

25 October 2011

Agreement

Concerning the adoption of uniform technical prescriptions for wheeled vehicles, equipment and parts which can be fitted and/or be used on wheeled vehicles and the conditions for reciprocal recognition of approvals granted on the basis of these prescriptions *

(Revision 2, including the amendments which entered into force on 16 October 1995)

Addendum 79: Regulation No. 80

Revision 1

Incorporating all valid text up to:

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Uniform provisions concerning the approval of seats of large passenger vehicles and of these vehicles with regard to the strength of the seats and their anchorages



UNITED NATIONS

* Former title of the Agreement: Agreement Concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, done at Geneva on 20 March 1958.

Regulation No. 80

Uniform provisions concerning the approval of seats of large passenger vehicles and of these vehicles with regard to the strength of the seats and their anchorages

Contents

	<i>Page</i>
Regulation	
1. Scope	5
2. Definitions	6
3. Application for approval	8
4. Approval	8
5. Requirements for seats	9
6. Requirements for seat anchorages of a vehicle type	9
7. Requirements for installation of seats in a vehicle type	10
8. Conformity of production	11
9. Penalties for non-conformity of production	11
10. Modifications and extension of approval of the seat type and/or the vehicle type	11
11. Production definitely discontinued	12
12. Transitional provisions	12
13. Names and addresses of Technical Services responsible for conducting approval tests and of Type Approval Authorities	12
Appendices	
1 Test procedures for seats according to paragraph 5 and/or anchorages according to paragraph 6.1.2.	13
2 Test procedures for the anchorages of a vehicle in application of paragraph 6.1.1.	17
3 Measurements to be made	18
4 Determination of acceptability criteria	19
5 Static test requirements and procedures	20
6 Energy absorption characteristics of the rear part of seat backs	23

Annexes

1	Communication concerning the approval or refusal or extension or withdrawal of approval or production definitively discontinued of a seat type or types with regard to its (their) strength, pursuant to Regulation No. 80.....	24
2	Communication concerning the approval or refusal or extension or withdrawal of approval or production definitively discontinued of a type of vehicle with regard to the strength of the seat anchorages pursuant to Regulation No. 80.....	26
3	Arrangements of approval marks	28
4	Procedure for determining the "H" point and the actual torso angle for seating positions in motor vehicles.....	29
	Appendix 1: Description of the three dimensional "H" point machine (3 DH machine).....	34
	Appendix 2: Three-dimensional reference system.....	37
	Appendix 3: Reference data concerning seating positions	38

1. Scope

- 1.1. This Regulation applies to:
- (a) Passenger seats for forward-facing installation in vehicles of categories M₂ and M₃, of Classes II, III and B¹;
 - (b) Vehicles of categories M₂ and M₃ of Classes II, III and B¹ in respect of their passenger seat anchorages and seat installation.
 - (c) It does not apply to rearward-facing seats or to any head restraint fitted to these seats.
- 1.2. At the request of the manufacturer, vehicles of category M₂¹ approved to Regulation No. 17 shall be deemed to meet the requirements of this Regulation.
- 1.3. Vehicles where some seats benefit from the derogation provided in paragraph 7.4. to Regulation No. 14 shall be approved to this Regulation.
- 1.4. The installation of side-facing seats shall be prohibited in vehicles of categories M₂ (of Class III or B) and M₃ (of Class III or B).
- 1.5. At the request of the manufacturer and in agreement with the technical service, as well as the Type Approval Authority of the Contracting Party, an approval may be granted for vehicles of category M₃ (of Class III or B) of a technically permissible maximum laden mass exceeding 10 tonnes with side-facing seats on condition that these side-facing seats are grouped together at the rear of the vehicle to form an integrated saloon of up to 10 seats. Such side-facing seats shall be fitted with, at least, a head restraint and a two-point belt with retractor type-approved in accordance with Regulation No. 16. Further, the anchorages for their safety belts shall comply with dimensional and strength requirements based on those as laid down in Regulation No. 14. However it shall be taken into account that the seat is side-facing instead of forward-facing, and test and inspections shall not be waived on that basis. The communication document (Annex 2) shall bear the remark stating that side-facing seats have been permitted according to this paragraph. Such approvals shall not be granted anymore as from 1 November 2014 or as from the date of adoption of uniform test provisions for side-facing seats (i.e. this Regulation) as well as provisions for such seats regarding safety-belt anchorages (i.e. Regulation No. 14) and vehicles equipped with safety-belts (i.e. Regulation No. 16), whichever date is earlier.
- 1.6. Paragraph 1.4. shall not apply to ambulances or to vehicles intended for use by the armed services, civil defence, fire services and forces responsible for maintaining public order.

¹ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.2, para. 2

2. Definitions

For the purposes of this Regulation:

- 2.1. "Approval of a seat" means an approval of a seat type as a component in relation to the protection of the occupants of forward-facing seats with regard to their strength and the design of the seat backs;
- 2.2. "Approval of a vehicle" means an approval of a vehicle type with regard to the strength of the parts of the vehicle structure to which seats are to be secured, and with regard to the installation of seats;
- 2.3. "Seat type" means seats which do not differ essentially with respect to the following characteristics likely to affect their strength and their aggressiveness:
 - 2.3.1. Structure, shape, dimensions and materials of the load bearing parts;
 - 2.3.2. Types and dimensions of the seat back adjustment and locking system;
 - 2.3.3. Dimensions, structure and materials of the attachments and supports (e.g. legs);
- 2.4. "Vehicle type" means vehicles which do not differ essentially in respect of:
 - 2.4.1. The constructional features relevant to this Regulation; and,
 - 2.4.2. The type or types of type approved seat(s) fitted to the vehicle, if any.
- 2.5. "Seat" means a structure likely to be anchored to the vehicle structure, including its trim and attachment fittings, intended to be used in a vehicle, and to seat one or more adult persons. Depending on its orientation, a seat is defined as follows:
 - 2.5.1. "Forward-facing seat" means a seat which can be used while the vehicle is in motion and which faces towards the front of the vehicle in such a manner that the vertical plane of symmetry of the seat forms an angle of less than +10° or - 10° with the vertical plane of symmetry of the vehicle.
 - 2.5.2. "Rearward-facing seat" means a seat which can be used while the vehicle is in motion and which faces towards the rear of the vehicle in such a manner that the vertical plane of symmetry of the seat forms an angle of less than +10° or - 10° with the vertical plane of symmetry of the vehicle.
 - 2.5.3. "Side-facing seat" means a seat which, with regard to its alignment with the vertical plane of symmetry of the vehicle, does not meet either of the definitions given in paragraphs 2.5.1. or 2.5.2. above.
- 2.6. "Individual seat" means a seat designed and constructed for the accommodation of one seated passenger;
- 2.7. "Double seat" means a seat designed and constructed for the accommodation of two seated passengers side by side; two seats side by side and having no interconnection shall be regarded as two individual seats;
- 2.8. "Row of seats" means a seat designed and constructed for the accommodation of three or more seated passengers side by side; several individual or double seats arranged side by side shall not be regarded as a row of seats;
- 2.9. "Seat cushion" means the part of the seat which is arranged almost horizontally and designed to support a seated passenger;

- 2.10. "*Seat-back*" means the part of the seat that is almost vertical, designed to support the passenger's back, shoulders and, possibly, his head;
- 2.11. "*Adjustment system*" means the device by which the seat or its parts can be adjusted to a position suited to the seated occupant;
- 2.12. "*Displacement system*" means a device enabling the seat or one of its parts to be displaced laterally or longitudinally without a fixed intermediate position of the seat or one of its parts, to facilitate access by passengers;
- 2.13. "*Locking system*" means a device ensuring that the seat and its parts are maintained in the position of use;
- 2.14. "*Anchorage*" means a part of the floor or of the body of a vehicle to which a seat may be fixed;
- 2.15. "*Attachment fittings*" means bolts or other components used to attach the seat to the vehicle;
- 2.16. "*Trolley*" means the test equipment made and used for dynamic reproduction of road accidents involving frontal collision;
- 2.17. "*Auxiliary seat*" means a seat for the manikin mounted on the trolley to the rear of the seat to be tested. This seat shall be representative of the seat to be used in the vehicle behind the seat to be tested;
- 2.18. "*Reference plane*" means the plane passing through the points of contact of the heels of the manikin, used for the determination of the H point and the actual angle of torso for the seating position of motor vehicles according to the prescriptions of Annex 4;
- 2.19. "*Reference height*" means the height of the top of the seat above the reference plane;
- 2.20. "*Manikin*", a manikin corresponding to the specifications for HYBRID II or III²;
- 2.21. "*Reference zone*", means the space between two vertical longitudinal planes, 400 mm apart and symmetrical with respect to the H-point, and defined by rotation from vertical to horizontal of the headform apparatus, described in Regulation No. 21, Annex 1. The apparatus shall be positioned as described in that annex to Regulation No. 21 and set to its maximum length of 840 mm and its minimum length of 736 mm for residual limitation of said space;
- 2.22. "*3-point belt*" for the purposes of this Regulation also includes belts with more than three anchorage points;
- 2.23. "*Seat spacing*" means, in the case of seats facing in the same direction, the distance between the front of a seat squab and the back of the seat squab of the seat preceding it, measured horizontally at the height of 620 mm above the floor.

² The technical specifications and detailed drawings of HYBRID II and III, corresponding to the principal dimensions of the fiftieth percentile male of the United States of America, and the specifications for its adjustment for this test are deposited with the Secretary-General of the United Nations and may be consulted on request at the secretariat of the Economic Commission for Europe, Palais des Nations, Geneva, Switzerland.

3. Application for approval

- 3.1. The application for approval of a seat shall be submitted by the seat manufacturer or by his duly accredited representative.
- 3.2. The application for approval of the vehicle shall be submitted by the vehicle manufacturer or by his duly accredited representative.
- 3.3. The application for approval of a seat or a vehicle shall be accompanied by the following documents in triplicate and the following particulars:
 - 3.3.1. For approval of a seat:
 - 3.3.1.1. A detailed description of the seat, its attachment fittings and its adjustment, displacement and locking systems;
 - 3.3.1.2. Drawings, on an appropriate scale and in sufficient detail, of the seat, its attachment fittings and adjustment, displacement and locking systems;
 - 3.3.2. For approval of a vehicle:
 - 3.3.2.1. A detailed description of the parts of the structure of the vehicle used as anchorages;
 - 3.3.2.2. Drawings, on an appropriate scale and in sufficient detail, of the parts of the vehicle used as anchorages.
- 3.4. The following shall be submitted to the technical service responsible for the approval tests:
 - 3.4.1. Two seats representative of the type to be approved, in the case of approval of a seat;
 - 3.4.2. A part of the vehicle structure, in the case of approval of a vehicle.

4. Approval

- 4.1. If the seat submitted for approval under this Regulation meets the relevant requirements of paragraph 5. below, approval of that seat type shall be granted.
- 4.2. If the vehicle submitted for approval under this Regulation meets the relevant requirements of paragraphs 6. and 7. below, approval of that vehicle type shall be granted.
- 4.3. An approval number shall be assigned to each type approved. Its first two digits (at present 02, corresponding to the 02 series of amendments) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The same Contracting Party shall not assign the same number to any other seat type or any other vehicle type.
- 4.4. Notice of approval or of extension or refusal of approval of a seat type and/or a vehicle type pursuant to this Regulation shall be communicated to the Parties to the 1958 Agreement applying this Regulation, by means of a form conforming to the model in Annex 1 and/or Annex 2 to this Regulation.

- 4.5. There shall be affixed, conspicuously and in a readily accessible place specified on the approval form, to every seat conforming to a seat type approved under this Regulation and to every vehicle conforming to a vehicle type approved under this Regulation an international approval mark consisting of:
 - 4.5.1. A circle surrounding the letter "E" followed by the distinguishing number of the country which has granted approval³;
 - 4.5.2. The number of this Regulation, followed by the letter R, a dash and the approval number, placed to the right of the circle prescribed in paragraph 4.5.1.
- 4.6. The approval mark shall be clearly legible and shall be indelible.
- 4.7. As the case may be, the approval mark shall be placed on the seat or seats or on, or close to, the data plate affixed to the vehicle by the manufacturer.
- 4.8. Examples of arrangements of approval marks are given in Annex 3.

5. Requirements for seats

- 5.1. Each type of seat shall be subject to the test requirements of either Appendix 1 (dynamic test) or Appendices 5 and 6 (static test) at the request of the manufacturer.
- 5.2. The tests which the seat type has passed shall be recorded in the communication form concerning the approval of a seat type and conforming to the model in Annex 1.
- 5.3. Every adjustment and displacement system provided shall incorporate a locking system, which shall operate automatically.
- 5.4. The adjustment and locking systems shall not be required to be in full working order after the test.
- 5.5. A head restraint shall be mounted on every outboard front seat in every vehicle of category M₂ with a maximum mass not exceeding 3,500 kg. This head restraint shall comply with the requirements of Regulation No. 25, as amended by the 03 series of amendments.

6. Requirements for seat anchorages of a vehicle type

- 6.1. The anchorages for the seats of the vehicle shall be capable of withstanding:
 - 6.1.1. Either the test described in Appendix 2;
 - 6.1.2. Or, if a seat is mounted on the part of the vehicle structure being tested, the tests prescribed in Appendix 1. The seat need not to be an approved seat provided that it satisfies the requirements of paragraph 3.2.1. of the above mentioned appendix.

³ The distinguish numbers of the Contracting Parties to the 1958 Agreement are reproduced in Annex 3 to Consolidated Resolution on the Construction of Vehicles (R.E.3), document TRANS/WP.29/78/Rev.2.

- 6.2. Permanent deformation, including breakage, of an anchorage or of the surrounding area shall be permissible provided that the prescribed force has been sustained throughout the prescribed period.
- 6.3. When there is more than one type of anchorage on a vehicle, each variant shall be tested in order to obtain an approval for the vehicle.
- 6.4. One test may be used to approve simultaneously a seat and a vehicle.
- 6.5. In the case of vehicles of category M₃, seat anchorages shall be deemed to comply with the requirements of paragraphs 6.1. and 6.2. if the safety-belt anchorages of the corresponding seating positions are fitted directly to the seats to be installed and these belt anchorages comply with the requirements of Regulation No. 14, if necessary with the derogation provided in paragraph 7.4.

7. Requirements for installation of seats in a vehicle type

- 7.1. All forward-facing seats installed shall be approved to the requirements of paragraph 5. of this Regulation and subject to the following conditions:
 - 7.1.1. The seat shall have a reference height of at least 1 m; and
 - 7.1.2. The H-point of the seat immediately behind shall be less than 72 mm higher than the H-point of the seat in question or, if the seat behind has the H-point more than 72 mm higher, the seat in question shall be tested and approved for installation in such a position.
- 7.2. When approved to Appendix 1, Test 1 and 2 shall apply, except as follows:
 - 7.2.1. Test 1 shall not apply where the rear of the seat cannot be struck by an unrestrained passenger (i.e. there is no forward-facing seat directly behind the seat to be tested).
 - 7.2.2. Test 2 shall not apply
 - 7.2.2.1. If the rear of the seat cannot be struck by a restrained passenger; or
 - 7.2.2.2. If the seat behind is fitted with a 3-point belt with anchorages that comply fully with Regulation No. 14 (without derogation); or
 - 7.2.2.3. If the seat fulfils the requirements of Appendix 6 to this Regulation.
- 7.3. When approved to Appendices 5 and 6, all tests shall apply, except as follows:
 - 7.3.1. The test of Appendix 5 shall not apply if the rear of the seat cannot be struck by an unrestrained passenger (i.e. there is no forward-facing seat directly behind the seat to be tested).
 - 7.3.2. The test of Appendix 6 shall not apply:
 - 7.3.2.1. If the rear of the seat cannot be struck by a restrained passenger; or
 - 7.3.2.2. If the seat behind is fitted with a 3-point belt with anchorages that comply fully with Regulation No. 14 (without derogation).

8. Conformity of production

The conformity of production procedures shall comply with those set out in the Agreement, Appendix 2 (E/ECE/324-E/ECE/TRANS/505/Rev.2), with the following requirements:

- 8.1. Seats and or vehicles approved to this Regulation shall be so set out in paragraphs 5., 6. and 7. above.
- 8.2. In order to verify that the requirements of paragraph 8.1. are met, suitable controls of the production shall be carried out. In this case, suitable controls mean checking the dimensions of the product as well as the existence of procedures for the effective control of the quality of products.
- 8.3. The competent authority which has granted type approval may at any time verify the conformity control methods applicable to each production unit and carry out on samples any test deemed necessary among the tests carried out for the approval. The normal frequency of these verifications shall be once a year.

9. Penalties for non-conformity of production

- 9.1. The approval granted in respect of a seat type and/or a vehicle type pursuant to this Regulation may be withdrawn if the requirements set forth above are not met.
- 9.2. If a Contracting Party to the Agreement applying this Regulation withdraws an approval it has previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation, by means of a communication form conforming to the model in Annex 1 and/or Annex 2 to this Regulation.

10. Modification and extension of approval of the seat type and/or the vehicle type

- 10.1. Every modification of the seat type and/or the vehicle type shall be notified to the Type Approval Authority which approved the seat type and/or the vehicle type. The department may then either:
 - 10.1.1. Consider that the modifications made are unlikely to have an appreciable adverse effect and that in any case the seat and/or the vehicle still complies with the requirements; or
 - 10.1.2. Require a further test report from the technical service responsible for conducting the tests.
- 10.2. Confirmation or refusal of approval, specifying the alterations shall be communicated by the procedure specified in paragraph 4.4. above to the Parties to the Agreement applying this Regulation.
- 10.3. The competent authority issuing the extension of approval shall assign a series number for such an extension and inform thereof the other Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in Annex 1 and/or Annex 2 to this Regulation.

11. Production definitely discontinued

If the holder of the approval completely ceases to manufacture a vehicle type approved in accordance with this Regulation, he shall so inform the authority which granted the approval. Upon receiving the relevant communication that authority shall inform thereof the other Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in Annex 1 and or Annex 2 to this Regulation.

12. Transitional provisions

- 12.1. As from the official date of entry into force of the 02 series of amendments, no Contracting Party applying this Regulation shall refuse to grant approvals under this Regulation as amended by the 02 series of amendments.
- 12.2. As from 1 November 2012 Contracting Parties applying this Regulation shall grant approvals only if the requirements of this Regulation, as amended by the 02 series of amendments, are satisfied.
- 12.3. As from 1 November 2014, approvals granted in conformity to this Regulation shall cease to be valid, except those granted in conformity with the requirements of this Regulation as amended by the 02 series of amendments.
- 12.4. As from 1 November 2014, Contracting Parties applying this Regulation may refuse first national or regional registration (first entry into service) of a vehicle which has not been type approved in conformity with the requirements of the 02 series of amendments to this Regulation.
- 12.5. As from 1 November 2014 or as from the date of adoption of uniform test provisions for side-facing seats (i.e. this Regulation) as well as provisions for such seats regarding safety-belt anchorages (i.e. Regulation No. 14) and vehicles equipped with safety-belts (i.e. Regulation No. 16), whichever date is earlier, approvals granted under paragraph 1.5. of this Regulation shall cease to be valid.
- 12.6. Even after the date of entry into force of the 02 series of amendments, approvals of the components to the 01 series of amendments to this Regulation shall remain valid and Contracting Parties applying this Regulation shall continue to accept them and shall not refuse to grant extensions of approval to the 01 series of amendments to this Regulation.

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

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

Appendix 1

Test procedures for seats according to paragraph 5. and/or anchorages according to paragraph 6.1.2.

1. Requirements
 - 1.1. The tests are to determine:
 - 1.1.1. If the seat occupant(s) is (are) correctly retained by the seat(s) in front of him (them) and/or by the use of a safety belt.
 - 1.1.1.1. This requirement shall be considered satisfied if the forward movement of any part of the trunk and the head of the manikin does not pass beyond the transversal vertical plane situated at 1.6 m from the R point of the auxiliary seat;
 - 1.1.2. If the seat occupant(s) is (are) not seriously injured.
 - 1.1.2.1. This requirement shall be considered satisfied if the following biomechanical acceptability criteria for the instrumented manikin, determined in accordance with Appendix 4, are met; that is:
 - 1.1.2.1.1. The head acceptability criterion HIC is less than 500;
 - 1.1.2.1.2. The thorax acceptability criterion (ThAC) is less than 30 g except for periods totalling less than 3 ms ($g = 9.81 \text{ m/s}^2$);
 - 1.1.2.1.3. The femur acceptability criterion (FAC) is less than 10 kN and the value of 8 kN is not exceeded for periods totalling more than 20 ms;
 - 1.1.3. If the seat and the seat mountings are strong enough.
 - 1.1.3.1. This requirement shall be considered satisfied if:
 - 1.1.3.1.1. No part of the seat, the seat mountings or the accessories becomes completely detached during the test;
 - 1.1.3.1.2. The seat remains firmly held, even if one or more anchorages are partly detached, and all the locking systems remain locked during the whole duration of the test;
 - 1.1.3.1.3. After the test no structural part of the seat or accessories has any fracture or sharp or pointed edges or corners likely to cause any bodily injury.
 - 1.2. All fittings forming part of the back of the seat or accessories thereto shall be such as to be unlikely to cause any bodily injury to a passenger during impact. This requirement shall be considered satisfied if any part contactable by a sphere 165 mm in diameter presents a radius of curvature of at least 5 mm.
 - 1.2.1. If any part of the fittings and accessories referred to above is made of a material of hardness less than 50 Shore A on a rigid backing, the requirements set out in paragraph 1.2. above shall apply only to the rigid backing.

- 1.2.2. The parts of the back of the seat such as adjustment devices for the seat and accessories shall not be subject to any requirements of paragraph 1.2. if in the position of rest they are situated below a horizontal plane 400 mm above the reference plane, even if the occupant might enter into contact with them.
- 2. Preparation of the seat to be tested
 - 2.1. The seat to be tested shall be mounted:
 - 2.1.1. Either on a testing platform representative of the body of a vehicle,
 - 2.1.2. Or on a rigid testing platform.
 - 2.2. The anchorage on the testing platform provided for the test seat(s) shall be identified to or have the same characteristics as that used in vehicle(s) in which the seat is intended to be used.
 - 2.3. The seat to be tested shall be complete with all upholstery and accessories. If the seat is fitted with a table, it shall be in the stowed position.
 - 2.4. If adjustable laterally, the seat shall be positioned for maximum extension.
 - 2.5. If adjustable, the seat back shall be adjusted so that the resulting inclination of the torso of the manikin used for determining the H-point and the actual torso angle for seating positions in motor vehicles is as close as possible to that recommended by the manufacturer for normal use or, in the absence of any particular recommendation by the manufacturer, as near as possible to 25° towards the rear in relation to the vertical.
 - 2.6. If the seat back is equipped with a head restraint adjustable for height, it shall be in its lowest position.
 - 2.7. Safety-belts of an approved type, conforming to Regulation No. 16 and mounted on anchorages installed according to Regulation No. 14 (including, if appropriate, the derogation provided in paragraph 7.4. to that Regulation) shall be fitted to both the auxiliary seat and the seat to be tested.
- 3. Dynamic tests
 - 3.1. Test 1

The testing platform shall be mounted on a trolley.
 - 3.2. Auxiliary seat

The auxiliary seat may be of the same type as the seat being tested and shall be located parallel to and directly behind the seat being tested. The two seats shall be at the same height, adjusted identically and on a seat spacing of 750 mm.

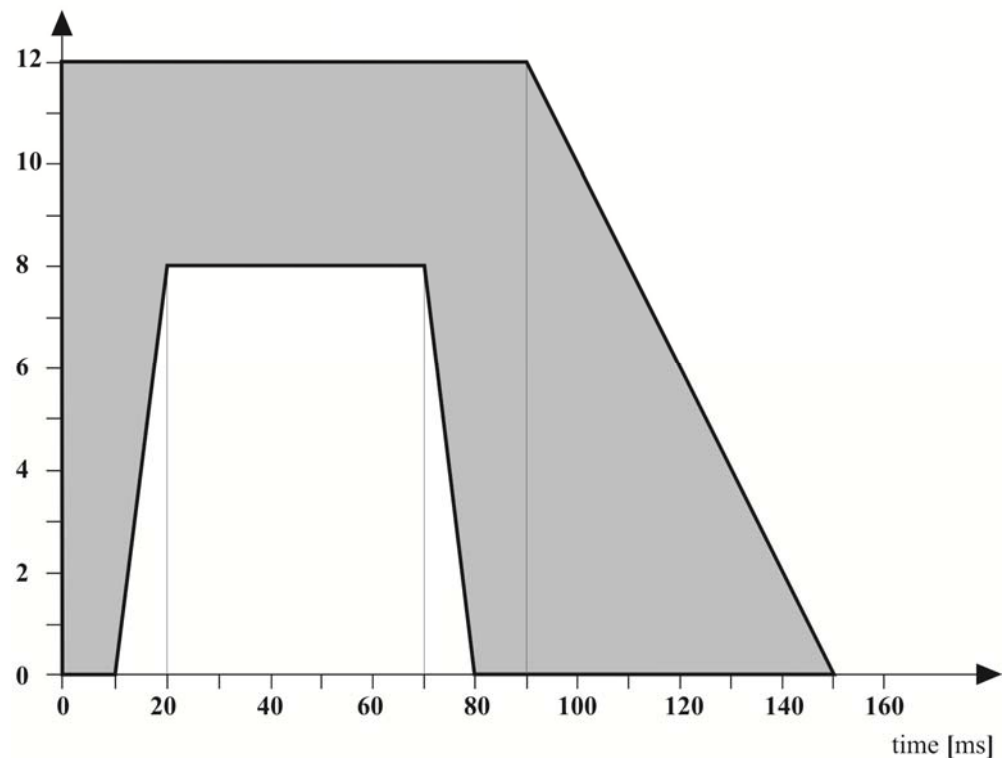
 - 3.2.1. If an auxiliary seat of a different type is used this shall be mentioned in the communication form concerning the approval of a seat type and conformity to the model in Annex 1 to this Regulation.
 - 3.3. Manikin
 - 3.3.1. The manikin shall be placed unrestrained on the auxiliary seat so that its plane of symmetry corresponds to the plane of symmetry of the seating position in question.
 - 3.3.2. The manikin's hands shall rest on its thighs with the elbows touching the seat back; the legs shall be extended to the maximum and shall, if possible, be parallel; the heels shall touch the floor.

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- 3.3.3. Each manikin required shall be installed on a seat in accordance with the following procedure:
- 3.3.3.1. The manikin shall be placed on the seat as close as possible to the desired position,
- 3.3.3.2. A flat rigid surface 76 mm x 76 mm in area shall be placed as low as possible against the front of the manikin's torso,
- 3.3.3.3. The flat surface shall be pressed horizontally against the manikin's torso at a load of between 25 and 35 daN:
- 3.3.3.3.1. The torso shall be drawn forward by the shoulders to the vertical position, then laid back against the seat back. This operation shall be performed twice;
- 3.3.3.3.2. Without the torso moving, the head shall be placed in a position such that the platform supporting the measuring instruments contained in the head is horizontal and that the median sagittal plane of the head is parallel to that of the vehicle.
- 3.3.3.4. The flat surface be carefully removed,
- 3.3.3.5. The manikin shall be moved forward on the seat and the installation procedure described above repeated,
- 3.3.3.6. If necessary, the position of the lower members shall be corrected,
- 3.3.3.7. The measuring instruments installed shall not in any way affect the movement of the manikin during impact,
- 3.3.3.8. The temperature of the system of measuring instruments shall be stabilized before the test and maintained so far as possible within a range between 19 °C and 26 °C.
- 3.4. Impact simulation
- 3.4.1. The total velocity change of the trolley simulating the impact shall be between 30 and 32 km/h.
- 3.4.2. The deceleration or, at the choice of the applicant, acceleration of the trolley during the impact simulation shall be in accordance with the provisions shown in Figure 1 below. Except for intervals totalling less than 3 ms, the curve of the trolley's deceleration or acceleration as function of time shall remain between the limit curves shown in Figure 1.
- 3.4.3. Furthermore, the average deceleration or acceleration shall be comprised between 6.5 and 8.5 g.
- 3.5. Test 2
- 3.5.1. Test 1 shall be repeated with a manikin seated in the auxiliary seat: the manikin shall be restrained by a safety-belt fitted and adjusted in accordance with the manufacturer's instructions. The number of safety-belt anchorage points for the purpose of Test 2 shall be recorded in the communication form concerning the approval of a seat type and conforming to the model in Annex 1 to this Regulation.
- 3.5.2. The auxiliary seat shall be either of the same type as the seat being tested or of a different type, the details of which shall be recorded in the communication form concerning the approval of a seat type and conforming to the model in Annex 1 to this Regulation.

3.5.3. In the case where Test 2 is conducted with the manikin restrained by a 3-point belt and the injury criteria are not exceeded, the auxiliary seat shall be considered to have met the requirements relating to the static test loads and movement of the upper anchorage during the test specified in Regulation No. 14 with regard to this installation.

Figure 1

deceleration or acceleration (g)



time (ms)

Appendix 2

Test procedure for the anchorages of a vehicle in application of paragraph 6.1.1.

1. Test apparatus
 - 1.1. A rigid structure sufficiently representative of the seat intended for use on the vehicle is fixed by the means of fixation (bolts, screws, etc.) provided by the manufacturer to the parts of the structure submitted to the tests.
 - 1.2. If several seat types differing from one another in respect of the distance between the front and back ends of their feet can be mounted on the same anchorage, the test shall be carried out with the shortest footing. This footing shall be described on the type approval certificate.
2. Test procedure
 - 2.1. A force F shall be applied.
 - 2.1.1. At a height of 750 mm above the reference plane and on the vertical line containing the geometrical centre of the surface bounded by the polygon having the different anchorage points as apexes or, if applicable, the extreme anchorages of the seat, by the rigid structure as defined in paragraph 1.1. above;
 - 2.1.2. In the horizontal direction and directed to the front of the vehicle;
 - 2.1.3. In a delay as short as possible and for a duration of at least 0.2 s.
 - 2.2. The force F shall be determined either
 - 2.2.1. By the following formula: $F = (5,000 \pm 50) \times i$ where:
F is given in N and i represents the number of seating positions of the seat for which the anchorages to be tested are to be approved; or, if requested by the manufacturer,
 - 2.2.2. In accordance with the representative loads measured during dynamic tests as described in Appendix 1 to this Regulation.

Appendix 3

Measurements to be made

1. All measurements necessary shall be made with measurement systems corresponding to the specifications of International Standard ISO 6487:1987 entitled "Measurement techniques in impact tests: Instrumentation".
2. Dynamic test
 - 2.1. Measurements to be made on the trolley

The characteristics of the deceleration or acceleration of the trolley shall be measured, from the decelerations or accelerations measured on the rigid frame of the trolley, with measurement systems with a CFC of 60.
 - 2.2. Measurements to be made on manikins

The readings of the measuring devices shall be recorded through independent data channels of the following CFC:

 - 2.2.1. Measurements in the head of the manikin

The resultant triaxial acceleration referring to the centre of gravity (γ_r)¹ shall be measured with a CFC of 600.
 - 2.2.2. Measurements in the thorax of the manikin

The resultant acceleration at the centre of gravity shall be measured with a CFC of 180.
 - 2.2.3. Measurements in the femur of the manikin

The axial compression force shall be measured with a CFC of 600.

¹ Expressed in g (= 9.81 m/s²) the scalar value of which is calculated according to the following formula:

$$\gamma_r^2 = \gamma_l^2 + \gamma_v^2 + \gamma_t^2$$

where:

γ_l = value of instant longitudinal acceleration;

γ_v = value of instant vertical acceleration;

γ_t = value of instant transversal acceleration.

Appendix 4

Determination of acceptability criteria

- 1.1. This injury criterion (HIC) is calculated on the basis of the resultant triaxial acceleration measured according to Appendix 3, paragraph 2.2.1. by the following expression:

$$\text{HIC} = (t_2 - t_1) \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} \gamma_r dt \right]^{2.5}$$

in which t_1 and t_2 are any values of time during the test, HIC being maximum value for and interval t_1, t_2 . The values of t_1 and t_2 are expressed in seconds.

2. Thorax acceptability criterion (ThAC)
 - 2.1. This criterion is determined by the absolute value of resultant acceleration, expressed in g and measured according to Appendix 3, paragraph 2.2.2., and by the acceleration period, expressed in ms.
3. Femur acceptability criterion (FAC)

This criterion is determined by the compression load expressed in kN, transmitted axially on each femur of the manikin and measured according to Appendix 3, paragraph 2.2.3., and by the duration of the compression load, expressed in ms.

Appendix 5

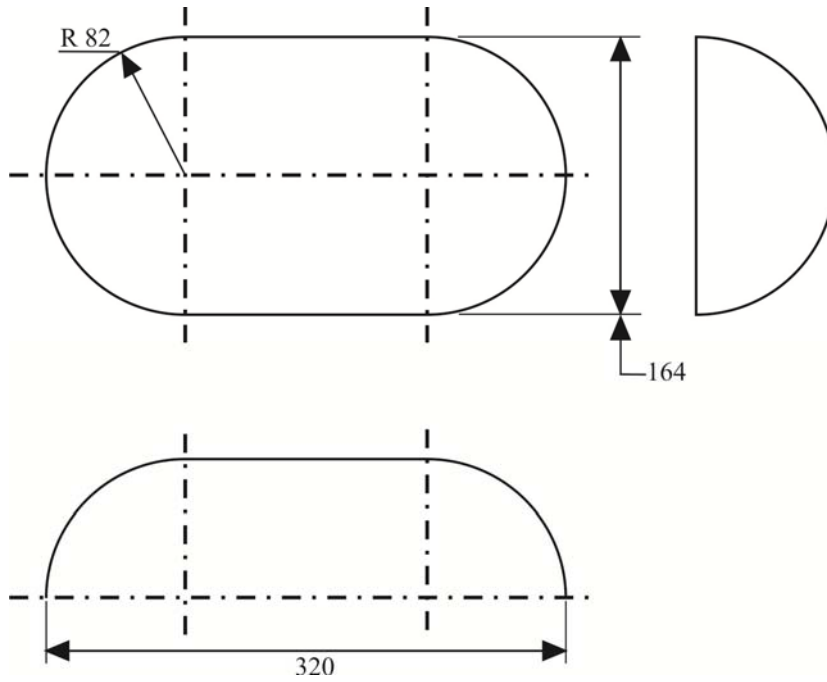
Static test requirements and procedure

1. Requirements
 - 1.1. The requirements for seats tested according to this appendix are to determine:
 - 1.1.1. If the seat occupants are correctly retained by the seats in front of them;
 - 1.1.2. If the seat occupants are not seriously injured; and
 - 1.1.3. If the seat and the seat mountings are strong enough.
 - 1.2. The requirements of paragraph 1.1.1. above shall be considered satisfied if the maximum displacement of the central of application of each force prescribed in paragraph 2.2.1. measured in the horizontal plane and in the longitudinal median plane of the relevant seating position does not exceed 400 mm.
 - 1.3. The requirements of paragraph 1.1.2. above shall be considered satisfied if the following characteristics are met:
 - 1.3.1. The maximum displacement of the central point of application of each of the forces prescribed in paragraph 2.2.1., measured as described in paragraph 1.2., is not less than 100 mm;
 - 1.3.2. The maximum displacement of the central point of application of each of the forces prescribed in paragraph 2.2.2., measured as described in paragraph 1.2., is not less than 50 mm.
 - 1.3.3. All fittings forming part of the back of the seat or accessories thereto shall be such as to be unlikely to cause any bodily injury to a passenger during impact. This requirement shall be considered satisfied if any part contactable by a sphere 165 mm in diameter presents a radius of curvature of at least 5 mm.
 - 1.3.4. If any part of the fittings and accessories referred to above is made of a material of hardness less than 50 shore A on a rigid backing, the requirements set out in paragraph 1.3.3. above shall apply only to the rigid backing.
 - 1.3.5. The parts of the back of the seat such as adjustment devices for the seat and accessories shall not be subject to any requirements of paragraph 1.3.3. if in the position of rest they are situated below a horizontal plane 400 mm above the reference plane, even if the occupant might enter into contact with them.
 - 1.4. The requirements of paragraph 1.1.3. shall be considered satisfied if:
 - 1.4.1. No part of the seat, the seat mountings or the accessories becomes completely detached during the test;
 - 1.4.2. The seat remains firmly held, even if one or more anchorages is (are) partly detached, and all the locking systems remain locked during the whole duration of the test;
 - 1.4.3. After the test no structural part of the seat or accessories has any fracture or sharp or pointed edges or corners likely to cause any bodily injury.

-
2. Static tests
 - 2.1. Test apparatus
 - 2.1.1. This consists of cylindrical surfaces with a radius of curvature equal to 82 ± 3 mm and a width:
 - 2.1.1.1. At least equal to the width of the seat-back of each seating position of the seat to be tested for the upper form,
 - 2.1.1.2. Equal to $320 -0/+10$ mm for the lower form as shown in Figure 1 of this appendix.
 - 2.1.2. The surface resting against the parts of the seat shall be made of a material the hardness of which is not less than 80 Shore A.
 - 2.1.3. Each cylindrical surface shall be equipped with at least one force transducer able to measure the forces applied in the direction defined in paragraph 2.2.1.1.
 - 2.2. Test procedure
 - 2.2.1. A test force to $\frac{1,000}{H_1} \pm 50$ N shall be applied using a device, conforming to paragraph 2.1. above, to the rear part of the seat corresponding to each seating position of the seat.
 - 2.2.1.1. The direction of application of the force shall be situated in the vertical median plane of the seating position concerned; it shall be horizontal and from the rear towards the front of the seat.
 - 2.2.1.2. This direction shall be situated at the height H_1 which shall be between 0.70 m and 0.80 m and above the reference plane. The exact height shall be determined by the manufacturer.
 - 2.2.2. A test force equal to $\frac{2,000}{H_2} \pm 100$ N shall be applied simultaneously to the rear part of the seat corresponding to each seating position of the seat in the same vertical plane and in the same direction at the height H_2 which shall be between 0.45 and 0.55 m above the reference plane, with a device conforming to paragraph 2.1. above. The exact height shall be determined by the manufacturer.
 - 2.2.3. The test form shall be maintained as far as possible in contact with the rear of the seat during the application of the forces specified in paragraphs 2.2.1. and 2.2.2. above. They shall be able to pivot in a horizontal plane.
 - 2.2.4. Where a seat consists of more than one seating position, the forces corresponding to each seating position shall be applied simultaneously and there shall be as many upper and lower forms as seating positions.
 - 2.2.5. The initial position of each seating position of each of the forms shall be determined by bringing the test devices into contact with the seat with a force equal to at least 20 N.
 - 2.2.6. The forces indicated in paragraphs 2.2.1. and 2.2.2. above shall be applied as rapidly as possible and shall be maintained together at the specified value, whatever the deformation, for at least 0.2 seconds.

2.2.7. If the test has been carried out with one or more forces but not with all forces greater than those specified in paragraphs 2.2.1. and 2.2.2. above and if the seat complies with the requirements, the test shall be considered to be satisfied.

Figure 1
Static test apparatus



Appendix 6

Energy absorption characteristics of the rear part of seat backs

1. Elements of the rear part of seat backs situated in the reference zone, as defined in paragraph 2.21. of this Regulation, shall be verified at the request of the manufacturer according to the energy absorbing requirements set out in Annex 4, to Regulation No. 21. For this purpose, all accessories fitted shall be tested in all positions of use, except tables which shall be considered in the stowed position.
2. This test shall be referred to in the communication form concerning the approval of a seat type conforming to the model in Annex 1 to this Regulation. A drawing showing the area of the part of the seat back, verified by the energy dissipation test, shall be enclosed.

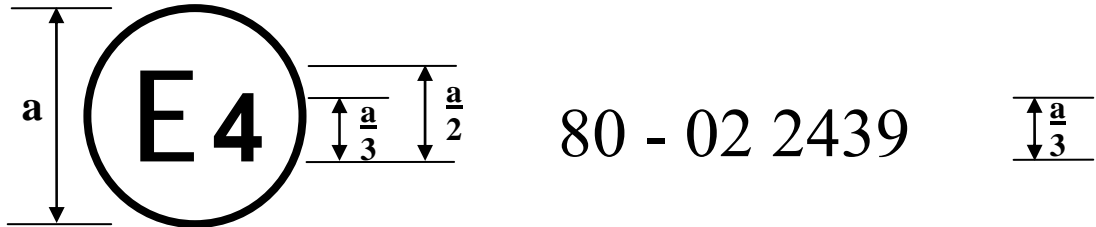
-
- 5.6. Seat approved in accordance with paragraph 5.1. of this Regulation (dynamic test): yes/no²
 - 5.6.1. Test 1 according to Appendix 1: yes/no²
 - 5.6.2. Test 2 according to Appendix 1: yes/no²
 - 5.6.3. Description of the safety-belts and anchorages used for the purpose of Test 2:
.....
 - 5.6.4. Type of auxiliary seat used for Test 2 (if different from the type of seat approved):....
.....
 - 5.7. Seat approved in accordance with paragraph 5.1. of this Regulation (static test): yes/no²
 - 5.8. Test according to Appendix 5: yes/no²
 - 5.9. Test according to Appendix 6: yes/no²
 6. Seat submitted for approval on:
 7. Type of device: deceleration/acceleration²
 8. Technical service, responsible for the approval test:
 9. Date of report issued by that service:.....
 10. Number of report issued by that service:
 11. Approval granted/refused/extended/withdrawn²
 12. Position of approval mark on the seat:
 13. Place:.....
 14. Date:.....
 15. Signature:
 16. The following documents, bearing the approval number shown above, are available on request:

6. Vehicle submitted for approval on:
7. Technical service, responsible for the approval test:
8. Date of report issued by that service:
9. Number of report issued by that service:
10. Approval granted/refused/extended/withdrawn²
11. Location of approval mark on the vehicle:
12. Place:.....
13. Date:.....
14. Signature:
15. The following documents, bearing the approval number shown above, are available on request:

Annex 3

Arrangements of approval marks

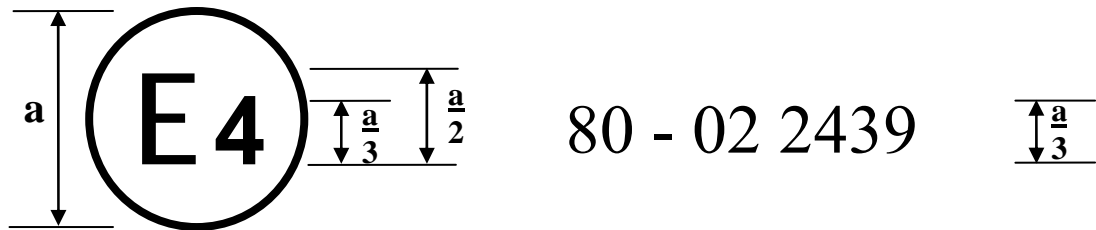
1. Arrangement in the approval mark for a seat



$a = 8 \text{ mm min}$

The above approval mark affixed to a seat shows that the seat type concerned has, with regard to the strength of the seats, the test being carried out in accordance with paragraph 2. of Annex 4, been approved in the Netherlands (E4) under number 022439. The approval number indicates that the approval was granted in accordance with the requirements of Regulation No. 80 as amended by the 02 series of amendments.

2. Arrangement in the approval mark for a vehicle type



$a = 8 \text{ mm min}$

The above approval mark, affixed to a vehicle, shows that this type of vehicle has been approved in the Netherlands (E4) under number 022439 with regard to the strength of the anchorages on the vehicle. The approval number indicates that the approval was granted in accordance with the requirements of Regulation No. 80 as amended by the 02 series of amendments.

Annex 4

Procedure for determining the "H" point and the actual torso angle for seating position in motor vehicles

1. Purpose
The procedure described in this annex is used to establish the "H" point location and the actual torso angle for one or several seating positions in a motor vehicle and to verify the relationship of measured data to design specifications given by the vehicle manufacturer¹.
2. Definitions
For the purposes of this annex:
 - 2.1. "Reference data" means one or several of the following characteristics of a seating position:
 - 2.1.1. The "H point" and the "R" point and their relationship;
 - 2.1.2. The actual torso angle and the design torso angle and their relationship;
 - 2.2. "Three-dimensional 'H' point machine" (3 DH machine) means the device used for the determination of "H" points and actual torso angles. This device is described in Appendix 1 to this annex;
 - 2.3. "'H' point" means the pivot centre of the torso and thigh of the 3 DH machine installed in the vehicle seat in accordance with paragraph 4. below. The "H" point is located in the centre of the centreline of the device which is between the "H" point sight buttons on either side of the 3 DH machine. The "H" point corresponds theoretically to the "R" point (for tolerances see paragraph 3.2.2. below). Once determined in accordance with the procedure described in paragraph 4., the "H" point is considered fixed in relation to the seat-cushion structure and to move with it when the seat is adjusted;
 - 2.4. "'R' point" or "seating reference point" means a design point defined by the vehicle manufacturer for each seating position and established with respect to the three-dimensional reference system;
 - 2.5. "Torso-line" means the centreline of the probe of the 3 DH machine with the probe in the fully rearward position;
 - 2.6. "Actual torso angle" means the angle measured between a vertical line through the "H" point and the torso line using the back angle quadrant on the 3 DH machine. The actual torso angle corresponds theoretically to the design torso angle (for tolerances see paragraph 3.2.2. below);
 - 2.7. "Design torso angle" means the angle measures between a vertical line through the "R" point and the torso line in a position which corresponds to the design position of the seat-back established by the vehicle manufacturer;

¹ In any seating position other than front seats where the "H" point cannot be determined using the "Three-dimensional 'H' point machine" or procedures, the "R" point indicated by the manufacturer may be taken as a reference at the discretion of the competent authority.

- 2.8. "Centreplane of occupant" (C/LO) means the median plane of the 3 DH machine positioned in each designated seating position; it is represented by the co-ordinate of the "H" point on the "Y" axis. For individual seats, the centreplane of the seat coincides with the centreplane of the occupant. For other seats, the centreplane of the occupant is specified by the manufacturer;
- 2.9. "Three-dimensional reference system" means a system as described in Appendix 2 to this annex;
- 2.10. "Fiducial marks" are physical points (holes, surfaces, marks or indentations) on the vehicle body as defined by the manufacturer;
- 2.11. "Vehicle measuring attitude" means the position of the vehicle as defined by the co-ordinates of fiducial marks in the three-dimensional reference system.
3. Requirements
- 3.1. Data presentation
- For each seating position where reference data are required in order to demonstrate compliance with the provisions of the present Regulation, all or an appropriate selection of the following data shall be presented in the form indicated in Appendix 3 to this annex:
- 3.1.1. The co-ordinates of the "R" point relative to the three-dimensional reference system;
- 3.1.2. The design torso angle;
- 3.1.3. All indications necessary to adjust the seat (if it is adjustable) to the measuring position set out in paragraph 4.3. below;
- 3.2. Relationship between measured data and design specifications
- 3.2.1. The co-ordinates of the "H" point and the value of the actual torso angle obtained by the procedure set out in paragraph 4. below shall be compared, respectively, with the co-ordinates of the "R" point and the value of the design torso angle indicated by the vehicle manufacturer;
- 3.2.2. The relative positions of the "R" point and the "H" point and the relationship between the design torso angle and the actual torso angle shall be considered satisfactory for the seating position in question if the "H" point, as defined by its co-ordinates, lies within a square of 50 mm side length with horizontal and vertical sides whose diagonals intersect at the "R" point, and if the actual torso angle is within 5° of the design torso angle;
- 3.2.3. If these conditions are met, the "R" point and the design torso angle shall be used to demonstrate compliance with the provisions of this Regulation;
- 3.2.4. If the "H" point or the actual torso angle does not satisfy the requirements of paragraph 3.2.2. above, the "H" point and the actual torso angle shall be determined twice more (three times in all). If the results of two of these three operations satisfy the requirements, the conditions of paragraph 3.2.3. above shall apply;
- 3.2.5. If the results of at least two of the three operations described in paragraph 3.2.4. above do not satisfy the requirements of paragraph 3.2.2. above, or if the verification cannot take place because the vehicle manufacturer has failed to supply information regarding the position of the

"R" point or regarding the design torso angle, the centroid of the three measured points or the average of the three measured angles shall be used and be regarded as applicable in all cases where the "R" point or the design torso angle is referred to in this Regulation.

4. Procedure for "H" point and actual torso angle determination
- 4.1. The vehicle shall be pre-conditioned at the manufacturer's discretion, at a temperature of 20 ± 10 °C to ensure that the seat material reaches room temperature. If the seat to be checked has never been sat upon, a 70 to 80 kg person or device shall sit on the seat twice for one minute to flex the cushion and back. At the manufacturer's request, all seat assemblies shall remain unloaded for a minimum period of 30 min. prior to installation of the 3 DH machine;
- 4.2. The vehicle shall be at the measuring attitude defined in paragraph 2.11. above;
- 4.3. The seat, if it is adjustable, shall be adjusted first to the rearmost normal driving or riding position, as indicated by the vehicle manufacturer, taking into consideration only the longitudinal adjustment of the seat, excluding seat travel used for purposes other than normal driving or riding positions. Where other modes of seat adjustment exist (vertical, angular, seat-back, etc.) these will be then adjusted to the position specified by the vehicle manufacturer. For suspension seats, the vertical position shall be rigidly fixed corresponding to a normal driving position as specified by the manufacturer;
- 4.4. The area of the seating position contacted by the 3 DH machine shall be covered by a muslin cotton, of sufficient size and appropriate texture, described as a plain cotton fabric having 18.9 threads per/cm² and weighing 0.228 kg/m² or knitted or non-woven fabric having equivalent characteristics. If test is run on a seat outside the vehicle, the floor on which the seat is placed shall have the same essential characteristics² as the floor of the vehicle in which the seat is intended to be used;
- 4.5. Place the seat and back assembly of the 3 DH machine so that the centreplane of the occupant (C/LO) coincides with the centreplane of the 3 DH machine. At the manufacturer's request, the 3 DH machine may be moved inboard with respect to the C/LO if the 3 DH machine is located so far outboard that the seat edge will not permit levelling of the 3 DH machine;
- 4.6. Attach the foot and lower leg assemblies to the seat pan assembly, either individually or by using the T-bar and lower leg assembly. A line through the "H" point sight buttons shall be parallel to the ground and perpendicular to the longitudinal centreplane of the seat;
- 4.7. Adjust the feet and leg positions of the 3 DH machine as follows:
 - 4.7.1. Designated seating position: driver and outside front passenger
 - 4.7.1.1. Both feet and leg assemblies shall be moved forward in such a way that the feet take up natural positions on the floor, between the operating pedals if necessary. Where possible the left foot shall be located approximately the same distance to the left of the centreplane of the 3 DH machine as the right foot is to the right. The spirit level verifying the transverse orientation of the

² Tilt angle, height difference with a seat mounting, surface texture, etc.

- 3 DH machine is brought to the horizontal by readjustment of the seat pan if necessary, or by adjusting the leg and foot assemblies towards the rear. The line passing through the "H" point sight buttons shall be maintained perpendicular to the longitudinal centreplane of the seat;
- 4.7.1.2. If the left leg cannot be kept parallel to the right leg and the left foot cannot be supported by the structure, move the left foot until it is supported. The alignment of the sight buttons shall be maintained;
- 4.7.2. Designated seating position: outboard rear
- For rear seats or auxiliary seats, the legs are located as specified by the manufacturer. If the feet then rest on parts of the floor which are at different levels, the foot which first comes into contact with the front seat shall serve as a reference and the other foot shall be so arranged that the spirit level giving the transverse orientation of the seat of the device indicates the horizontal;
- 4.7.3. Other designated seating positions:
- The general procedure indicated in paragraph 4.7.1. above shall be followed except that the feet shall be placed as specified by the vehicle manufacturer.
- 4.8. Apply lower leg and thigh weights and level the 3 DH machine;
- 4.9. Tilt the back pan forward against the forward stop and draw the 3 DH machine away from the seat-back using the T-bar. Reposition the 3 DH machine on the seat by one of the following methods:
- 4.9.1. If the 3 DH machine tends to slide rearward, use the following procedure. Allow the 3 DH machine to slide rearward until a forward horizontal restraining load on the T-bar is no longer required, i.e. until the seat pan contacts the seat-back. If necessary, reposition the lower leg;
- 4.9.2. If the 3 DH machine does not tend to slide rearward, use the following procedure. Slide the 3 DH machine rearwards by applying an horizontal rearward load to the T-bar until the seat pan contacts the seat-back (see Figure 2 of Appendix 1 to this annex);
- 4.10. Apply a 100 ± 10 N load to the back and pan assembly of the 3 DH machine at the intersection of the hip angle quadrant and the T-bar housing. The direction of load application shall be maintained along a line passing by the above intersection to a point just above the thigh bar housing (see Figure 2 of Appendix 1 to this annex). Then carefully return the back pan to the seat-back. Care must be exercised throughout the remainder of the procedure to prevent the 3/DH machine from sliding forward;
- 4.11. Install the right and left buttock weights and then, alternately, the eight torso weights. Maintain the 3 DH machine level;
- 4.12. Tilt the back pan forward to release the tension on the seat-back. Rock the 3 DH machine from side to side through 10° arc (5° to each side of the vertical centreplane) for three complete cycles to release any accumulated friction between the 3 DH machine and the seat;
- During the rocking action, the T-bar of the 3 DH machine may tend to diverge from the specified horizontal and vertical alignment. The T-bar must therefore be restrained by applying an appropriate lateral load during the rocking motions. Care shall be exercised in holding the T-bar and rocking the 3 DH machine to ensure that no inadvertent exterior loads are applied in a vertical or fore and aft direction;

The feet of the 3 DH machine are not to be restrained or held during this step. If the feet change position, they should be allowed to remain in that attitude for the moment.

Carefully return the back pan to the seat-back and check the two spirit levels for zero position. If any movement of the feet has occurred during the rocking operation of the 3 DH machine, they must be repositioned as follows:

Alternately, lift each foot off the floor the minimum necessary amount until no additional foot movement is obtained. During this lifting, the feet are to be free to rotate; and no forward or lateral loads are to be applied. When each foot is placed back in the down position, the heel is to be in contact with the structure designed for this;

Check the lateral spirit level for zero position; if necessary, apply a lateral load to the top of the back pan sufficient to level the 3 DH machine's seat pan on the seat;

- 4.13. Holding the T-bar to prevent the 3 DH machine from sliding forward on the seat cushion, proceed as follows:
 - (a) Return the back pan to the seat-back;
 - (b) Alternately apply and release a horizontal rearward load, not to exceed 25 N, to the back angle bar at a height approximately at the centre of the torso weights until the hip angle quadrant indicates that a stable position has been reached after load release. Care shall be exercised to ensure that no exterior downward or lateral loads are applied to the 3 DH machine. If another level adjustment of the 3 DH machine is necessary, rotate the back pan forward, re-level, and repeat the procedure from paragraph 4.12.;
- 4.14. Take all measurements:
 - 4.14.1. The co-ordinates of the "H" point are measured with respect to the three-dimensional reference system;
 - 4.14.2. The actual torso angle is read at the back angle quadrant of the 3 DH machine with the probe in its fully rearward position;
- 4.15. If a re-run of the installation of the 3 DH machine is desired, the seat assembly should remain unloaded for a minimum period of 30 min prior to the re-run. The 3 DH machine should not be left loaded on the seat assembly longer than the time required to perform the test;
- 4.16. If the seats in the same row can be regarded as similar (bench seat, identical seats, etc.) only one "H" point and one "actual torso angle" shall be determined for each row of seats, the 3 DH machine described in Appendix 1 to this annex being seated in a place regarded as representative for the row. This place shall be:
 - 4.16.1. In the case of the front row, the driver's seat;
 - 4.16.2. In the case of the rear row or rows, an outer seat.

Annex 4

Appendix 1

Description of the three dimensional "H" point machine¹ (3 DH machine)

1. Back and seat pans
The back and seat pans are constructed of reinforced plastic and metal; they simulate the human torso and thigh and are mechanically hinged at the "H" point. A quadrant is fastened to the probe hinged at the "H" point to measure the actual torso angle. An adjustable thigh bar, attached to the seat pan, establishes the thigh centreline and serves as a baseline for the hip angle quadrant.
2. Body and leg elements
Lower leg segments are connected to the seat pan assembly at the T-bar joining the knees, which is a lateral extension of the adjustable thigh bar. Quadrants are incorporated in the lower leg segments to measure knee angles. Shoe and foot assemblies are calibrated to measure the foot angle. Two spirit levels orient the device in space. Body element weights are placed at the corresponding centres of gravity to provide seat penetration equivalent to a 76 kg male. All joints of the 3 DH machine should be checked for free movement without encountering noticeable friction.

¹ For details of the construction of the 3 DH machine refer to Society of Automotive Engineers (SAE), 400 Commonwealth Drive, Warrendale, Pennsylvania 15096, United States of America. The machine corresponds to that described in ISO Standard 6549-1980.

Figure 1
3 DH machine elements designation

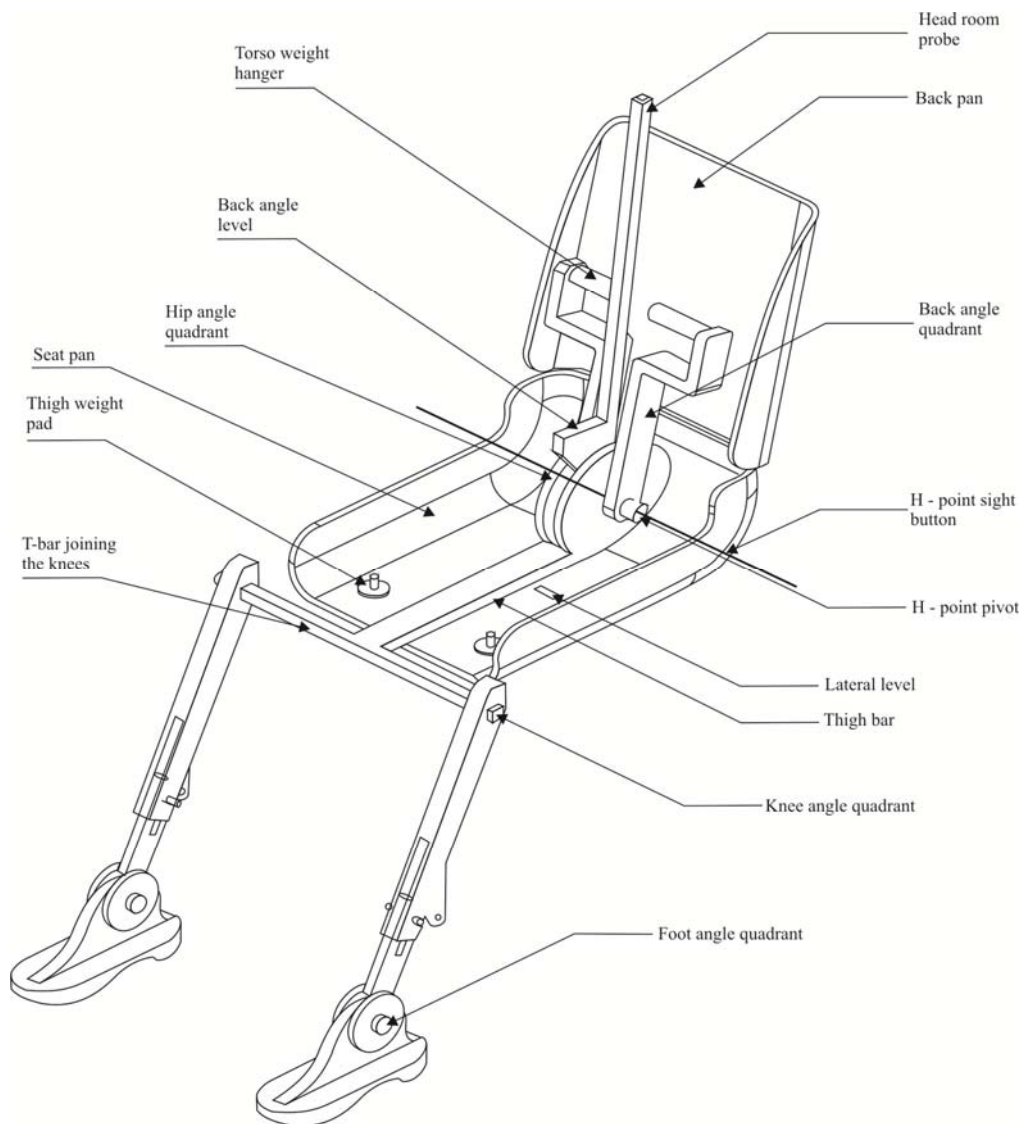
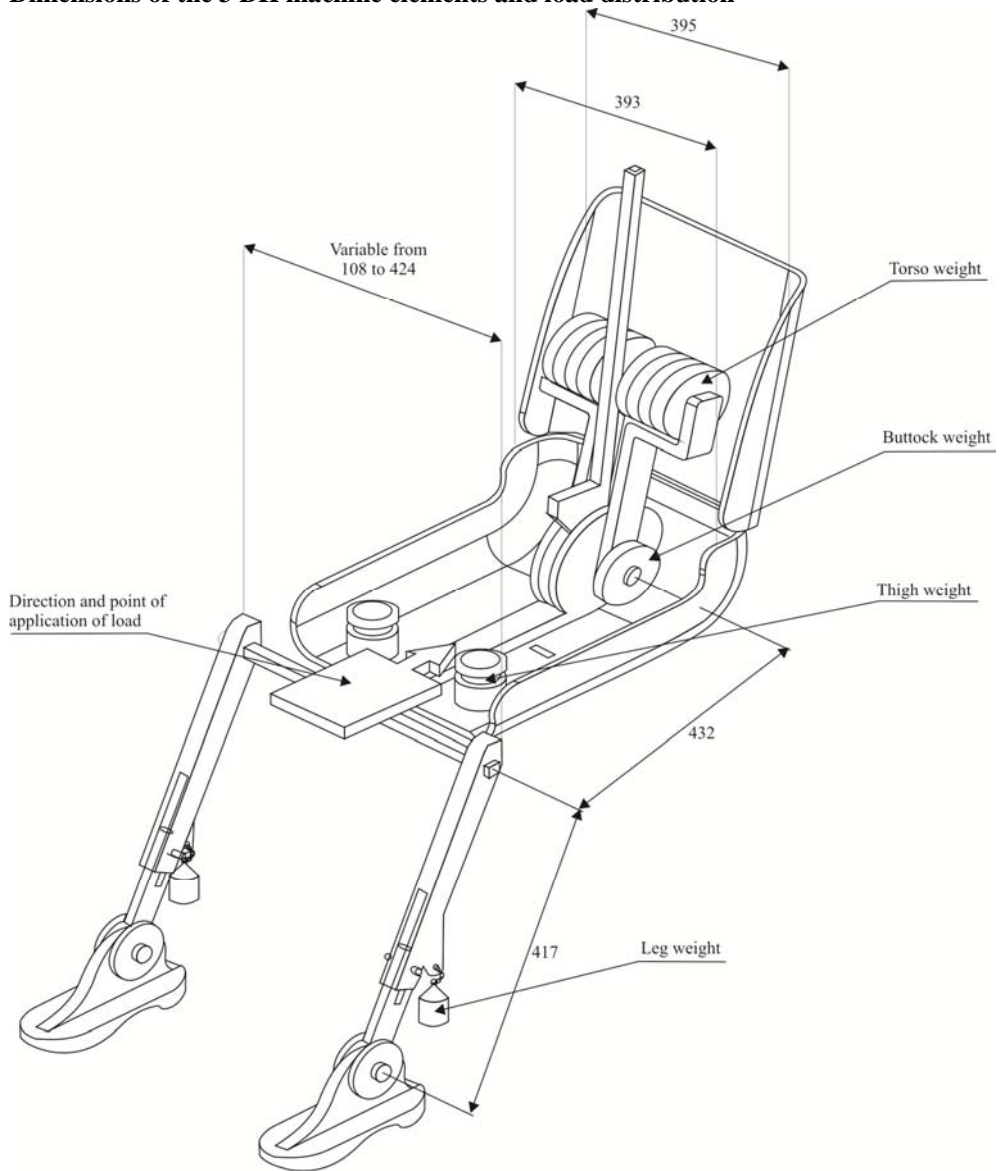


Figure 2
Dimensions of the 3 DH machine elements and load distribution



Annex 4

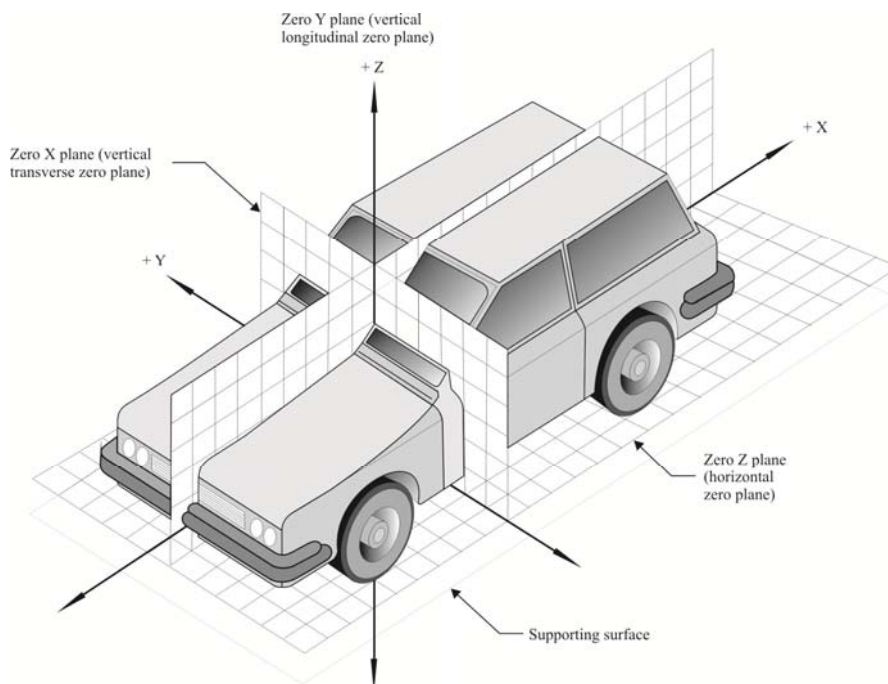
Appendix 2

Three-dimensional reference system

1. The three-dimensional reference system is defined by three orthogonal planes established by the vehicle manufacturer (see Figure 1)¹.
2. The vehicle measuring attitude is established by positioning the vehicle on the supporting surface such that the co-ordinates of the fiducial marks correspond to the values indicated by the manufacturer.
3. The co-ordinates of the "R" point and the "H" point are established in relation to the fiducial marks defined by the vehicle manufacturer.

Figure 1

Three-dimensional reference system



¹ The reference system corresponds to ISO standard 4130, 1978.

Annex 4

Appendix 3

Reference data concerning seating positions

1. Coding of reference data
Reference data are listed consecutively for each seating position. Seating positions are identified by a two-digit code. The first digit is an Arabic numeral and designates the row of seats, counting from the front to the rear of the vehicle. The second digit is a capital letter which designates the location of the seating position in a row, as viewed in the direction of forward motion of the vehicle; the following letters shall be used:
L = left
C = centre
R = right
2. Description of vehicle measuring attitude
 - 2.1. Co-ordinates of fiducial marks
X
Y
Z
3. List of reference data
 - 3.1. Seating position:
 - 3.1.1. Co-ordinates of "R" point
X
Y
Z
 - 3.1.2. Design torso angle:
 - 3.1.3. Specifications for seat adjustment¹
Horizontal:
Vertical:
Angular:
Torso angle:

Note: List reference data for further seating positions under 3.2., 3.3., etc.

¹ Strike out what does not apply.