start) switch is in the “on” (run) position.’

Paragraph 5.2.2.22.1, delete the reference to footnote 19 and the footnote 19.

Paragraph 5.2.2.22.2, renumber the reference to footnote 20 and footnote 20 as footnote 19 and delete the reference to footnote 21 and footnote 21.

Add new paragraph 5.2.2.23, to read (including the insertion of a reference to a new footnote 20 and a new footnote 20):

‘5.2.2.23. Subject to the provisions of paragraph 12.4 to this Regulation, all vehicles of categories O 3 and O 4 (20) having no more than 3 axles and equipped with air suspension shall be equipped with a vehicle stability function. This shall include at least roll-over control and meet the technical requirements of Annex 21 to this Regulation.

(20) Trailers for exceptional load transport and trailers with areas for standing passengers shall be excluded from this requirement.’

Add a new paragraph 12.1.6, to read (including footnote 21):

‘12.1.6. As from the official date of entry into force of the 11 series of amendments, no Contracting Party applying this Regulation shall refuse to grant type-approval under this Regulation as amended by the 11 series of amendments (21).

(21) This paragraph shall not prevent Denmark from continuing to mandate a vehicle stability function meeting the requirements of this Regulation.’

Add a new paragraph 12.1.7, to read:

‘12.1.7. Supplement 1 to the 11 series of amendments to this Regulation shall be applied as specified in paragraph 12.4.1.’

Add a new paragraph 12.1.8, to read:

‘12.1.8. As from the official date of entry into force of Supplement 2 to the 11 series of amendments to this Regulation, no Contracting Party applying this Regulation shall refuse to grant approval under this Regulation as amended by Supplement 2 to the 11 series of amendments.’

Add a new paragraph 12.2.6, to read:

‘12.2.6. As from 48 months after the entry into force of Supplement 1 to the 11 series of amendments to this Regulation, Contracting Parties shall grant approvals to vehicles exempted by paragraphs 5.2.1.32 and 5.2.2.23 including the footnotes, only if they comply with the requirements of Supplement 1 to the 11 series of amendments to this Regulation.’

Add a new paragraph 12.2.7, to read:

‘12.2.7. As from 48 months after the date of entry into force of Supplement 2 to the 11 series of amendments to this Regulation, Contracting Parties applying this Regulation shall grant approvals only if the vehicle type to be approved meets the requirements of this Regulation as amended by Supplement 2 to the 11 series of amendments.’
Add a new paragraph 12.3.2, to read:

‘12.3.2. Starting 84 months after the entry into force of Supplement 2 to the 11 series of amendments to this Regulation, Contracting Parties applying this Regulation may refuse first national registration (first entry into service) of a vehicle which does not meet the requirements of Supplement 2 to the 11 series of amendments to this Regulation.’

Add a new paragraph 12.4, to read (including note (*)):

‘12.4. Mandatory provisions for vehicles equipped with a vehicle stability function

12.4.1. Requirements for the equipment of vehicles with vehicle stability functions as specified in paragraphs 5.2.1.32 and 5.2.2.23 of this Regulation, as amended by the 11 series of amendments, shall be applied as follows:

<table>
<thead>
<tr>
<th>Vehicle category</th>
<th>Application date (as from the date after entry into force of the 11 series of amendments)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Contracting Parties applying this Regulation shall grant approvals only if the vehicle type to be approved meets the requirements of this Regulation as amended by the 11 series of amendments</td>
</tr>
<tr>
<td>M₂</td>
<td>60 months</td>
</tr>
<tr>
<td>M₁ (Class III) (*)</td>
<td>12 months</td>
</tr>
<tr>
<td>M₁ &lt; 16 tonnes (pneumatic transmission)</td>
<td>24 months</td>
</tr>
<tr>
<td>M₁ (Class II and B) (hydraulic transmission)</td>
<td>60 months</td>
</tr>
<tr>
<td>M₁ (Class III) (hydraulic transmission)</td>
<td>60 months</td>
</tr>
<tr>
<td>M₁ (Class III) (pneumatic control transmission and hydraulic energy transmission)</td>
<td>72 months</td>
</tr>
<tr>
<td>M₁ (Class II) (pneumatic control transmission and hydraulic energy transmission)</td>
<td>72 months</td>
</tr>
<tr>
<td>M₃ (other than above)</td>
<td>24 months</td>
</tr>
<tr>
<td>N₁ (hydraulic transmission)</td>
<td>60 months</td>
</tr>
<tr>
<td>N₁ (pneumatic control transmission and hydraulic energy transmission)</td>
<td>72 months</td>
</tr>
<tr>
<td>N₁ (other than above)</td>
<td>48 months</td>
</tr>
<tr>
<td>N₁ (2 axle tractors for semi-trailers)</td>
<td>12 months</td>
</tr>
<tr>
<td>N₁ (2 axle tractors for semi-trailers with pneumatic control transmission (ABS))</td>
<td>36 months</td>
</tr>
<tr>
<td>N₁ (3 axles with electric control transmission (EBS))</td>
<td>36 months</td>
</tr>
<tr>
<td>N₁ (2 and 3 axles with pneumatic control transmission (ABS))</td>
<td>48 months</td>
</tr>
<tr>
<td>N₁ (other than above)</td>
<td>24 months</td>
</tr>
<tr>
<td>O₁ (combined axle load between 3,5 - 7,5 tonnes)</td>
<td>48 months</td>
</tr>
<tr>
<td>O₁ (other than above)</td>
<td>36 months</td>
</tr>
<tr>
<td>O₄</td>
<td>24 months</td>
</tr>
</tbody>
</table>

(*) Class III as defined in Regulation No 107.’

Paragraphs 12.4 and 12.4.1 (former), renumber as paragraphs 12.5 and 12.5.1.
Amendments to Annex 2


14.14. The vehicle is equipped with a vehicle stability function: Yes/No (2)

If yes: ............................................................................................................................................

The vehicle stability function has been tested according to and fulfils the requirements of Annex 21:

Yes/No (2)

Vehicle stability function is optional equipment: Yes/No (2)

Vehicle stability function includes directional control: Yes/No (2)

Vehicle stability function includes roll-over control: Yes/No (2)

14.14.1. Where an Annex 19 test report has been utilised, the test report number shall be stated: ............................................................................................................................................

Amendments to Annex 10

Annex 10, paragraph 1.3.1, footnote 2, amend to read:

(2) In the case of multiple axles, where the axle spread between one axle and its adjacent axle is greater than 2.0 m, each individual axle shall be considered as an independent axle group.’

Amendments to Annex 11

Annex 11

Paragraph 2, amend to read:

2. The term “identical”, as used in paragraphs 1.1, 1.2 and 1.3 above, means identical as regards the geometric and mechanical characteristics and the materials used for the components of the vehicle referred to in those paragraphs.

In the case of trailers, these requirements are deemed to be fulfilled, with respect to paragraphs 1.1 and 1.2 above, if the identifiers referred to in Appendix 2, paragraph 3.7 of this Annex for the axle/brake of the subject trailer are contained in a report for a reference axle/brake.

A “reference axle/brake” is an axle/brake for which a test report mentioned in Appendix 2, paragraph 3.9 of this Annex exists.’

Annex 11 — Appendix 1

Table I, amend to read (including note 1):

<table>
<thead>
<tr>
<th>Axles of the vehicle</th>
<th>Reference axes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static mass (P) (1)</td>
<td>Test mass (P_e) (1)</td>
</tr>
<tr>
<td>kg</td>
<td>kg</td>
</tr>
<tr>
<td>Braking force needed at wheels</td>
<td>Braking force developed at wheels</td>
</tr>
<tr>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Speed</td>
<td>Speed</td>
</tr>
<tr>
<td>km/h</td>
<td>km/h</td>
</tr>
</tbody>
</table>

Axle 1

Axle 2

Axle 3

Axle 4

(1) See paragraph 2.1 of Appendix 2 to this Annex.”
Table III, third row, amend to read (including the deletion of note 2):

<table>
<thead>
<tr>
<th>REFERENCE AXLE</th>
<th>REPORT No</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>(copy attached)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Braking force per axle (N) (see paragraph 4.2.1, Appendix 2)</th>
<th>Type-I</th>
<th>Type-III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axle 1</td>
<td>$T_1 = \ldots % F_e$</td>
<td>$T_1 = \ldots % F_e$</td>
</tr>
<tr>
<td>Axle 2</td>
<td>$T_2 = \ldots % F_e$</td>
<td>$T_2 = \ldots % F_e$</td>
</tr>
<tr>
<td>Axle 3</td>
<td>$T_3 = \ldots % F_e$</td>
<td>$T_1 = \ldots % F_e$</td>
</tr>
</tbody>
</table>

Annex 11 — Appendix 2

Insert a new paragraph 1.2.2, to read:

‘1.2.2. Tests carried out in accordance with this Appendix prior to Supplement 2 to the 11 series of amendments to this Regulation which, together with any supporting data from the vehicle/axle/brake manufacturer, provide sufficient information to meet the requirements of Supplement 2 to the 11 series of amendments can be used for a new report or the extension of an existing test report without the need to carry out actual tests.’

Paragraph 2, amend to read:

‘2. SYMBOLS AND DEFINITIONS

2.1. Symbols

\[ P = \text{part of the vehicle mass borne by the axle under static conditions} \]

\[ F = \text{normal reaction of road surface on the axle under static conditions} = P \cdot g \]

\[ F_R = \text{total normal static reaction of road surface on all wheels of trailer} \]

\[ F_e = \text{test axle load} \]

\[ P_e = \frac{F_e}{g} \]

\[ g = \text{acceleration due to gravity: } g = 9.81 \text{ m/s}^2 \]

\[ C = \text{brake input torque} \]

\[ C_0 = \text{brake input threshold torque, definition see paragraph 2.2.2} \]

\[ C_{0,\text{dec}} = \text{declared brake input threshold torque} \]

\[ C_{\text{max}} = \text{declared maximum brake input torque} \]

\[ R = \text{tyre rolling radius (dynamic)} \]

\[ T = \text{brake force at tyre/road interface} \]

\[ T_R = \text{total brake force at tyre/road interface of the trailer} \]

\[ M = \text{brake torque} = T \cdot R \]

\[ z = \text{braking rate} = \frac{T}{F} \text{ or } \frac{M}{(R \cdot F)} \]

\[ s = \text{actuator stroke (working stroke plus free stroke)} \]

\[ s_p = \text{see Annex 19, Appendix 9} \]
Th_A = see Annex 19, Appendix 9

l = lever length

r = internal radius of brake drums or effective radius of brake discs

p = brake actuation pressure

Note: Symbols with the suffix "e" relate to the parameters associated with the reference brake test and may be added to other symbols as appropriate.

2.2. Definitions

2.2.1. Mass of a disc or drum

2.2.1.1. The “declared mass” is the mass declared by the manufacturer which is a representative mass for the brake identifier (see paragraph 3.7.2.2 of this Appendix).

2.2.1.2. The “nominal test mass” is the mass which the manufacturer specifies for the disc or drum with which the relevant test is carried out by the Technical Service.

2.2.1.3. The “actual test mass” is the mass measured by the Technical Service prior to the test.

2.2.2. “Brake input threshold torque”:

2.2.2.1. The brake input threshold torque “C_0” is the input torque necessary to produce a measurable brake torque. This torque may be determined by extrapolation of measurements within a range not exceeding 15 percent braking rate or other equivalent methods (e.g. Annex 10, paragraph 1.3.1.1).

2.2.2.2. The brake input threshold torque “C_{0,dec}” is the brake input threshold torque declared by the manufacturer which is a representative brake input threshold torque for the brake (see paragraph 3.7.2.2.1 of this Appendix) and is needed to produce diagram 2 of Annex 19.

2.2.2.3. The brake input threshold torque “C_{0,e}” is determined by the procedure as defined in paragraph 2.2.2.1 above, measured by the Technical Service at the end of the test.

2.2.3. “External diameter of a disc”:

2.2.3.1. The “declared external diameter” is the external diameter of a disc declared by the manufacturer which is a representative external diameter for the disc (see paragraph 3.7.2.2.1 of this Appendix).

2.2.3.2. The “nominal external diameter” is the external diameter which the manufacturer specifies for the disc on which the relevant test is carried out by the Technical Service.

2.2.3.3. The “actual external diameter” is the external diameter measured by the Technical Service prior to the test.

2.2.4. The “effective length of the cam shaft” is the distance from the centre line of the S-cam to the centre line of the operating lever.

Paragraph 3.4, amend to read:

‘3.4. Test conditions (general)’

Paragraphs 3.7 to 3.7.3, should be deleted.

Insert new paragraphs 3.7 to 3.9.4, to read:

‘3.7. Identification

3.7.1. The axle shall carry in a visible position at least the following identification information grouped together, in any order, in a legible and indelible manner:

(a) Axle manufacturer and/or make;

(b) Axle identifier (see paragraph 3.7.2.1 of this Appendix);
(c) Brake identifier (see paragraph 3.7.2.2 of this Appendix);

(d) \( F_p \) identifier (see paragraph 3.7.2.3 of this Appendix);

(e) Base part of test report number (see paragraph 3.9 of this Appendix).

An example is given below:

```
Axle Manufacturer and/or make ABC
ID1-XXXXXX
ID2-YYYYYY
ID3-112000
ID4-ZZZZZZZ
```

3.7.1.1. A non-integrated automatic brake adjustment device shall carry in a visible position at least the following identification information grouped together, in a legible and indelible manner:

(a) Manufacturer and/or make;

(b) Type;

(c) Version.

3.7.1.2. The make and type of each brake lining shall be visible when the lining/pad is mounted on the brake shoe/back plate in a legible and indelible manner.

3.7.2. Identifiers

3.7.2.1. Axle identifier

The axle identifier categorizes an axle in terms of its braking force/torque capability as stated by the axle manufacturer.

The axle identifier shall be an alphanumeric number consisting of the four characters “ID1-” followed by a maximum of 20 characters.

3.7.2.2. Brake identifier

The brake identifier shall be an alphanumeric number consisting of the four characters “ID2-” followed by a maximum of 20 characters.

A brake with the same identifier is a brake which does not differ with regard to the following criteria:

(a) Type of brake (e.g. drum (S-cam, wedge, etc.) or disc brake (fixed, floating, single or twin disc, etc.));

(b) Base material (e.g. ferrous or non ferrous) with respect to caliper housing, brake carrier, brake disc and brake drum;

(c) Dimensions with the suffix “e” according to figures 2A and 2B of Appendix 5 of this Annex;

(d) The basic method used within the brake to generate the braking force;

(e) In the case of disc brakes, the friction ring mounting method: fixed or floating;

(f) Brake factor \( B_p \);

(g) Different brake characteristics with respect to the requirements of Annex 11 which are not covered by subparagraph 3.7.2.2.1.
3.7.2.2.1. Differences allowed within the same brake identifier

The same brake identifier may include different brake characteristics with regard to the following criteria:

(a) Increase in maximum declared brake input torque $C_{max}$;
(b) Deviation of declared brake disc and brake drum mass $m_{dec}$: ± 20 per cent;
(c) Method of attachment of the lining/pad on the brake shoe/back plate;
(d) In the case of disc brakes, increase of maximum stroke capability of the brake;
(e) Effective length of the cam shaft;
(f) Declared threshold torque $C_{0,dec}$;
(g) ± 5 mm from the declared external diameter of the disc;
(h) Type of cooling of the disc (ventilated/non-ventilated);
(i) Hub (with or without integrated hub);
(j) Disc with integrated drum — with or without parking brake function;
(k) Geometric relationship between disc friction surfaces and disc mounting;
(l) Brake lining type;
(m) Material variations (excluding changes in base material, see paragraph 3.7.2.2) for which the manufacturer confirms that such a material variation does not change the performance with respect to the required tests;
(n) Back plate and shoes.

3.7.2.3. $F_e$ identifier

The $F_e$ identifier indicates the test axle load. It shall be an alphanumeric number consisting of the four characters “ID3-” followed by the $F_e$ value in daN, without the “daN” unit identifier.

3.7.2.4. Test report identifier

The test report identifier shall be an alphanumeric number consisting of the four characters “ID4-” followed by the base part of the test report number.

3.7.3. Automatic brake adjustment device (integrated and non-integrated)

3.7.3.1. Types of automatic brake adjustment device

The same type of automatic brake adjustment device does not differ with regard to the following criteria:

(a) Body: base material (e.g. ferrous or non ferrous, cast iron or forged steel);
(b) Maximal permitted brake shaft moment;
(c) Adjustment operating principle, e.g. stroke (travel) dependent, force dependent or electronic/mechanical.
3.7.3.2. Versions of automatic brake adjustment device, with respect to the adjustment behaviour

Automatic brake adjustment devices within a type that have an impact on the running clearance of the brake are considered to be different versions.

3.8. Test criteria

The testing shall demonstrate compliance with all the requirements laid down in Appendix 2 of this Annex.

In the case that a new test report, or a test report extension, is required for a modified axle/brake within the limits specified in paragraph 3.7.2.2.1, the following criteria are used to determine the necessity for further testing taking into account worst case configurations agreed with the Technical Service.

Abbreviations shown below are used in the subsequent table:

<table>
<thead>
<tr>
<th>Abbreviations</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT (complete test)</td>
<td>Test according to Annex 11, Appendix 2:</td>
</tr>
<tr>
<td></td>
<td>3.5.1: Supplementary cold performance test</td>
</tr>
<tr>
<td></td>
<td>3.5.2: Fade test (Type-I test) (*)</td>
</tr>
<tr>
<td></td>
<td>3.5.3: Fade test (Type-III test) (*)</td>
</tr>
<tr>
<td>FT (fade test)</td>
<td>Test according to Annex 11, Appendix 2:</td>
</tr>
<tr>
<td></td>
<td>3.5.1: Supplementary cold performance test</td>
</tr>
<tr>
<td></td>
<td>3.5.2: Fade test (Type-I test) (*)</td>
</tr>
<tr>
<td></td>
<td>3.5.3: Fade test (Type-III test) (*)</td>
</tr>
</tbody>
</table>

(*) If applicable.

<table>
<thead>
<tr>
<th>Differences according to paragraph 3.7.2.2.1 above</th>
<th>Test criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Increase in maximum declared brake input torque $C_{\text{max}}$</td>
<td>Change allowed without additional testing</td>
</tr>
<tr>
<td>(b) Deviation of declared brake disc and brake drum mass $m_{\text{disc}}$: ± 20 per cent</td>
<td>CT: The lightest variant shall be tested. If the nominal test mass for a new variant deviates less than 5 per cent from a previously tested variant with a higher nominal value then the test of the lighter version may be dispensed with. The actual test mass of the test specimen may vary ± 5 per cent from the nominal test mass.</td>
</tr>
<tr>
<td>(c) Method of attachment of the lining/pad on the brake shoe/back plate</td>
<td>The worst case specified by the manufacturer and agreed by the Technical Services conducting the test</td>
</tr>
<tr>
<td>(d) In the case of disc brakes, increase of maximum stroke capability of the brake</td>
<td>Change allowed without additional testing</td>
</tr>
<tr>
<td>(e) Effective length of the cam shaft</td>
<td>The worst case is considered to be the lowest cam shaft torsional stiffness and shall be verified by either: (i) FT or (ii) Change allowed without additional testing if by calculation the influence with respect to stroke and braking force can be shown. In this case the test report shall indicate the following extrapolated values: $s_{\text{e}}, C_{\text{e}}, T_{\text{e}}, T_{\text{e}}/F_{\text{e}}$.</td>
</tr>
</tbody>
</table>
Differences according to paragraph 3.7.2.2.1 above | Test criteria
--- | ---
(f) Declared threshold torque $C_{\text{dec}}$ | It shall be checked that the brake performance remains within the corridors of Diagram 2 of Annex 19

(g) $\pm 5\text{ mm}$ from the declared external diameter of the disc | The worst case test is considered the smallest diameter. The actual external diameter of the test specimen may vary $\pm 1\text{ mm}$ from the nominal external diameter specified by the axle manufacturer.

(h) Type of cooling of the disc (ventilated/non-ventilated) | Each type shall be tested

(i) Hub (with or without integrated hub) | Each type shall be tested

(j) Disc with integrated drum — with or without parking brake function | Testing is not required for this feature

(k) Geometric relationship between disc friction surfaces and disc mounting | Testing is not required for this feature

(l) Brake lining type | Each type of brake lining

(m) Material variations (excluding changes in base material, see paragraph 3.7.2.2) for which the manufacturer confirms that such a material variation does not change the performance with respect to the required tests | Test not required for this condition

(n) Back plate and shoes | Worst case test conditions (*):
Back plate: minimum thickness
Shoe: lightest brake shoe

---

3.8.1. If an automatic brake adjustment device deviates from a tested one according to paragraphs 3.7.3.1 and 3.7.3.2 an additional test according to paragraph 3.6.2 of this Appendix is necessary.

3.9. Test report

3.9.1. Test report number

The test report number consists of two parts: a base part and a suffix which identifies the issue level of the test report.

The base part, consisting of a maximum of 20 characters, and suffix shall be clearly separated from each other using e.g. a dot or slash.

The base part of the test report number shall only cover brakes with the same brake identifier and the same brake factor (according to paragraph 4 of Annex 19 to this Regulation).

3.9.2. Test code

In addition to the test report number a “test code” consisting of up to eight characters (e.g. ABC123) shall indicate the test results applicable to the identifiers and the test specimen, which is described by the details given in paragraph 3.7 above.
3.9.3. Test results
3.9.3.1. The result of tests carried out in accordance with paragraphs 3.5 and 3.6.1 of this Appendix shall be reported on a form, a model of which is shown in Appendix 3 to this Annex.

3.9.3.2. In the case of a brake installed with an alternative brake adjustment device the results of tests carried out in accordance with paragraph 3.6.2 of this Appendix shall be reported on a form, a model of which is shown in Appendix 4 to this Annex.

3.9.4. Information document
An information document, provided by the axle or vehicle manufacturer, containing at least the information defined in Appendix 5 to this Annex shall be part of the Test Report.

The information document shall identify, if applicable, the various variants of the brake/axle equipment with respect to the essential criteria listed in paragraph 3.7.2.2.1 above.

Paragraph 4.1, amend to read:

‘4.1. Verification of components
The brake specification of the vehicle to be type approved shall comply with the requirements laid down in paragraphs 3.7 and 3.8 above.’

Paragraphs 4.1.1 to 4.1.7, should be deleted.

Paragraph 4.3.1.4, the formula, amend to read:

\[ T = (T_e - 0.01 \cdot F_e) \cdot \frac{C - C_o}{C_e - C_{oe}} \cdot \frac{R_e}{R} + 0.01 \cdot F \]

Paragraph 4.3.2, the formula, amend to read:

\[ \frac{T_R}{F_R} = \frac{\Sigma T'}{\Sigma F} \]

Annex 11 — Appendix 3
Amend to read (including the deletion of figures 1A, 1B, 2A and 2B):

‘APPENDIX 3

Model test report form as prescribed in paragraph 3.9 of Appendix 2 to this Annex

TEST REPORT No: .........................

Base part: ID4- .........................

Suffix: ...................................

1. GENERAL
1.1. Axle manufacturer (name and address): ..............................................................

1.1.1. Make of axle manufacturer: ............................................................

1.2. Brake manufacturer (name and address): ........................................................

1.2.1. Brake identifier: ID2- ............................................................

1.2.2. Automatic brake adjustment device: integrated/non-integrated (i)

1.3. Manufacturer's Information Document: ..........................................................
2. TEST RECORD

The following data has to be recorded for each test:

2.1. Test code (see paragraph 3.9.2 of Appendix 2 of this Annex): .............................................................

2.2. Test specimen: (precise identification of the variant tested related to the Manufacturer’s
Information Document. See also paragraph 3.9.2 of Appendix 2 of this Annex)

2.2.1. Axle

2.2.1.1. Axle identifier: ID1-.................................................................

2.2.1.2. Identification of tested axle: ......................................................

2.2.1.3. Test axle load (Fe identifier): ID3-.............................................. daN

2.2.2. Brake

2.2.2.1. Brake identifier: ID2-.................................................................

2.2.2.2. Identification of tested brake: ......................................................

2.2.2.3. Maximum stroke capability of the brake (\(\text{}\)): ..............................................................

2.2.2.4. Effective length of the cam shaft (\(\text{}\)): ..............................................................

2.2.2.5. Material variation as per paragraph 3.8 (m) of Appendix 2 of this Annex: ..................

2.2.2.6. Brake drum/disc (\(\text{}\))

2.2.2.6.1. Actual test mass of disc/drum (\(\text{}\)): ......................................................

2.2.2.6.2. Nominal external diameter of disc (\(\text{}\)): ......................................................

2.2.2.6.3. Type of cooling of the disc ventilated/non-ventilated (\(\text{}\))

2.2.2.6.4. With or without integrated hub (\(\text{}\))

2.2.2.6.5. Disc with integrated drum — with or without parking brake function (\(\text{}\)) (\(\text{}\))

2.2.2.6.6. Geometric relationship between disc friction surfaces and disc mounting: ..........................

2.2.2.6.7. Base material: ...................................................................................

2.2.2.7. Brake lining or pad (\(\text{}\))

2.2.2.7.1. Manufacturer: ...........................................................................

2.2.2.7.2. Make: ...........................................................................................

2.2.2.7.3. Type: ............................................................................................

2.2.2.7.4. Method of attachment of the lining/pad on the brake shoe/back plate (\(\text{}\)): ..................

2.2.2.7.5. Thickness of back plate, weight of shoes or other describing information (Manufacturer's
Information Document) (\(\text{}\)): ............................
2.2.2.7.6. Base material of brake shoe/back plate (1): .................................................................

2.2.3. Automatic brake adjustment device (not applicable in the case of integrated automatic brake adjustment device) (1)

2.2.3.1. Manufacturer (name and address): ................................................................................

2.2.3.2. Make: ............................................................................................................................... 

2.2.3.3. Type: ............................................................................................................................... 

2.2.3.4. Version: ............................................................................................................................ 

2.2.4. Wheel(s) (dimensions see Figures 1A and 1B in Appendix 5 of this Annex)

2.2.4.1. Reference tyre rolling radius \( R_e \) at test axle load \( F_e \): ............................................

2.2.4.2. Data of the fitted wheel during testing:

<table>
<thead>
<tr>
<th>Tyre size</th>
<th>Rim size</th>
<th>( X_e ) (mm)</th>
<th>( D_e ) (mm)</th>
<th>( E_e ) (mm)</th>
<th>( G_e ) (mm)</th>
</tr>
</thead>
</table>

2.2.5. Lever length \( l_e \): ...........................................................................................................

2.2.6. Brake actuator

2.2.6.1. Manufacturer: .................................................................................................................

2.2.6.2. Make: ............................................................................................................................... 

2.2.6.3. Type: ............................................................................................................................... 

2.2.6.4. (Test) Identification number: .............................................................................................. 

2.3. Test results (corrected to take account of rolling resistance of 0,01 \( \cdot F_e \))

2.3.1. In the case of vehicles of categories \( O_2 \) and \( O_3 \)

<table>
<thead>
<tr>
<th>Test type:</th>
<th>0</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annex 11, Appendix 2, paragraph:</td>
<td>3.5.1.2</td>
<td>3.5.2.2/3</td>
</tr>
<tr>
<td>Test speed</td>
<td>km/h</td>
<td>40</td>
</tr>
<tr>
<td>Brake actuator pressure ( p_e )</td>
<td>kPa</td>
<td>—</td>
</tr>
<tr>
<td>Braking time</td>
<td>min</td>
<td>—</td>
</tr>
<tr>
<td>Brake force developed ( T_e )</td>
<td>daN</td>
<td>—</td>
</tr>
<tr>
<td>Brake efficiency ( T_e/F_e )</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Actuator stroke ( s_e )</td>
<td>mm</td>
<td>—</td>
</tr>
<tr>
<td>Brake input torque ( C_e )</td>
<td>Nm</td>
<td>—</td>
</tr>
<tr>
<td>Brake input threshold torque ( C_{0,e} )</td>
<td>Nm</td>
<td>—</td>
</tr>
</tbody>
</table>
2.3.2. In the case of vehicles of category O₄

<table>
<thead>
<tr>
<th>Test type:</th>
<th>0</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annex 11, Appendix 2, paragraph:</td>
<td>3.5.1.2</td>
<td>3.5.3.1</td>
</tr>
<tr>
<td>Test speed initial</td>
<td>km/h</td>
<td>60</td>
</tr>
<tr>
<td>Test speed final</td>
<td>km/h</td>
<td></td>
</tr>
<tr>
<td>Brake actuator pressure $p_e$</td>
<td>kPa</td>
<td>—</td>
</tr>
<tr>
<td>Number of brake applications</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Duration of braking cycle</td>
<td>s</td>
<td>—</td>
</tr>
<tr>
<td>Brake force developed $T_e$</td>
<td>daN</td>
<td></td>
</tr>
<tr>
<td>Brake efficiency $T_e/F_e$</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Actuator stroke $s_e$</td>
<td>mm</td>
<td>—</td>
</tr>
<tr>
<td>Brake input torque $C_e$</td>
<td>Nm</td>
<td>—</td>
</tr>
<tr>
<td>Brake input threshold torque $C_{0,e}$</td>
<td>Nm</td>
<td>—</td>
</tr>
</tbody>
</table>

2.3.3. This item is to be completed only when the brake has been subject to the test procedure defined in paragraph 4 of Annex 19 to this Regulation to verify the cold performance characteristics of the brake by means of the brake factor ($B_f$).

2.3.3.1. Brake factor $B_f$:

2.3.3.2. Declared threshold torque $C_{0,dec}$ Nm

2.3.4. Performance of the automatic brake adjustment device (if applicable)

2.3.4.1. Free running according to paragraph 3.6.3 of Annex 11, Appendix 2: yes/no

3. APPLICATION RANGE

The application range specifies the axle/brake variants that are covered in this test report, by showing which variables are covered by the individual test codes.

4. This test has been carried out and the results reported in accordance with Appendix 2 to Annex 11 and where appropriate paragraph 4 of Annex 19 to Regulation No 13 as last amended by the … series of amendments.

At the end of the test defined in paragraph 3.6 of Annex 11, Appendix 2, (4) the requirements of paragraph 5.2.2.8.1 of Regulation No 13 were deemed to be fulfilled/not fulfilled (1).

TECHNICAL SERVICE (5) CARRYING OUT THE TEST

Signed: ............................................................................. Date: .................................... .........................................

5. APPROVAL AUTHORITY (5)

Signed: ............................................................................. Date: .................................... .........................................

(1) Strike out what does not apply.
(2) Applies to disc brakes only.
(3) Applies to drum brakes only.
(4) Only to be completed when an automatic brake wear adjustment device is installed.
(5) To be signed by different persons even when the Technical Service and Approval Authority are the same or alternatively, a separate Approval Authority authorization is issued with the report.'
Annex 11 — Appendix 4

Item 1.1, replace ‘Technically permissible axle load ($P_e$)’ by ‘Test axle load ($F_e$ identifier): ID3’.

Add a new Appendix 5 to Annex 11, to read:

APPENDIX 5

Trailer axle and brake information document with respect to the alternative Type I and Type III procedure

1. GENERAL
1.1. Name and address of axle or vehicle manufacturer: .................................................................

2. AXLE DATA
2.1. Manufacturer (name and address): ............................................................................................
2.2. Type/variant: ...............................................................................................................................
2.3. Axle identifier: ID1 ....................................................................................................................
2.4. Test axle load ($F_e$): .................................................................................................................... daN
2.5. Wheel and brake data according to the following figures 1A and 1B

Figure 1A

![Diagram of trailer axle and brake components]
3. BRAKE

3.1. General information

3.1.1. Make: .................................................................................................................................................................

3.1.2. Manufacturer (name and address): ........................................................................................................................

3.1.3. Type of brake (e.g. drum/disc): ............................................................................................................................

3.1.3.1. Variant (e.g. S-cam, single wedge etc.): ................................................................................................................

3.1.4. Brake identifier: ID2-..............................................................................................................................................

3.1.5. Brake data according to the following figures 2A and 2B:
3.2. Drum brake data

3.2.1. Brake adjustment device (external/integrated): .................................................................

3.2.2. Declared maximum brake input torque $C_{\text{max}}$: .............................................................. Nm

3.2.3. Mechanical efficiency: $\eta = $ ................................................................. ......................................

3.2.4. Declared brake input threshold torque $C_{0,\text{dec}}$: ............................................................... Nm

3.2.5. Effective length of the cam shaft: ..................................................................................... mm

3.3. Brake drum

3.3.1. Max diameter of friction surface (wear limit): ................................................................. mm

3.3.2. Base material: ........................................................................................................................

3.3.3. Declared mass: ..................................................................................................................... kg

3.3.4. Nominal mass: ...................................................................................................................... kg
3.4. Brake lining

3.4.1. Manufacturer and address: .................................................................

3.4.2. Make: ..................................................................................................

3.4.3. Type: ..................................................................................................

3.4.4. Identification (type identification on lining): ........................................

3.4.5. Minimum thickness (wear limit): ................................................. mm

3.4.6. Method of attaching friction material to brake shoe: ......................

3.4.6.1. Worst case of attachment (in the case of more than one): ............

3.5. Disc brake data

3.5.1. Connection type to the axle (axial, radial, integrated, etc.): ............

3.5.2. Brake adjustment device (external/integrated): ..............................

3.5.3. Max. actuation stroke: ................................................................. mm

3.5.4. Declared maximum input force Th_{Amax}: ..................................... daN

3.5.4.1. \( C_{\text{max}} = \frac{\text{Th}_{A_{\text{max}}} \cdot l_e}{\eta} \) .............................................. Nm

3.5.5. Friction radius: \( r_e \) ............................................................... mm

3.5.6. Lever length: \( l_e \) ................................................................. mm

3.5.7. Input/output ratio (\( l_e/\eta_e \)): \( i = \) ...........................................

3.5.8. Mechanical efficiency: \( \eta = \) .....................................................

3.5.9. Declared brake input threshold force Th_{A_{0,dec}}: ............................ N

3.5.9.1. \( C_{\text{dec}} = \frac{\text{Th}_{A_{0,dec}} \cdot l_e}{\eta} \) .............................................. Nm

3.5.10. Minimum rotor thickness (wear limit): ......................................... mm

3.6. Brake disc data

3.6.1. Disc type description: ........................................................................

3.6.2. Connection/mounting to the hub: ....................................................

3.6.3. Ventilation (yes/no): ........................................................................

3.6.4. Declared mass: ............................................................................... kg

3.6.5. Nominal mass: ............................................................................... kg

3.6.6. Declared external diameter: .......................................................... mm

3.6.7. Minimum external diameter: ......................................................... mm

3.6.8. Inner diameter of friction ring: ..................................................... mm

3.6.9. Width of ventilation channel (if appl.): ......................................... mm

3.6.10. Base material: ................................................................................

3.7. Brake pad data

3.7.1. Manufacturer and address: ............................................................

3.7.2. Make: ..........................................................................................

3.7.3. Type: ..........................................................................................

3.7.4. Identification (type identification on pad back plate): ......................

3.7.5. Minimum thickness (wear limit): ................................................. mm

3.7.6. Method of attaching friction material to pad back plate: .....................

3.7.6.1. Worst case of attachment (in the case of more than one): ............
Amendments to Annex 13

Annex 13, paragraph 4.3, amend to read:

‘4.3. In the event of a failure as defined in paragraph 4.1 above, the following requirements shall apply:

Motor vehicles: The residual braking performance shall be that prescribed for the vehicle in question in the event of a failure of part of the transmission of the service braking system as defined in paragraph 5.2.1.4 of this Regulation. This requirement shall not be construed as a departure from the requirements concerning secondary braking.

Trailers: The residual braking performance shall be that defined in paragraph 5.2.2.15.2 of this Regulation.’

Amendments to Annex 16

Annex 16, amend to read:

‘ANNEX 16

Compatibility between towing vehicles and trailers with respect to iso11992 data communications

1. GENERAL

1.1. The requirements of this Annex shall only apply to towing vehicles and trailers equipped with an electric control line as defined in paragraph 2.24 of the Regulation.

1.2. The ISO7638 connector provides a power supply for the braking system or anti-lock braking system of the trailer. In the case of vehicles equipped with an electric control line as defined in paragraph 2.24 of the Regulation this connector also provides a data communication interface via Pins 6 and 7 — see paragraph 5.1.3.6 of the Regulation.

1.3. This Annex defines requirements applicable to the towing vehicle and trailer with respect to the support of messages defined within ISO 11992-2:2003 including Amd.1:2007.

2. The parameters defined within ISO 11992-2:2003 including Amd.1:2007 that are transmitted by the electric control line shall be supported as follows:

2.1. The following functions and associated messages are those specified within this Regulation that shall be supported by the towing vehicle or trailer as appropriate:

2.1.1. Messages transmitted from the towing vehicle to the trailer:

<table>
<thead>
<tr>
<th>Function/Parameter</th>
<th>ISO 11992-2:2003 Reference</th>
<th>Regulation No 13 Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service/secondary brake demand value</td>
<td>EBS11 Byte 3-4</td>
<td>Annex 10, paragraph 3.1.3.2</td>
</tr>
<tr>
<td>Two electrical circuits brake demand value</td>
<td>EBS12 Byte 3 Bit 1-2</td>
<td>Regulation No 13, paragraph 5.1.3.2</td>
</tr>
<tr>
<td>Pneumatic control line</td>
<td>EBS12 Byte 3 Bit 5-6</td>
<td>Regulation No 13, paragraph 5.1.3.2</td>
</tr>
</tbody>
</table>
2.1.2. Messages transmitted from the trailer to the towing vehicle:

<table>
<thead>
<tr>
<th>Function/Parameter</th>
<th>ISO 11992-2:2003 Reference</th>
<th>Regulation No 13 Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDC Active/passive</td>
<td>EBS21 Byte 2 Bit 1-2</td>
<td>Annex 21, paragraph 2.1.6</td>
</tr>
<tr>
<td>Vehicle electrical supply sufficient/insufficient</td>
<td>EBS22 Byte 2 Bit 1-2</td>
<td>Regulation No 13, paragraph 5.2.2.20</td>
</tr>
<tr>
<td>Red warning signal request</td>
<td>EBS22 Byte 2 Bit 3-4</td>
<td>Regulation No 13, paragraphs 5.2.2.15.2.1, 5.2.2.16 and 5.2.2.20</td>
</tr>
<tr>
<td>Supply line braking request</td>
<td>EBS22 Byte 4 Bit 3-4</td>
<td>Regulation No 13, paragraph 5.2.2.15.2.2</td>
</tr>
<tr>
<td>Stop lamps request</td>
<td>EBS22 Byte 4 Bit 5-6</td>
<td>Regulation No 13, paragraph 5.2.2.22.1</td>
</tr>
<tr>
<td>Vehicle pneumatic supply sufficient/insufficient</td>
<td>EBS23 Byte 1 Bit 7-8</td>
<td>Regulation No 13, paragraph 5.2.2.16</td>
</tr>
</tbody>
</table>

2.2. When the trailer transmits the following messages, the towing vehicle shall provide a warning to the driver:

<table>
<thead>
<tr>
<th>Function/Parameter</th>
<th>ISO 11992-2:2003 Reference</th>
<th>Driver Warning Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDC Active/Passive (1)</td>
<td>EBS21 Byte 2 Bit 1-2</td>
<td>Annex 21, paragraph 2.1.6</td>
</tr>
<tr>
<td>Red warning signal request</td>
<td>EBS22 Byte 2 Bit 3-4</td>
<td>Regulation No 13, paragraph 5.2.1.29.2.1</td>
</tr>
</tbody>
</table>

(1) VDC (Vehicle Dynamic Control) as defined within ISO 11992-2:2003 including Amd.1:2007 is defined within this Regulation as Vehicle Stability Function — see paragraph 2.34 of the Regulation.

2.3. The following messages defined in ISO 11992-2:2003 including Amd.1:2007 shall be supported by the towing vehicle or trailer:

2.3.1. Messages transmitted from the towing vehicle to the trailer:
No messages currently defined.

2.3.2. Messages transmitted from the trailer to the towing vehicle:

<table>
<thead>
<tr>
<th>Function/Parameter</th>
<th>ISO 11992-2:2003 Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle service brake active/passive</td>
<td>EBS22 Byte 1, Bit 5-6</td>
</tr>
<tr>
<td>Braking via electric control line supported</td>
<td>EBS22 Byte 4, Bit 7-8</td>
</tr>
<tr>
<td>Geometric data index</td>
<td>EBS24 Byte 1</td>
</tr>
<tr>
<td>Geometric data index content</td>
<td>EBS24 Byte 2</td>
</tr>
</tbody>
</table>
2.4. The following messages shall be supported by the towing vehicle or trailer as appropriate when the vehicle is installed with a function associated with that parameter:

2.4.1. Messages transmitted from the towing vehicle to the trailer:

<table>
<thead>
<tr>
<th>Function/Parameter</th>
<th>ISO 11992-2:2003 Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle type</td>
<td>EBS11 Byte 2, Bit 3-4</td>
</tr>
<tr>
<td>VDC (Vehicle Dynamic Control) Active/passive (1)</td>
<td>EBS11 Byte 2, Bit 5-6</td>
</tr>
<tr>
<td>Brake demand value for front or left side of vehicle</td>
<td>EBS11 Byte 7</td>
</tr>
<tr>
<td>Brake demand value for rear or right side of vehicle</td>
<td>EBS11 Byte 8</td>
</tr>
<tr>
<td>ROP (Roll-Over Protection) system enabled/disabled (2)</td>
<td>EBS12 Byte 1, Bit 3-4</td>
</tr>
<tr>
<td>YC (Yaw Control) system enabled/disabled (3)</td>
<td>EBS12 Byte 1, Bit 5-6</td>
</tr>
<tr>
<td>Enable/disable trailer ROP (Roll Over Protection) system (4)</td>
<td>EBS12 Byte 2, Bit 1-2</td>
</tr>
<tr>
<td>Enable/disable trailer YC (Yaw Control) system (4)</td>
<td>EBS12 Byte 2, Bit 3-4</td>
</tr>
<tr>
<td>Traction help request</td>
<td>RGE11 Byte 1, Bit 7-8</td>
</tr>
<tr>
<td>Lift axle 1 — position request</td>
<td>RGE11 Byte 2, Bit 1-2</td>
</tr>
<tr>
<td>Lift axle 2 — position request</td>
<td>RGE11 Byte 2, Bit 3-4</td>
</tr>
<tr>
<td>Steering axle locking request</td>
<td>RGE11 Byte 2, Bit 5-6</td>
</tr>
<tr>
<td>Seconds</td>
<td>TD11 Byte 1</td>
</tr>
<tr>
<td>Minutes</td>
<td>TD11 Byte 2</td>
</tr>
<tr>
<td>Hours</td>
<td>TD11 Byte 3</td>
</tr>
<tr>
<td>Months</td>
<td>TD11 Byte 4</td>
</tr>
<tr>
<td>Day</td>
<td>TD11 Byte 5</td>
</tr>
<tr>
<td>Year</td>
<td>TD11 Byte 6</td>
</tr>
<tr>
<td>Local minute offset</td>
<td>TD11 Byte 7</td>
</tr>
<tr>
<td>Local hour offset</td>
<td>TD11 Byte 8</td>
</tr>
</tbody>
</table>

(1) VDC (Vehicle Dynamic Control) as defined within ISO 11992-2:2003 including Amd.1:2007 is defined within this Regulation as Vehicle Stability Function — see paragraph 2.34 of the Regulation.

(2) ROP (Roll-Over Protection) as defined within ISO 11992-2:2003 including Amd.1:2007 is defined within this Regulation as Roll-Over Control — see paragraph 2.32.2.2 of the Regulation.

(3) YC (Yaw Control) as defined within ISO 11992-2:2003 including Amd.1:2007 is defined within this Regulation as Directional Control — see paragraph 2.32.2.1 of the Regulation.
### 2.4.2. Messages transmitted from the trailer to the towing vehicle:

<table>
<thead>
<tr>
<th>Function/Parameter</th>
<th>ISO 11992-2:2003 Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support of side or axle wise brake force distribution</td>
<td>EBS21 Byte 2, Bit 3-4</td>
</tr>
<tr>
<td>Wheel based vehicle speed</td>
<td>EBS21 Byte 3-4</td>
</tr>
<tr>
<td>Lateral acceleration</td>
<td>EBS21 Byte 8</td>
</tr>
<tr>
<td>Vehicle ABS active/passive</td>
<td>EBS22 Byte 1, Bit 1-2</td>
</tr>
<tr>
<td>Amber warning signal request</td>
<td>EBS22 Byte 2, Bit 5-6</td>
</tr>
<tr>
<td>Vehicle type</td>
<td>EBS22 Byte 3, Bit 5-6</td>
</tr>
<tr>
<td>Loading ramp approach assistance</td>
<td>EBS22 Byte 4, Bit 1-2</td>
</tr>
<tr>
<td>Axle load sum</td>
<td>EBS22 Byte 5-6</td>
</tr>
<tr>
<td>Tyre pressure sufficient/insufficient</td>
<td>EBS23 Byte 1, Bit 1-2</td>
</tr>
<tr>
<td>Brake lining sufficient/insufficient</td>
<td>EBS23 Byte 1, Bit 3-4</td>
</tr>
<tr>
<td>Brake temperature status</td>
<td>EBS23 Byte 1, Bit 5-6</td>
</tr>
<tr>
<td>Tyre/wheel identification (pressure)</td>
<td>EBS23 Byte 2</td>
</tr>
<tr>
<td>Tyre/wheel identification (lining)</td>
<td>EBS23 Byte 3</td>
</tr>
<tr>
<td>Tyre/wheel identification (temperature)</td>
<td>EBS23 Byte 4</td>
</tr>
<tr>
<td>Tyre pressure (actual tyre pressure)</td>
<td>EBS23 Byte 5</td>
</tr>
<tr>
<td>Brake lining</td>
<td>EBS23 Byte 6</td>
</tr>
<tr>
<td>Brake temperature</td>
<td>EBS23 Byte 7</td>
</tr>
<tr>
<td>Brake cylinder pressure first axle left wheel</td>
<td>EBS25 Byte 1</td>
</tr>
<tr>
<td>Brake cylinder pressure first axle right wheel</td>
<td>EBS25 Byte 2</td>
</tr>
<tr>
<td>Brake cylinder pressure second axle left wheel</td>
<td>EBS25 Byte 3</td>
</tr>
<tr>
<td>Brake cylinder pressure second axle right wheel</td>
<td>EBS25 Byte 4</td>
</tr>
<tr>
<td>Brake cylinder pressure third axle left wheel</td>
<td>EBS25 Byte 5</td>
</tr>
<tr>
<td>Brake cylinder pressure third axle right wheel</td>
<td>EBS25 Byte 6</td>
</tr>
<tr>
<td>ROP (Roll Over Protection) system enabled/disabled (?)</td>
<td>EBS25 Byte 7, Bit 1-2</td>
</tr>
<tr>
<td>YC (Yaw Control) system enabled/disabled (?)</td>
<td>EBS25 Byte 7, Bit 3-4</td>
</tr>
</tbody>
</table>
### Table: Function/Parameter and ISO 11992-2:2003 Reference

<table>
<thead>
<tr>
<th>Function/Parameter</th>
<th>ISO 11992-2:2003 Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traction help</td>
<td>RGE21 Byte 1, Bit 5-6</td>
</tr>
<tr>
<td>Lift axle 1 position</td>
<td>RGE21 Byte 2, Bit 1-2</td>
</tr>
<tr>
<td>Lift axle 2 position</td>
<td>RGE21 Byte 2, Bit 3-4</td>
</tr>
<tr>
<td>Steering axle locking</td>
<td>RGE21 Byte 2, Bit 5-6</td>
</tr>
<tr>
<td>Tyre/wheel identification</td>
<td>RGE23 Byte 1</td>
</tr>
<tr>
<td>Tyre temperature</td>
<td>RGE23 Byte 2-3</td>
</tr>
<tr>
<td>Air leakage detection (Tyre)</td>
<td>RGE23 Byte 4-5</td>
</tr>
<tr>
<td>Tyre pressure threshold detection</td>
<td>RGE23 Byte 6, Bit 1-3</td>
</tr>
</tbody>
</table>

(1) ROP (Roll-Over Protection) as defined within ISO 11992-2:2003 including Amd.1:2007 is defined within this Regulation as Roll-Over Control — see paragraph 2.32.2.2 of the Regulation.

(2) YC (Yaw Control) as defined within ISO 11992-2:2003 including Amd.1:2007 is defined within this Regulation as Directional Control — see paragraph 2.32.2.1 of the Regulation.

---

2.5. The support of all other messages defined within ISO 11992-2:2003 including Amd.1:2007 is optional for the towing vehicle and trailer.

**Amendments to Annex 17**

Annex 17,

Add new paragraphs 3.2.2.6 and 3.2.2.7, to read:

‘3.2.2.6. Illumination of stop lamps

Simulate message EBS22 byte 4 bits 5 to 6 set to 00 and check that the stop lamps are not illuminated.

Simulate message EBS22 byte 4 bits 5 to 6 set to 01 and check that the stop lamps are illuminated.

3.2.2.7. Intervention of Trailer Stability Function

Simulate message EBS21 byte 2 bits 1 to 2 set to 00 and check that the driver warning defined in paragraph 2.1.6 of Annex 21 is not illuminated.

Simulate message EBS21 byte 2 bits 1 to 2 set to 01 and check that the driver warning defined in paragraph 2.1.6 of Annex 21 is illuminated. Add a new paragraph 3.2.3.2, to read:

‘3.2.3.2. Paragraph 2.4.1 of Annex 16 defines additional messages that shall under specific circumstances be supported by the towing vehicle. Additional checks may be carried out to verify the status of supported messages to ensure the requirements of paragraph 5.1.3.6.2 of the Regulation are fulfilled.’

Add new paragraphs 4.2.2.4 to 4.2.2.6, to read:

‘4.2.2.4. Automatically commanded braking

In case the trailer includes a function where its operation results in an automatically commanded braking intervention, the following shall be checked:

If no automatically commanded braking intervention is generated, check that message EBS22 byte 4 bits 5 to 6 are set to 00.

Simulate an automatically commanded braking intervention, when the resulting deceleration is ≥ 0.7 m/sec², check that message EBS22 byte 4 bits 5 to 6 are set to 01.'
4.2.2.5. Vehicle stability function

In the case of a trailer equipped with a vehicle stability function, the following checks shall be carried out:

When the vehicle stability function is inactive, check that message EBS21 byte 2 bits 1 to 2 are set to 00.

Simulate an intervention of the vehicle stability control function as specified in paragraph 2.2.4 of Annex 21 and check that message EBS21 byte 2 bits 1 to 2 are set to 01.

4.2.2.6. Support of the electric control line

Where the trailer braking system does not support braking via the electric control line check that message EBS22 byte 4 bits 7 to 8 are set to 00.

Where the trailer braking system supports the electric control line, check that message EBS22 byte 4 bits 7 to 8 are set to 01.

Add a new paragraph 4.2.3.2, to read:

‘4.2.3.2. Paragraph 2.4.2 of Annex 16 defines additional messages that shall under specific circumstances be supported by the trailer. Additional checks may be carried out to verify the status of supported messages to ensure the requirements of paragraph 5.1.3.6.2 of the Regulation are fulfilled.’

Annex 19,

Add a new paragraph 1.1.5, to read:

‘1.1.5. Vehicle stability function (refer to paragraph 6).’

Paragraph 2.2.3, for Appendix 7 read Appendix 9.

Paragraph 4.2.2, amend to read:

‘4.2.2. The brake factor is determined by using the following formula:

\[ B_F = \frac{\Delta \text{Output torque}}{\Delta \text{Input torque}} \]

and shall be verified for each of the lining or pad materials specified in paragraph 4.3.1.3.’

Paragraph 4.3.2.3, amend to read:

‘4.3.2.3. The declared threshold torque \( C_{0,\text{dec}} \)’

Add new paragraphs 6 to 6.6.1, to read:

‘6. Vehicle stability function

6.1. General

6.1.1. This section defines a test procedure to determine the dynamic characteristics of a vehicle equipped with a vehicle stability function consisting of at least one of the following functions:

(a) directional control;
(b) roll-over control.

6.2. Information document

6.2.1. The system/vehicle manufacturer shall supply to the Technical Service an Information Document of the control function(s) for which performance verification is required. This document shall contain at least the information defined in Appendix 7 to this Annex.'
6.3. Definition of test vehicle(s)

6.3.1. Based on the stability control function(s) and their application(s) defined in the manufacturer’s information document the Technical Service shall carry out a performance verification. This may include one or more dynamic manoeuvres as defined in paragraph 2.2.3 of Annex 21 to this Regulation on a trailer(s) having up to three axles which is representative of the application(s) defined in paragraph 2.1 of the manufacturers information document.

6.3.1.1. When selecting the trailer(s) for evaluation, consideration shall also be given to the following:

(a) Suspension type: for each suspension group, e.g. balanced pneumatic, a trailer of that specification shall be evaluated;

(b) Wheel base: wheel base shall not be a limiting factor;

(c) Brake type: approval shall be limited to trailers with S-cam or disc brakes but should other types become available, then comparative testing may be required;

(d) Braking system: the braking system of the trailer(s) to be evaluated shall comply with all of the relevant requirements of this Regulation.

6.4. Test schedule

6.4.1. To evaluate the vehicle stability control function the tests used shall be agreed between the system/vehicle manufacturer and the Technical Service and shall include conditions, appropriate to the function being evaluated, that would without the intervention of the stability control function result in loss of directional control or roll-over. The dynamic manoeuvres, test conditions and results shall be included in the test report.

6.5. Towing vehicle

6.5.1. The towing vehicle used for evaluating the performance of the vehicle (trailer) stability function shall have the necessary pneumatic and electrical connections and if the towing vehicle is equipped with a vehicle stability function as defined in paragraph 2.34 of this Regulation that function shall be disabled.

6.6. Test report

6.6.1. A test report shall be produced, the content of which shall be at least that defined in Appendix 8 to this Annex.

Add a new Appendix 7 to Annex 19, to read:

‘APPENDIX 7

Vehicle stability function information document

1. GENERAL

1.1. Name of manufacturer

1.2. System name

1.3. System variations

1.4. Control function (directional/roll-over/both) including an explanation of the basic function and/or philosophy of the control

1.5. System configurations (where appropriate)

1.6. System identification

2. APPLICATIONS

2.1. List of trailer types and configurations for which approval is required
2.2. Schematic diagrams of the respective configurations installed on the trailers defined in item 2.1 above with consideration given to the following:

(a) Lift axles
(b) Steering axles
(c) Anti-lock braking configurations

2.3. Scope of application with respect to suspension type:

(a) Air suspension: any type of balanced “trailing arm” air suspension

(b) Other suspensions: individually identified by manufacturer, model and type (balanced/unbalanced)

2.4. Additional information (if applicable) to the application of the directional control and/or the roll-over control function(s)

3. COMPONENT DESCRIPTION

3.1. Sensors external to the controller

(a) Function

(b) Limitations on the location of the sensors

(c) Identification, e.g. part numbers

3.2. Controller(s)

(a) General description and function

(b) Identification e.g. part numbers

(c) Limitations on the location of the controller(s)

(d) Additional features

3.3. Modulators

(a) General description and function

(b) Identification

(c) Limitations

3.4. Electrical equipment

(a) Circuit diagrams

(b) Powering methods

3.5. Pneumatic circuits

System schematics including anti-lock braking configurations associated with the trailer types defined in paragraph 6.2.1 of this Annex.

3.6. Safety aspects of the electronic system in accordance with Annex 18 to this Regulation

3.7. Electro-magnetic compatibility

3.7.1. Documentation demonstrating compliance with Regulation No 10 including the 02 series of amendments.
Add a new Appendix 8 to Annex 19, to read:

‘APPENDIX 8

Vehicle stability function test report

TEST REPORT No: .................................

1. IDENTIFICATION
1.1. Manufacturer of the vehicle stability function (name and address): ............................................................
1.2. System name/model: ........................................................................................................................................................
1.3. Control function: ..........................................................................................................................................................

2. SYSTEM(S) AND INSTALLATIONS APPROVED
2.1. Anti-lock braking configurations (where appropriate): ........................................................................
2.2. Range of application (trailer type(s) and number of axles): ...........................................................
2.3. System identification: ...........................................................................................................................
2.4. Additional features: ....................................................................................................................................

3. TEST DATA AND RESULTS
3.1. Test vehicle data (including the specification and functionality of the towing vehicle): ..............
3.2. Test surface information: ..........................................................................................................................
3.3. Additional Information: ..........................................................................................................................
3.4. Demonstrative tests/simulations used for the purpose of evaluating the directional control and the roll-over control as appropriate: ........................................................................
3.5. Test results: ........................................................................................................................................
3.6. Assessment in accordance with Annex 18 to this Regulation: ............................................................

4. LIMITS OF INSTALLATION
4.1. Suspension type: ........................................................................................................................................
4.2. Brake type: ................................................................................................................................................
4.3. Location of components on the trailer: ......................................................................................................
4.4. Anti-lock braking configurations: ...........................................................................................................
4.5. Other recommendations/limitations (e.g. lifting axles, steering axles, etc.): ...........................................

5. ATTACHMENTS: ........................................................................................................................................

6. DATE OF TEST: ........................................................................................................................................

7. This test has been carried out and the results reported in accordance with Annex 19 to ECE Regulation No 13 as last amended by the … series of amendments.

TECHNICAL SERVICE (1) CONDUCTING THE TEST

Signed: ..................................................Date: ..........................................................

8. APPROVAL AUTHORITY (1)

Signed: ..................................................Date: ..........................................................

(1) To be signed by different persons even when the Technical Service and Approval Authority are the same or alternatively, a separate Approval Authority Authorisation issued with the report.’
Appendices 7 and 8, renumber as Appendices 9 and 10.

### Amendments to Annex 20

Annex 20.

Paragraph 2.1.3, amend to read:

‘2.1.3. A documentation package that contains the relevant verification information including the relevant calculations, where appropriate, for the following:

<table>
<thead>
<tr>
<th>Performance requirements</th>
<th>Annex 20 reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold service braking performance</td>
<td>3</td>
</tr>
<tr>
<td>Parking brake performance</td>
<td>4</td>
</tr>
<tr>
<td>Automatic (emergency) brake performance</td>
<td>5</td>
</tr>
<tr>
<td>Failure of brake distribution system</td>
<td>6</td>
</tr>
<tr>
<td>Anti-lock braking</td>
<td>7</td>
</tr>
<tr>
<td>Vehicle stability function</td>
<td>8</td>
</tr>
<tr>
<td>Functional checks</td>
<td>9</td>
</tr>
</tbody>
</table>

Add new paragraphs 8 to 8.2.1.4, to read:


8.1. Evaluation of a trailer in accordance with paragraph 2 of Annex 21 to this Regulation may be waived at the time of trailer type approval provided that the vehicle stability function complies with the relevant requirements of Annex 19 to this Regulation.

8.2. Verification

8.2.1. Verification of components and installation

The specification of the braking system, in which the stability control function is integrated and installed on the trailer to be type-approved shall be verified by satisfying each of the following criteria:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.2.1.1. (a) Sensor(s)</td>
<td>No change allowed</td>
</tr>
<tr>
<td>(b) Controller(s)</td>
<td>No change allowed</td>
</tr>
<tr>
<td>(c) Modulator(s)</td>
<td>No change allowed</td>
</tr>
<tr>
<td>8.2.1.2. Trailer types as defined in the test report</td>
<td>No change allowed</td>
</tr>
<tr>
<td>8.2.1.3. Installation configurations as defined in the test report</td>
<td>No change allowed</td>
</tr>
<tr>
<td>8.2.1.4. For other limitations refer to paragraph 4 of the test report as described in Appendix 8 of Annex 19 to this Regulation.</td>
<td>No change allowed</td>
</tr>
</tbody>
</table>

Paragraphs 8 to 8.1.7.1 (former), renumber as paragraphs 9 to 9.1.7.1.

Paragraphs 8.1.8 and 8.1.8.1 (former), renumber as paragraph 9.1.9 and 9.1.9.1.

Add new paragraphs 9.1.8 and 9.1.8.1, to read:

‘9.1.8. Vehicle stability function

9.1.8.1. For practical reasons verification of the vehicle stability function shall be limited to an installation check as defined in paragraph 8.2 above and observation of the correct warning signal sequence to ensure no faults are present.’
ANNEX 21

Special requirements for vehicles equipped with a vehicle stability function

1. GENERAL

This annex defines the special requirements for vehicles equipped with a vehicle stability function, pursuant to paragraphs 5.2.1.32 and 5.2.2.23 of this Regulation.

2. REQUIREMENTS

2.1. Power-driven vehicles

2.1.1. Where a vehicle is equipped with a vehicle stability function as defined in paragraph 2.34 of this Regulation, the following shall apply:

In the case of directional control the function shall have the ability to automatically control individually the speed of the left and right wheels on each axle or an axle of each axle group (1) by selective braking based on the evaluation of actual vehicle behaviour in comparison with a determination of vehicle behaviour demanded by the driver (2).

In the case of roll-over control the function shall have the ability to automatically control the wheel speeds on at least two wheels of each axle or axle group (1) by selective braking or automatically commanded braking based on the evaluation of actual vehicle behaviour that may lead to vehicle roll-over (2).

In both cases, the function is not required:

(a) When the vehicle speed is below 20 km/h;

(b) Until the initial start-up self test and plausibility checks have been completed;

(c) When the vehicle is being driven in reverse.

2.1.2. To realise the functionality defined above a vehicle stability function shall include, in addition to selective braking and/or automatically commanded braking, at least the following:

(a) The ability to control engine power output;

(b) In the case of directional control: The determination of actual vehicle behaviour from values of yaw rate, lateral acceleration, wheel speeds, and from the driver's control inputs to the braking and steering systems and to the engine. Only on-board generated information shall be used. If these values are not directly measured, the evidence of the appropriate correlation with directly measured values under all driving conditions (e.g. including driving in a tunnel) shall be shown to the technical service at the time of type approval;

(c) In the case of roll-over control: The determination of actual vehicle behaviour from values of the vertical force on the tyre(s) (or at least lateral acceleration and wheel speeds) and from the driver's control inputs to the braking system and to the engine. Only on-board generated information shall be used. If these values are not directly measured, the evidence of the appropriate correlation with directly measured values under all driving conditions (e.g. including driving in a tunnel) shall be shown to the technical service at the time of type approval;

(d) In the case of a towing vehicle equipped according to paragraph 5.1.3.1 of this Regulation: The ability to apply the service brakes of the trailer via the respective control line(s) independently of the driver.
2.1.3. The vehicle stability function shall be demonstrated to the Technical Service by dynamic manoeuvres on one vehicle. This may be realized by a comparison of results obtained with the vehicle stability function enabled and disabled for a given load condition. As an alternative to carrying-out dynamic manoeuvres for other vehicles and other load conditions, fitted with the same vehicle stability system, the results from actual vehicle tests or computer simulations may be submitted.

The use of the simulator is defined in Appendix 1 to this Annex.

The specification and validation of the simulator is defined in Appendix 2 to this Annex.

Until unified test procedures are agreed, the method by which this demonstration is carried out shall be agreed between the vehicle manufacturer and the Technical Service and shall include the critical conditions of directional control and roll-over control as appropriate to the vehicle stability function installed on the vehicle with the method of demonstration and results being appended to the type approval report. This may be carried-out other than at the time of type approval.

As a means of demonstrating the vehicle stability function any of the following dynamic manoeuvres shall be used (7):

<table>
<thead>
<tr>
<th>Directional control</th>
<th>Roll-over control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reducing radius test</td>
<td>Steady state circular test</td>
</tr>
<tr>
<td>Step steer input test</td>
<td>J-turn</td>
</tr>
<tr>
<td>Sine with dwell</td>
<td></td>
</tr>
<tr>
<td>J-turn</td>
<td></td>
</tr>
<tr>
<td>μ-split single lane change</td>
<td></td>
</tr>
<tr>
<td>Double lane change</td>
<td></td>
</tr>
<tr>
<td>Reversed steering test or “fish hook” test</td>
<td></td>
</tr>
<tr>
<td>Asymmetrical one period sine steer or pulse steer input test</td>
<td></td>
</tr>
</tbody>
</table>

To demonstrate repeatability the vehicle will be subject to a second demonstration using the selected manoeuvre(s).

2.1.4. Interventions of the vehicle stability function shall be indicated to the driver by a specific optical warning signal. The indication shall be present as long as the vehicle stability function is in an intervention mode. The warning signals specified in paragraph 5.2.1.29 of this Regulation shall not be used for this purpose.

Interventions of the vehicle stability function used in any learning process to determine the vehicle operational characteristics shall not generate the above signal.

The signal shall be visible to the driver, even in daylight, such that the driver can easily verify the satisfactory condition of the signal without leaving the driver’s seat.
2.1.5. A vehicle stability function failure or defect shall be detected and indicated to the driver by the specific yellow optical warning signal referred to in paragraph 5.2.1.29.1.2 of this Regulation.

The warning signal shall be constant and remain displayed as long as the failure or defect persists and the ignition (start) switch is in the “on” (run) position.

2.1.6. In the case of a power-driven vehicle equipped with an electric control line and electrically connected to a trailer with an electric control line the driver shall be warned by a specific optical warning signal whenever the trailer provides the information “VDC Active” via the data communications part of the electric control line. The optical signal defined in paragraph 2.1.4 above may be used for this purpose.

2.2. Trailers

2.2.1. Where a trailer is equipped with a vehicle stability function as defined in paragraph 2.34 of this Regulation, the following shall apply:

In the case of directional control the function shall have the ability to automatically control individually the speed of the left and right wheels on each axle or an axle of each axle group (1) by selective braking based on the evaluation of actual trailer behaviour in comparison with a determination of the relative behaviour of the towing vehicle (2).

In the case of roll-over control the function shall have the ability to automatically control the wheel speeds on at least two wheels of each axle or axle group (1) by selective braking or automatically commanded braking based on the evaluation of actual trailer behaviour that may lead to roll-over (2).

2.2.2. To realise the functionality defined above a vehicle stability function shall include, in addition to automatically commanded braking and where appropriate selective braking, at least the following:

(a) The determination of actual trailer behaviour from values of the vertical force on the tyre(s), or at least lateral acceleration and wheel speeds. Only on-board generated information shall be used. If these values are not directly measured, the evidence of the appropriate correlation with directly measured values under all driving conditions (e.g. including driving in a tunnel) shall be shown to the technical service at the time of type approval.

2.2.3. The vehicle stability function shall be demonstrated to the Technical Service by dynamic manoeuvres on one vehicle. This may be done by a comparison of results obtained with the vehicle stability function enabled and disabled for a given load condition. As an alternative to carrying-out dynamic manoeuvres for other vehicles and other load conditions, fitted with the same vehicle stability system, the results from actual vehicle tests or computer simulations may be submitted.

The use of the simulator is defined in Appendix 1 to this Annex.

The specification and validation of the simulator is defined in Appendix 2 to this Annex.

Until unified test procedures are agreed, the method by which this demonstration is carried out shall be agreed between the trailer manufacturer and the Technical Service and shall include the critical conditions of roll-over control and directional control as appropriate to the vehicle stability function installed on the trailer with the method of demonstration and results being appended to the type approval report. This may be carried-out other than at the time of type approval.
As a means of demonstrating the vehicle stability function any of the following dynamic manoeuvres shall be used (1):

<table>
<thead>
<tr>
<th>Directional control</th>
<th>Roll-over control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reducing radius test</td>
<td>Steady state circular test</td>
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<tr>
<td>Step steer input test</td>
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<tr>
<td>Sine with dwell</td>
<td></td>
</tr>
<tr>
<td>J-turn</td>
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</tr>
<tr>
<td>Asymmetrical one period sine steer or pulse steer input test</td>
<td></td>
</tr>
</tbody>
</table>

To demonstrate repeatability the vehicle will be subject to a second demonstration using the selected manoeuvre(s).

2.2.4. Trailers equipped with an electric control line, when electrically connected to a towing vehicle with an electric control line, shall provide the information “VDC active” via the data communications part of the electric control line when the vehicle stability function is in an intervention mode. Interventions of the vehicle stability function used in any learning process to determine the trailer operational characteristics shall not generate the above information.

2.2.5. To maximise the performance of trailers that utilise “select-low” such trailers are permitted to change control mode to “select-high” during an intervention of the “Vehicle Stability Function”.

(1) In the case of multiple axles, where the spread between one axle and its adjacent axle is greater than 2 m, each individual axle shall be considered as an independent axle group.

(2) Additional interaction with other vehicle systems or components is allowed. Where these systems or components are subject to special regulations, such interaction shall comply with the requirements of those regulations, e.g. interaction with the steering system shall comply with the requirements set out in Regulation No 79 for corrective steering.

(3) Should the use of any of the above defined manoeuvres not result in loss of directional control or roll-over as appropriate an alternative manoeuvre may be used in agreement with the Technical Service.

APPENDIX 1

Use of the dynamic stability simulation

The effectiveness of the directional and/or roll-over stability control function of power-driven vehicles and trailers of categories M, N and O, may be determined by computer simulation.

1. USE OF THE SIMULATION

1.1 The vehicle stability function shall be demonstrated by the vehicle manufacturer to the Type Approval Authority or Technical Service with the same dynamic manoeuvre(s) as for the practical demonstration in paragraph 2.1.3 or 2.2.3 of Annex 21.

1.2. The simulation shall be a means whereby the vehicle stability performance may be demonstrated with the vehicle stability function enabled or disabled, and in the laden and unladen conditions.

1.3. The simulations shall be carried out with a validated modelling and simulation tool. The verification shall be carried out using the same manoeuvre(s) as defined in paragraph 1.1 above.

The method by which the simulation tool is validated is given in Annex 21, Appendix 2.
APPENDIX 2

Dynamic stability simulation tool and its validation

1. SPECIFICATION OF THE SIMULATION TOOL

1.1. The simulation method shall take into account the main factors which influence the directional and roll motion of the vehicle. A typical model may include the following vehicle parameters in an explicit or implicit form:

(a) axle/wheel;
(b) suspension;
(c) tyre;
(d) chassis/vehicle body;
(e) power train/driveline, if applicable;
(f) brake system;
(g) payload.

1.2. The Vehicle Stability Function shall be added to the simulation model by means of:

(a) a subsystem (software model) of the simulation tool; or
(b) the electronic control box in a hardware-in-the-loop configuration.

1.3. In the case of a trailer, the simulation shall be carried out with the trailer coupled to a representative towing vehicle.

1.4. Vehicle loading condition

1.4.1. The simulator shall be able to take into account the laden and unladen conditions.

1.4.2. The load shall be considered to be a fixed load with properties (mass, mass distribution and maximum recommended height of the centre of gravity) specified by the manufacturer.

2. VALIDATION OF THE SIMULATION TOOL

2.1. The validity of the applied modelling and simulation tool shall be verified by means of comparisons with a practical vehicle test(s). The test(s) utilised for the validation shall be those which, without control action, would result in loss of directional control (under-steer and over-steer) or roll-over control as appropriate to the functionality of the stability control function installed on a representative vehicle.

During the test(s) the following motion variables, as appropriate, shall be recorded or calculated in accordance with ISO 15037 Part 1:2005: General conditions for passenger cars or Part 2:2002: General conditions for heavy vehicles and buses (depending on the vehicle category):

(a) yaw velocity;
(b) lateral acceleration;
(c) wheel load or wheel lift;
(d) forward velocity;
(e) driver input.
2.2. The objective is to show that the simulated vehicle behaviour and operation of the vehicle stability function is comparable with that seen in practical vehicle tests.

2.3. The simulator shall be deemed to be validated when its output is comparable to the practical test results produced by a given vehicle type during the selected manoeuvre(s) from those defined with paragraph 2.1.3 or 2.2.3 of Annex 21, as appropriate.

   In the case of the steady state circular test the under-steer gradient shall be the means of making the comparison.

   In the case of a dynamic manoeuvre, the relationship of activation and sequence of the vehicle stability function in the simulation and in the practical vehicle test shall be the means of making the comparison.

2.4. The physical parameters that are different between the reference vehicle and simulated vehicle configurations shall be modified accordingly in the simulation.

2.5. A simulator test report shall be produced, a model of which is defined in Appendix 3 of this Annex, and a copy attached to the vehicle approval report.

APPENDIX 3

Vehicle stability function simulation tool test report

TEST REPORT No: .............................................

1. IDENTIFICATION
1.1. Name and address of the simulation tool manufacturer

1.2. Simulation tool identification: name/model/number (hardware and software)

2. SCOPE OF APPLICATION
2.1. Vehicle type: (e.g. truck, tractor, bus, semi-trailer, centre-axle trailer, full trailer)

2.2. Vehicle configuration: (e.g. 4 × 2, 4 × 4, 6 × 2, 6 × 4, 6 × 6)

2.3. Limiting factors: (e.g. mechanical suspension only)

2.4. Manoeuvre(s) for which the simulator has been validated:

3. VERIFYING VEHICLE TEST(S)
3.1. Description of vehicle(s) including the towing vehicle in case of trailer testing:

3.1.1. Vehicle(s) identification: make/model/VIN

3.1.1.1. Non-standard fitments:

3.1.2. Vehicle description, including axle configuration/suspension/wheels, engine and drive line, braking system(s) and vehicle stability function content (directional control/roll-over control), steering system, with name/model/number identification:

3.1.3. Vehicle data used in the simulation (explicit):

3.2. Description of test(s) including location(s), road/test area surface conditions, temperature and date(s):
3.3. Results laden and unladen with the vehicle stability function switched on and off, including the motion variables referred to in Annex 21, Appendix 2, paragraph 2.1 as appropriate:

4. SIMULATION RESULTS

4.1. Vehicle parameters and the values used in the simulation that are not taken from the actual test vehicle (implicit):

4.2. Results laden and unladen with the vehicle stability function switched on and off for each test conducted under paragraph 3.2 of this Appendix, including the motion variables referred to in Annex 21, Appendix 2, paragraph 2.1 as appropriate:

5. This test has been carried out and the results reported in accordance with Appendix 2 of Annex 21 to ECE Regulation No 13 as last amended by the … series of amendments.

Technical Service conducting the test (1): ...........................................................................................................

Signed: ............................................................ Date: ............................................................

Approval Authority (1): ..............................................................................................................................

Signed: ............................................................ Date: ............................................................

(1) To be signed by different persons if the Technical Service and the Approval Authority is the same organisation.