COMMISSION OF THE EUROPEAN COMMUNITIES

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94/0323 (COD)

Proposal for a
EUROPEAN PARLIAMENT AND COUNCIL DIRECTIVE

relating to the frontal impact resistance of motor vehicles and amending Directive 70/156/EEC

(presented by the Commission)

EXPLANATORY MEMORANDUM

1. SUMMARY

This proposal is aimed at reducing the number of people killed or seriously injured in road accidents by the introduction of new standards for the frontal impact resistance of passenger cars.

Applicable to new vehicle types approved after a certain date, the proposal sets out new test procedures, to come into effect in two stages, which when fully implemented will more realistically represent typical frontal impact accidents.

The proposal incorporates the technical prescriptions of the 30° angled, rigid barrier test, developed by the United Nations Economic Commission for Europe, as the first stage, and prepares the way for the introduction of a test procedure based on an offset deformable barrier (Stage II), as developed by the European Experimental Vehicles Committee.

2. BACKGROUND

For some years the annual average number of people killed in road accidents in the European Community has been in the order of 50,000, with more than 1.5 million casualties and in excess of 0.5 million hospital admissions, at an estimated cost of around 70 billion ecus. And, whilst human factors are thought to be a major contributor to such accidents, the design of the vehicle can play a significant part in reducing the likelihood of an accident occurring (primary safety) and, in particular, minimising the extent of injuries to occupants and road users if an accident occurs (secondary safety).

Research has shown that injuries sustained as a result of vehicle frontal impact accidents represents the single most significant cause of death and serious injury, and that changes in the design of passenger car frontal structures offers the greatest scope for casualty reduction.

This Memorandum therefore sets out the rationale behind the Commission's proposal for a new Council and Parliament directive relating to the frontal impact resistance of motor vehicles.

3. EXISTING LEGISLATIVE SITUATION

The list of directives within the framework for the type approval of motor vehicles includes a number of safety measures which are aimed at the reduction of casualties but, at present, there is only one which specifically relates to the structural crashworthiness of the vehicle, as set out below.

3.1 Directive 74/297/EEC

Adopted some 20 years ago and corresponding to UN ECE Regulation No 12, this Directive prescribes the maximum rearward and vertical displacement of the steering wheel when the vehicle impacts a solid barrier, head-on, at a speed of approximately 50 km/h. To comply with this requirement, which results in extremely high vehicle deceleration, vehicles are designed and constructed with very stiff frontal structures which can absorb the rapid input of kinetic energy without transmitting significant amounts to the passenger compartment, causing deformation of the latter.

3.2 Directive 91/662/EEC (amending the above Directive)

Adopted towards the end of 1991, but only now coming into full effect, this Directive recognised that, notwithstanding the limitation on steering wheel intrusion, a significant number of injuries occurred as a result of head/body contact with the steering wheel. Consequently, quasi-biomechanical criteria were introduced in the form of simple head-form and body-block tests, carried out in test rigs which simulate the actual vehicle.

3.3 Limitations to the Directives

There are two principal areas where the current legislation needs to be developed:

(a) Representation of Real Accidents

Although some road accidents involve head-on collisions between cars and solid objects, the majority of accidents involving frontal impact are car-to-car, generally with partial rather than full overlap. In such accidents there is often massive passenger compartment intrusion, suggesting that the structural members designed to absorb large amounts of energy do not come into effect in these circumstances. Research has shown that in most car-to-car frontal impacts, unless the stiff frontal members of both cars happen to align, they tend to pierce the softer surrounding structure, thus transmitting the energy into other parts of the vehicle, with the catastrophic consequences seen only too often at the scene of road accidents.

(b) Biomechanical Criteria

Although the amendment to Directive 74/297/EEC introduces simple criteria to limit forces transmitted to the head and body as a result of steering wheel contact, these fall short of true bio-mechanical criteria for injury assessment in a representative full-scale test situation. Advances in science and technology have enabled the critical criteria to be identified and the physical quantities to be measured in the form of an instrumented, life-like dummy.

3.4 American Federal Test FMVSS208

Passenger cars conforming to US regulations are required to comply with a frontal impact test against a solid barrier but, in contrast to the European test, the impacting vehicle must pass the test at any angle up to 30° to the perpendicular. The test also includes true biomechanical criteria which requires the use of instrumented test dummies.

The National Highway Transport Safety Administration (NHTSA) is currently looking into an alternative test procedure and is researching the relationship between real accidents and an offset deformable barrier test, and are of the view that an offset frontal test best represents the real-world crashes that produce the intrusion-related injuries and fatalities.

4. WORK OF THE EEVC

The European Experimental Vehicle Committee (EEVC) has, for some years, carried out research into a number of areas affecting vehicle safety. In particular, work has been focussed on the development of a static barrier test which more realistically reproduces the impact damage found in real accidents. In order to simulate the partial overlap of the majority of car-to-car accidents, and the effect of a relatively soft car frontal structure, Working Group 11 of EEVC developed the offset deformable barrier test. A solid barrier is faced with a soft structure which ressembles a car front in terms of approximate shape and relative stiffness. The impacting vehicle strikes the barrier with less than its whole width (typically 40 - 50 %) and at a representaive speed.

The results of this work have been encouraging in that it has been possible to replicate the kind of damage seen in real car-to-car accidents. The work is expected to be finalised at the end of March 1995 when a series of validation tests have been carried out.

It should be noted that a number of European vehicle manufacturers have already made public their use of the offset deformable barrier test technique in their development programmes. Australia has recently introduced a New Car Assessment Programme based on the emerging EEVC criteria for an offset deformable barrier test.

5. LEGISLATIVE APPROACH PROPOSED BY THE COMMISSION

5.1 Development of Legislation by UN ECE

The work of EEVC in this area of vehicle safety has been brought into the legislative arena via the United Nations Economic Commission for Europe (Working Group 29) and the Group of Experts on Passive Safety (GRSP) in particular. Whilst recognising the value and importance of the development of a more representative frontal impact test, legitimate concerns were expressed at the timescale required to introduce a new test procedure, based on the offset deformable barrier, and it was agreed to adopt an interim measure as soon as possible in order to address the unacceptable rate of road accident casualties.

Accordingly the well established US Federal Standard (FMVSS 208), known as the 30° angled rigid barrier test, was used as the basis for a draft European standard.

The resulting draft Regulation (TRANS/SC1/WP29/392) was adopted by WP29 in June 1993 and will come into force once it has been approved by the United Nations organisation in New York.

5.2 European Community Legislation

Within the Member States of the Community, who have to adopt a coordinated position when participating at WP29, there was a considerable debate over the technical merits of the 30° angled rigid barrier test (30°ARB) and the offset deformable barrier test (ODB). The compromise reached envisaged the establishment of the interim standard (30° ARB) on the condition that the latter standard (ODB) be brought in by October 1998 and earlier, if possible, on an optional basis.

In order to reflect this agreement made by the Member States, the Commission has accordingly developed a two-stage approach to the introduction of legislation.

6. THE TWO STAGE COMMISSION PROPOSAL

The Commission considers that the compromise reached in Geneva should be transformed into Community legislation without delay and outline requirements for the second stage specified as far as possible.

6.1 Stage I - 30° Angled Rigid Barrier Test

As stated earlier, the technical prescriptions for this test are taken from the proposed ECE Regulation which, in turn, is based on a Federal standard. It has been modified, by ECE, to include Anti Slide Devices (ASD) which are vertical steel bars set into the barrier face, but standing out 40 mm, in order to counter the tendency of the impacting vehicle to slide along the barrier and thus reduce the severity of the impact.

This interim measure offers a number of advantages over the existing Directive (74/297/EEC as amended):

(a) it establishes realistic bio-mechanical criteria to limit the forces to which occupants would be subjected in real accidents;

(b) it introduces a degree of assymmetry into the test by impacting the vehicle into an angled barrier.

In order to maintain parity with the implementation dates agreed by UN ECE, the Commission has proposed that Stage I should come into effect by 1 October 1995 for new vehicle types and by 1 October 2000 for all new vehicles registered.

Recognising that some new applications for approvals will be existing vehicles updated without structural changes, the Commission has included an exemption clause to allow the existing steering mechanism approval (74/297/EEC) to be perpetuated.

6.2 Stage II - Offset Deformable Barrier Test

The Commission intends to propose the emerging standard, based on the work of EEVC (which is currently being validated), as soon as possible and has therefore worded the Articles of the draft Directive accordingly and also included an outline of the new Annex that will be required. The second stage will be made mandatory from 1 October 1998 but available at the request of manufacturers on an optional basis from 1 January 1996. Appropriate measures will be prepared in order to bring Stage 2 into force on an optional basis by this date.

In seeking to make such a firm commitment to a particular timetable for the introduction of the second stage, the Commission recognises that it is to some extent dependant upon satisfactory progress being made by ECE in updating the Regulation. The Commission, however, wishes to emphasise that this timetable must be met and that if, upon completion of the EEVC validation programme, the ensuing revision runs into difficulties which might prejudice the outcome, the Commission reserves the possibility of implementing alternative measures in order to fulfil its obligations.

Recognising that this second stage will have significant consequences in terms of vehicle design, the Commission does not want to propose application for all new vehicles (as opposed to new vehicle types) after a particular date without having first evaluated the operation of the Directive to date and assessed the industrial feasibility of such a

measure. It is therefore proposed that the "registration" date for the application of the Directive, set provisionally at 1 October 2003, should be subject to a report from the Commission to the Council and European Parliament.

Research has shown that if all passenger cars were built to meet the requirements of this test then in the order of 65,000 deaths and serious injuries in Europe could be avoided every year (WALL J G, Vehicle Safety - What Are The Needs, Transport Research Laboratory, presented to FISITA Congress in 1992)

7. EFFECT UPON INDUSTRY

The technical requirements of the offset deformable barrier test (Stage II) are more stringent than those of the proposed interim measure (Stage I), and could only be met by a few vehicle types based on current specifications. However, since this higher safety standard will only be applied to new vehicle approvals, the cost to industry is expected to be minimal because it will not be necessary to incur the expense of adapting existing designs. The proposal for Stage II includes sufficient lead time to permit manufacturers to incorporate the new standard at the design stage.

In any event, the structural/design changes required to comply with the ODB test, compared with the angled barrier test, need not add weight or significant cost to the manufacturinge of the vehicle. Thus, when designed into new car structures, compliance with the ODB test will produce significantly safer vehicles with a minimum of cost to the manufacturers.

8. CONCLUSION

The Commission proposal for a planned, two-stage approach to the introduction of more realistic frontal impact standards for passenger cars provides a coherent and predictable framework for legislation.

The first, interim stage of the proposed measures introduces an equivalent test standard to that currently in force in the USA and makes a significant advance upon the existing European standard.

The proposed second stage, introducing the EEVC work on an offset deformable barrier test, already features in the new model development programme of many manufacturers. When implemented it will greatly enhance the safety of vehicles and, according to the fixed timetable, will nevertheless provide manufacturers with sufficient time to incorporate the requirements in new designs.

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THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community and in particular Article 100a,

Having regard to the proposal from the Commission[1],

Having regard to the opinion of the Economic and Social Committee[2],

Having regard to Council Directive 70/156/EEC of 6 February 1970 on the appoximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers[3], as last amended by Council Directive 93/81/EEC[4], and in particular Article 13(4) thereof;

Whereas the internal market comprises an area without internal frontiers in which the free movement of goods, persons, services and capital must be ensured; whereas total harmonization of technical requirements for motor vehicles is necessary in order fully to achieve that objective;

Whereas in order to reduce the number of European road accident casualties it is necessary to introduce legislative measures for the improvement of vehicular crash worthiness as far as practicable; whereas this Directive introduces frontal impact test requirements, including biomechanical criteria, to ensure that a high level of frontal impact resistance is provided;

Whereas in the Outcome of Proceedings of the Council Working Party on Economic Questions, in reaching a coordinated view prior to the 101st meeting of the United Nations Economic Commission for Europe (ECE) Working Parrty on the Construction of Motor Vehicles (WP29), confirmed their preference for a two-stage approach, reiterated their agreement to comply with the dates of 1 October 1995 for the first stage and 1 October 1998 for the second, and called upon the Commission to monitor the parallelism between Community regulations and the regulations of the ECE in Geneva[5];

Whereas the aim of this Directive is to introduce requirements based on the results of research which will be published in 1995, allowing the establishment of test criteria more representative of actual road accidents;

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(1) OJ No
(2) OJ No
(3) OJ No L 42, 23.2.1970, p. 1.
(4) OJ No L 264, 23.10.1993, p. 49.
(5) Outcome of Proceedings 8930/93 dated 30 September 1993.

Whereas lead times are necessarily required by vehicle manufacturers for the implemention of acceptable test criteria as recently developed by the UN ECE[6];

Whereas the offset deformable barrier test criteria represents a significant enhancement of safety standards in respect of frontal impact; whereas the technical details are not yet finalized;

Whereas in the meantime an intermediate standard, the 30 degree angled rigid barrier test, will provide an improved level of safety pending the finalization of the technical requirements for the offset deformable barrier test;

Whereas this Directive will be one of the separate directives which must be complied with in order to conform to the EEC type-approval procedure established by Directive 70/156/EEC; whereas, consequently, the provisions laid down in Directive 70/156/EEC relating to vehicle systems, components and separate technical units apply to this Directive;

Whereas the procedure for determining the reference point for seating positions in motor vehicles is given in Annex III to Council Directive 77/649/EEC[7], as last amended by Commission Directive 90/630/EEC[8], and consequently it is not necessary to repeat it in this Directive; whereas, reference is made to Council Directive 77/541/EEC[9], as last amended by Commission Directive 90/628/EEC[10], Council Directive 76/115/EEC[11], as last amended by Commission Directive 90/629/EEC[12] and Council Directive 74/297/EEC[13], as last amended by Commission Directive 91/662/EEC[14]; whereas reference is made to Code of Federal Regulations 49 CFR Part 572[15],

HAVE ADOPTED THIS DIRECTIVE:

Article 1

For the purposes of this Directive, "vehicle" shall have the meaning given to it in Article 2 of Directive 70/156/EEC.

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(6) UN ECE Regulation R.XX TRANS/SC1/WP29/392.
(7) OJ No L 267, 19.10.1977, p. 1.
(8) OJ No L 341, 6.12.1990, p. 20.
(9) OJ No L 220, 29.8.1977, p. 95.
(10) OJ No L 341, 6.12.1990, p. 1.
(11) OJ No L 24, 30.1.1976, p. 6.
(12) OJ No L 341, 6.12.1990, p. 14.
(13) OJ No L 165, 20.6.1974, p. 16.
(14) OJ No L 366, 31.12.1991, p. 1.
(15) United States of America Code of Federal Regulations, Title 49, Chapter V, Part 572; obtainable from the US Government Printing Office, Washington, DC 20402.

Article 2

1. No Member State may, on grounds relating to frontal impact resistance:

   - refuse, in respect of a type of vehicle, to grant EEC type-approval or national type-approval, or

   - prohibit the registration, sale or entry into service of a vehicle,

   if it complies with the requirements of this Directive.

2. With effect from 1 October 1995, Member States:

   - shall not grant EEC type-approval in accordance with Article 4 of Directive 70/156/EEC, and

   - may refuse to grant national type-approval,

   unless the vehicle type satisfies the requirements of this Directive.

3. Paragraph 2 shall not apply to vehicle types approved prior to 1 October 1995 pursuant to Directive 74/297/EEC, or subsequent extensions to this approval.

4. With effect from 1 October 2000, Member States shall consider certificates of conformity which accompany new vehicles in accordance with Directive 70/156/EEC to be no longer valid for the purposes of Article 7(1) of that Directive, if the requirements of this Directive are not fulfilled.

Article 3

Annex IV to Directive 70/156/EEC is hereby amended as follows:

1. In Part I, the following item is added:

   "53 Frontal impact resistance 95/.../EC L... X --------- "

2. In Part II, the following item is added:

   "53 Frontal impact resistance ... "

Article 4

1. In the framework of the adaptation of this Directive to technical progress, a second stage shall be adopted by the Commission. It shall be based on an impact test using an offset deformable barrier and biomechanical protection criteria as currently being developed by the European Experimental Vehicle Committee (EEVC), as outlined in Annex III to this Directive.

2. This second stage shall be applicable at the request of manufacturers on an optional basis from 1 October 1996 and shall be mandatory for new vehicle types approved from 1 October 1998.

2. This second stage shall be applicable to all new vehicles from 1 October 2003, subject to a report from the Commission to the European Parliament and Council to be made no later than 1 October 2001 on the operation of the Directive and the industrial feasibility of the above date.

Article 5

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive before 1 October 1995. They shall forthwith inform the Commission thereof.

   When Member States adopt these provisions, these shall contain a reference to this Directive or shall be accompanied by such reference at the time of their official publication. The procedure for such reference shall be adopted by Member States.

2. Member States shall communicate to the Commission the texts of the main provisions of national law which they adopt in the field covered by this Directive.

Article 6

This Directive shall enter into force on the twentieth day following that of its publication in the Official Journal of the European Communities.

Article 7

This Directive is addressed to the Member States.

Done at Brussels,

For the European Parliament
The President

For the Council
The President

LIST OF ANNEXES

ANNEX I

ADMINISTRATIVE PROVISIONS FOR TYPE-APPROVAL

1. APPLICATION FOR EEC TYPE APPROVAL

1.1 The application for EEC type-approval pursuant to Article 3 (4) of Directive 70/156/EEC of a vehicle type with regard to its frontal impact resistance shall be submitted by the manufacturer.

1.2 A model for the information document is given in Appendix 1.

1.3 A vehicle representative of the vehicle type to be approved shall be submitted to the technical service responsible for conducting the type-approval tests.

1.4 The manufacturer shall be entitled to present any data and results of tests carried out which make it possible to establish that compliance with the requirements can be achieved with a sufficient degree of confidence.

2. GRANTING OF EEC TYPE-APPROVAL

2.1 If the relevant requirements are satisfied, EEC type-approval pursuant to Article 4 (3) and, if applicable 4 (4) of Directive 70/156/EEC shall be granted.

2.2 A model for the EEC type-approval certificate is given in Appendix 2.

2.3 An approval number in accordance with Annex VII to Directive 70/156/EEC shall be assigned to each type of vehicle approved. The same Member State shall not assign the same number to another type of vehicle.

2.4 In case of doubt, account shall be taken, when verifying the compliance of the vehicle with the requirements of this Directive, of any data or test results provided by the manufacturer which can be taken into consideration in validating the approval test carried out by the approval authority.

3. MODIFICATION OF THE TYPE AND AMENDMENTS TO APPROVALS

3.1 In the case of modification of a vehicle type approved pursuant to this Directive, the provisions of Article 5 of Directive 70/156/EEC shall apply.

3.2 Any modification of the vehicle affecting the general form of the structure of the vehicle and/or any increase in mass greater than 8 % which in the judgement of the authority would have a marked influence on the results of the tests shall require a repetition of the test as described in Appendix 1 of Annex II;

3.3 If the modifications concern only the interior fittings, if the mass does not differ by more than 8 % and if the number of front seats initially provided in the vehicle remains the same, the following shall be carried out:

3.3.1 A simplified test as provided for in Appendix 4 of Annex II and/or,

3.3.2 A partial test as defined by the technical service in relation to the modifications made.

4. CONFORMITY OF PRODUCTION

4.1 As a general rule, measures to ensure the conformity of production shall be taken in accordance with the provisions laid down in Article 10 of Directive 70/156/EEC.

ANNEX I

Appendix 1

Information document No .....

pursuant to Annex I of Council Directive 70/156/EEC*

relating to the EEC type-approval of a vehicle with respect to

frontal impact resistance

The following information, if applicable, must be supplied in triplicate and include a list of contents. Any drawings must be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, must show sufficient detail.

If the systems, components or separate technical units have electronic controls, information concerning their performance must be supplied.

0	**GENERAL**
0.1	Make (trade name of manufacturer):
0.2	Type and general commercial description(s):
0.3	Means of identification of type, if marked on the vehicle[b]:
0.3.1	Location of that marking:
0.4	Category of vehicle[c]:
0.5	Name and address of manufacturer:
0.8	Address(es) of assembly plant(s):
1.	**GENERAL CONSTRUCTION CHARACTERISTICS OF THE VEHICLE**
1.1	Photographs and/or drawings of a representative vehicle:
1.6	Position and arrangement of the engine :
9.	**BODYWORK**
9.1	Type of bodywork :
9.2	Materials used and methods of construction :
9.10	Interior fittings
9.10.3	Seats
9.10.3.1	Number :
9.10.3.2	Position and arrangement :

Date, file

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* The item numbers and footnotes used in this Information Document correspond to those set out in Annex I to Directive 70/156/EEC.

Items not relevant for the purposes of this Directive are omitted.

ANNEX 1

Appendix 2

MODEL

(maximum format : A4 (210 x 297 mm)

EEC TYPE-APPROVAL CERTIFICATE

STAMP OF ADMINISTRATION

Communication concerning the

- type-approval(1)
- extension of type-approval(1)
- refusal of type-approval(1)
- withdrawal of type-approval(1)

of a type of vehicle/component/separate technical unit(1) with regard to Directive ../.../EEC, as last amended by Directive ../.../EEC(1)

Type-approval Number .....

Reason for extension .....

SECTION I

0.1 Make (trade name of manufacturer):

0.2 Type and general commercial description(s):

0.3 Means of identification of type, if marked on the vehicle/component/separate technical unit(1)(2):

0.3.1 Location of that marking:

0.4 Category of vehicle(3):

0.5 Name and address of manufacturer:

0.7 In the case of components and separate technical units, location and method of affixing of the EEC type-approval mark:

0.8 Address(es) of assembly plant(s):

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(1) Delete where not applicable.

(2) If the means of identification of type contains characters not relevant to a description of the vehicle, component or separate technical unit types covered by this type-approval certificate, such characters shall be represented in the documentation by the symbol "?" (e.g. ABC??123???).

(3) As defined in Annex II A to Directive 70/156/EEC.

SECTION II

1 Additional information (where applicable) (see Addendum)

2 Technical service responsible for carrying out the tests:

3 Date of test report:

4 Number of test report:

5 Remarks (if any) (see Addendum)

6 Place:

7 Date:

8 Signature:

9 The index to the information package lodged with the approval authority, which may be obtained on request, is attached.

ADDENDUM

to EEC type-approval certificate no .....

concerning the type-approval of a vehicle with regard to

Directive / /EEC.

1 Additional information

1.1 Brief description of the vehicle type as regards its structure, dimensions, lines and constituent materials :

1.2 Description of the protective system installed in the vehicle :

1.3 Description of the interior arrangements or fittings that might affect the tests :

1.4 Site of engine : forward / rear / central[1]

1.5 Drive : front-wheel : rear-wheel[1]

1.6 Mass of vehicle submitted for testing -

Front axle :

Rear axle :

Total :

5 Remarks: (eg, valid for left-hand drive and right-hand drive vehicles)

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(1) Delete where not applicable.

ANNEX II

TECHNICAL REQUIREMENTS

30 Degree Angled Rigid Barrier Test

1. SCOPE

1.1 This Directive applies to power-driven vehicles of category M_1 of a total permissible mass not exceeding 2.5 tonnes, with the exception of multi-stage build vehicles produced in quantities not exceeding those fixed for a small series; heavier vehicles and multi-stage build vehicles may be approved at the request of the manufacturer;

2. DEFINITIONS

For the purposes of this Directive:

2.1 **"Protective system"** means interior fittings and devices intended to restrain the occupants and contribute towards ensuring compliance with the requirements set out in Paragraph 3 below;

2.2 **"Type of protective system"** means a category of protective devices which do not differ in such essential respects as:

their technology;
their geometry;
their constituent materials;

2.3 **"Angle of impact"** means the angle between a line drawn perpendicular to the front face of the barrier and the line along which the vehicle is travelling in a longitudinal forward direction;

2.4 **"Barrier face"** means the face of the element immediately behind the plywood facing;

2.5 **"Anti-slide devices"** means steel-profiles mounted vertically to the "barrier face" as specified in Appendix 1. Their purpose is to reduce the lateral movement of the vehicle relative to the barrier during impact;

2.6 **"Vehicle type"** means a category of power-driven vehicles which do not differ in such essential respects as:

2.6.1 The length and width of the vehicle, in so far as they have a negative effect on the results of the impact test prescribed in this Directive,

2.6.2 The structure, dimensions, lines and materials of the part of the vehicle forward of the transverse plane through the "R" point of the driver's seat in so far as they have a negative effect on the results of the impact test prescribed in this Directive,

2.6.3 The lines and inside dimensions of the passenger compartment and the type of protective system, in so far as they have a negative effect on the results of the impact test prescribed in this Directive,

2.6.4 The siting (front, rear or centre) and the orientation (transversal or longitudinal) of the engine,

2.6.5 The mass, in so far as there is a negative effect on the result of the impact test prescribed in this Directive,

2.6.6 The optional arrangements or fittings provided by the manufacturer, in so far as they have a negative effect on the result of the impact test prescribed in this Directive,

2.7 **"Passenger compartment"** means the space for occupant accommodation, bounded by the roof, floor, side walls, doors, outside glazing and the bulkhead and the plane of the rear compartment bulkhead or the plane of the rear-seat back support;

2.8 **"R" point** means a reference point defined for each seat by the manufacturer in relation to the vehicle's structure;

2.9 **"H" point** means a reference point determined for each seat by the testing service responsible for approval;

2.10 **"Unladen kerb mass"** means the mass of the vehicle in running order, unoccupied and unladen but complete with fuel, coolant, lubricant, tools and a spare wheel (if these are provided as standard equipment by the vehicle manufacturer).

2.11 **"Multi-stage build"** means the procedure whereby two or more manufacturers separately and sequentially participate in the construction of a vehicle

3 SPECIFICATIONS

3.1 General specifications applicable to all tests

3.1.1 The "H" point for each seat shall be determined in accordance with the procedure described in Annex III to Council Directive 77/649/EEC.

3.1.2 When the protective system for the front seating positions includes belts, the belt components shall meet the requirements of Directive 77/541/EEC, as amended.

3.1.3 Seating positions where a dummy is installed and the protective system includes belts, shall be provided with anchorage points conforming to Directive 76/115/EEC, as amended.

3.2 Specifications

3.2.1 The performance criteria recorded, in accordance with Appendix 2, on the dummies in the front outboard seats shall meet the following conditions:

3.2.1.1 The head performance criterion (HPC) shall be less than or equal to 1000,

3.2.1.2 The thorax performance criterion (ThPC) shall be less than or equal to 75 mm,

3.2.1.3 The femur performance criterion (FPC) shall be less than or equal to 10 kN;

3.2.2 During the test no door shall open;

3.2.3 During the test no locking of the locking systems of the front doors shall occur;

3.2.4 After the impact, it shall be possible, without the use of tools:

3.2.4.1 To open at least one door per seat row if the door exists, and where necessary, tilt the seat-backs or seats to allow the evacuation of all the occupants[1],

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(1) This requirement shall not apply to vehicles not having a roof of rigid construction.

3.2.4.2 To release the dummies from the restraint system, which, if locked, shall be capable of being opened by a maximum pressure of 6 daN on the release control,

3.2.4.3 To remove the dummies intact from the vehicle;

3.2.5 No more than slight leakage of liquid from the fuel feed installation shall occur on collision;

3.2.6 If there is continuous leakage of liquid from the fuel-feed installation after the collision, the rate of leakage shall not exceed 5×10^{-4} kg/s; if the liquid from the fuel-feed system mixes with liquids from the other systems and the various liquids cannot easily be separated and identified, all the liquids collected shall be taken into account in evaluating the continuous leakage.

Appendix 1

TEST PROCEDURE

1. INSTALLATION AND PREPARATION OF THE VEHICLE

1.1 Testing ground

The test area shall be large enough to accommodate the run-up track, barrier and technical installations necessary for the test. The last part of the track, for at least 5 m before the barrier, shall be horizontal, flat and smooth.

1.2 Barrier

The barrier shall consist of a block of reinforced concrete not less than 3 m wide in front and not less than 1.5 m high. The barrier shall be of such thickness that its mass is not less than 7×10^4 kg. The front face shall be vertical: a line drawn perpendicular to the face shall form an angle of 30° with the line which the vehicle travels in a longitudinal forward direction, and the face shall be covered with plywood boards 20 mm thick in good condition. In addition, the ASD (steel profiles 40/40 mm) shall be mounted vertically at a distance of 350 mm left and right of the theoretical point of impact of the vehicle's longitudinal plane of symmetry (see Figure 1). The barrier shall be anchored in the ground with, if necessary, additional arresting devices to prevent its displacement.

1.3 Orientation of the barrier

The orientation of the angle of 30° shall be such that the first contact of the vehicle with the barrier shall be on the steering-column side. Where there is a choice between carrying out the test with a right-hand or left-hand drive vehicle, the test shall be carried out with the less favourable orientation as determined by the official laboratory responsible for the tests.

1.4 State of vehicle

1.4.1 General specification

The test vehicle shall be representative of the series production, shall include all the equipment normally fitted and shall be in normal running order. Some components may be replaced by equivalent masses where this substitution clearly has no noticeable effect on the results measured under Paragraph 6.

1.4.2 Mass of vehicle

1.4.2.1 For the test, the mass of the vehicle submitted shall be the unladen kerb mass;

1.4.2.2 The fuel tank shall be filled with water to mass equal to 90 % of the mass of a full tank as specified by the manufacturer;

1.4.2.3 All the other systems (brake, cooling, etc.) may be empty; in this case the mass of the liquids shall be offset.

1.4.2.4 If the mass of the measuring apparatus on board the vehicle exceeds the 25 kg allowed, it may be compensated by reductions which have no noticeable effect on the results measured under Paragraph 6 below;

1.4.2.5 The mass of the measuring apparatus shall not change each axle reference load by more than 5 %, each variation not exceeding 20 kg;

1.4.2.6 The mass of the vehicle resulting from the provisions of Paragraph 1.4.2.1 above shall be indicated in the report.

1.4.3 Passenger compartment adjustments

1.4.3.1 Position of steering wheel

The steering wheel, if adjustable, shall be placed in the normal position indicated by the manufacturer or, failing that, midway between the limits of its range(s) of adjustment. At the end of propelled travel, the steering wheel shall be left free, with its spokes in the position which according to the manufacturer corresponds to straight-ahead travel of the vehicle.

1.4.3.2 Glazing

The movable glazing of the vehicle shall be in the closed position. For test measurement purposes and in agreement with the manufacturer, it may be lowered, provided that the position of the operating handle corresponds to the closed position.

1.4.3.3 Gear-change lever

The gear-change lever shall be in the neutral position.

1.4.3.4 Pedals

The pedals shall be in their normal position of rest.

1.4.3.5 Doors

The doors shall be closed but not locked.

1.4.3.6 Opening roof

If an opening or removable roof is fitted, it shall be in place and in the closed position. For test measurement purposes and in agreement with the manufacturer, it may be open.

1.4.3.7 Sun-visor

The sun-visors shall be in the stowed position.

1.4.3.8 Rear-view mirror

The interior rear-view mirror shall be in the normal position of use.

1.4.3.9 Arm-rests

Arm-rests at the front and rear, if movable, shall be in the lowered position, unless this is prevented by the position of the dummies in the vehicles.

1.4.3.10 Head restraints

Head restraints adjustable for height shall be in their uppermost position.

1.4.3.11 Seats

1.4.3.11.1 Position of front seats

Seats adjustable longitudinally shall be placed so that their "H" point, (see 3.1.1) is in the middle position of travel or in the nearest locking position thereto, and at the height position defined by the manufacturer (if independently adjustable for height).

In the case of a bench seat, the reference shall be to the "H" point of the driver's place.

1.4.3.11.2 Position of the front seat-backs

If adjustable, the seat-backs shall be adjusted so that the resulting inclination of the torso of the dummy 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, to 25° towards the rear from the vertical.

1.4.3.11.3 Rear seats

If adjustable, the rear seats or rear bench seats shall be placed in the rearmost position

2. DUMMIES

2.1 Front seats

2.1.1 A dummy corresponding to the specifications for Hybrid III[1] and meeting the specifications for its adjustment shall be installed in each of the front outboard seats in accordance with the conditions set out in Appendix 3. The dummy shall be equipped for recording the data necessary to determine the performance criteria with measuring systems corresponding to the specifications in Appendix 5.

2.1.2 The adjustment of the dummy shall be approximately the same before and after the test.

2.1.3 The car will be tested with restraint systems, as provided by the manufacturer.

3. PROPULSION OF VEHICLE

3.1 The vehicle shall not be propelled by its own engine;

3.2 At the moment of impact the vehicle shall no longer be subject to the action of any additional steering or propelling device;

3.3 It shall reach the obstacle on a course which is not more than 150 mm laterally out of line with the theoretical course in either direction.

4. TEST SPEED

Vehicle speed at the moment of impact shall be 50 + 0, - 2 km/h. However, if the test was performed at a higher impact speed and the vehicle met the requirements, the test shall be considered satisfactory.

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(1) The technical specifications and detailed drawings of Hybrid III, corresponding to the principal dimensions of a 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.

5. MEASUREMENTS TO BE MADE ON DUMMY IN FRONT SEATS

5.1 All the measurements necessary for the verification of the performance criteria shall be made with measurement systems corresponding to the specifications of Appendix 5.

5.2 The different parameters shall be recorded through independent data channels of the following CFC (Channel Frequency Class):

5.2.1 Measurements in the head of the dummy

The acceleration (a) referring to the centre of gravity is calculated from the triaxial components of the acceleration measured with a CFC of 1000.

5.2.2 Measurements in the thorax of the dummy

The chest deflection shall be measured with a CFC of 180.

5.2.3 Measurements in the femur of the dummy

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

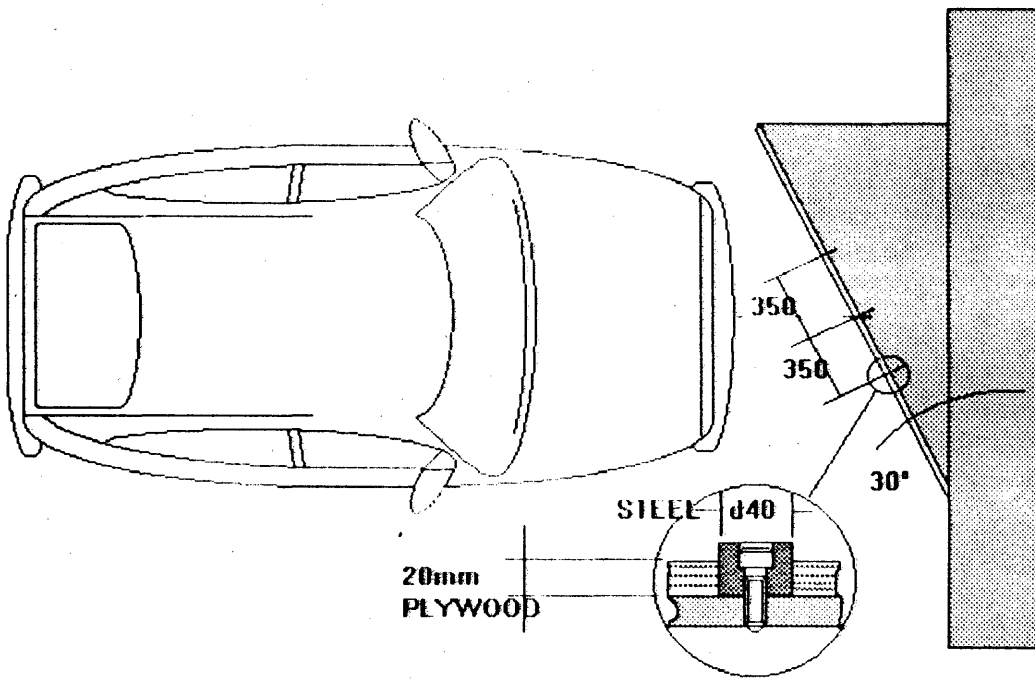
6. MEASUREMENTS TO BE MADE ON THE VEHICLE

6.1 To enable the simplified test described in Appendix 4 to be carried out, the deceleration time history of the structure shall be determined on the basis of the value of the longitudinal accelerometers at the base of the "B" pillar on the struck side of the vehicle with a CFC of 180 by means of data channels corresponding to the requirements set out in Appendix 5.

6.2 The speed time history which will be used in the test procedure described in Appendix 4 shall be obtained from the longitudinal accelerometer at the "B" pillar on the struck side.

FIGURE 1

30° Barrier with ASD (Anti-Slide Devices)



Appendix 2

DETERMINATION OF PERFORMANCE CRITERIA

1. HEAD PERFORMANCE CRITERION (HPC)

1.1 This criterion is considered to be satisfied when, during the test, there is no contact between the head and any vehicle component;

1.2 If that is not the case, a calculation of the value of HPC is made, on the basis of the acceleration (a), measured according to Annex II, Appendix 1, Paragraph 5.2.1, by the following expression:

$$HPC \quad (t_2 \quad t_1)\left[\frac{1}{t_2 \quad t_1}\int_{t_1}^{t_2} a\,dt\right]^{2.5}$$

in which:

1.2.1 If the beginning of the head contact can be determined satisfactorily, t_1 and t_2 are the two time instants, expressed in seconds, defining an interval between the beginning of the head contact and the end of the recording for which the value of HPC is maximum;

1.2.2 If the beginning of the head contact cannot be determined, t_1 and t_2 are the two time instants, expressed in seconds, defining a time interval between the beginning and the end of the recording for which the value of HPC is maximum.

2. THORAX PERFORMANCE CRITERION (ThPC)

2.1 This criterion is determined by the absolute value of the thorax deformation, expressed in mm and measured according to Annex II, Appendix 1, Paragraph 5.2.2.

3. FEMUR PERFORMANCE CRITERION (FPC)

3.1 This criterion is determined by the compression load expressed in kN, transmitted axially on each femur of the dummy and measured according to Annex II, Appendix 1, Paragraph 5.2.3.

Appendix 3

ARRANGEMENT AND INSTALLATION OF DUMMIES AND ADJUSTMENT OF RESTRAINT SYSTEMS

1. ARRANGEMENT OF DUMMIES

1.1 Separate seats

The plane of symmetry of the dummy shall coincide with the vertical median plane of the seat.

1.2 Front bench seat

1.2.1 Driver

The plane of symmetry of the dummy shall lie in the vertical plane passing through the steering wheel centre and parallel to the longitudinal median plane of the vehicle. If the seating position is determined by the shape of the bench, such seat shall be regarded as a separate seat.

1.2.2 Outer passenger

The plane of symmetry of the dummy shall be symmetrical with that of the driver dummy relative to the longitudinal median plane of the vehicle. If the seating position is determined by the shape of the bench, such seat shall be regarded as a separate seat.

1.3 Bench seat for front passengers (not including driver)

The planes of symmetry of the dummy shall coincide with the median planes of the seating positions defined by the manufacturer

1.4 Rear bench seat

The dummy shall be placed in a longitudinal plane substantially corresponding to the place of symmetry of the driver dummy.

2. INSTALLATION OF DUMMIES

2.1 Head

The transverse instrumentation platform of the head shall be horizontal within 0.5°. To level the head of the test dummy in vehicles with upright seats with non-adjustable backs, the following sequences must be followed. First adjust the position of the H-point within the limits set forth in Paragraph 2.4.3.1 of this Appendix to level the transverse instrumentation platform of the head of the test dummy. If the transverse instrumentation platform of the head is still not level, then adjust the pelvic angle of the test dummy within the limits provided in Paragraph 2.4.3.2. of this Appendix. If the transverse instrumentation platform of the head is still not level, then adjust the neck bracket of the test dummy the minimum amount necessary to ensure that the transverse instrumentation platform of the head is horizontal within 0.5°.

2.2 Arms

2.2.1 The driver's upper arms shall be adjacent to the torso with the centrelines as close to a vertical plane as possible.

2.2.2 The passenger's upper arms shall be in contact with the seat back and the sides of the torso.

2.3 Hands

2.3.1 The palms of the driver test dummy shall be in contact with the outer part of the steering wheel rim at the rim's horizontal centreline. The thumbs shall be over the steering wheel rim and shall be lightly taped to the steering wheel rim so that if the hand of the test dummy is pushed upward by a force of not less than 8.9 N and not more than 22.2 N, the tape shall release the hand from the steering wheel rim.

2.3.2 The palms of the passenger test dummy shall be in contact with outside of thigh. The little finger shall be in contact with the seat cushion.

2.4 Torso

2.4.1 In vehicles equipped with bench seats, the upper torso of the driver and passenger test dummies shall rest against the seat back. The midsagittal plane of the driver dummy shall be vertical and parallel to the vehicle's longitudinal centreline, and pass through the centre of the steering wheel rim. The midsagittal plane of the passenger dummy shall be vertical and parallel to the vehicle's longitudinal centreline and the same distance from the vehicle's longitudinal centreline as the midsagittal plane of the driver dummy.

2.4.2 In vehicles equipped with individual seats, the upper torso of the driver and passenger test dummies shall rest against the seat back. The midsagittal plane of the driver and the passenger dummy shall be vertical and shall coincide with the longitudinal centreline of the individual seat.

2.4.3 Lower torso

2.4.3.1 H-point

The H-point of the driver and passenger test dummies shall coincide within 13 mm in the vertical dimension and 13 mm in the horizontal dimension of a point 6 mm below the position of the H-point except that the length of the thigh and lower leg segments of the H-point machine shall be adjusted to 414 and 401 mm, instead of the 432 and 417 mm respectively.

2.4.3.2 Pelvic angle

As determined using the pelvic angle gauge(1) inserted into the H-point gauging hole of the dummy, the angle measured from the horizontal on the 76.2 mm flat surface of the gauge shall be 22.5° ± 2.5°.

2.5 Legs

The upper legs of the driver and passenger test dummies shall rest against the seat cushion to the extent permitted by placement of the feet. The initial distance between

(1) Until an international standard has been adopted for this item, gauges conforming to GM drawing 78051-532, referencing Part 572, shall be used.

the outboard knee clevis flange surfaces shall be 269 mm . To the extent practicable, the left leg of the driver dummy and both legs of the passenger dummy shall be in vertical longitudinal planes. To the extent practicable, the right leg of the driver dummy shall be in a vertical plane. Final adjustment to accommodate placement of feet in accordance with Paragraph 2.6 for various passenger compartment configurations is permitted.

2.6 Feet

2.6.1 The right foot of the driver test dummy shall rest on the undepressed accelerator with the rearmost point of the heel on the floor surface in the plane of the pedal. If the foot cannot be placed on the accelerator pedal, it shall be positioned perpendicular to the tibia and placed as far forward as possible in the direction of the centreline of the pedal with the rearmost point of the heel resting on the floor surface. The heel of the left foot shall be placed as far forward as possible and shall rest on the floor pan. The left foot shall be positioned as flat as possible on the toeboard. The longitudinal centreline of the left foot shall be placed as parallel as possible to the longitudinal centreline of the vehicle.

2.6.2 The heels of both feet of the passenger test dummy shall be placed as far forward as possible and shall rest on the floor pan. Both feet shall be positioned as flat as possible on the toeboard. The longitudinal centreline of the feet shall be placed as parallel as possible to the longitudinal centreline of the vehicle.

2.7 The measuring instruments installed shall not in any way affect the movement of the dummy during impact.

2.8 The temperature of the dummies and the system of measuring instruments shall be stabilised before the test and maintained so far as possible within a range between 19 °C and 22 °C.

3. ADJUSTMENT OF RESTRAINT SYSTEM

With the test dummy at its designated seating position as specified by the appropriate requirements of Paragraphs 2.1 through 2.6, place the belt around the test dummy and fasten the latch. Remove all slack from the lap belt. Pull the upper torso webbing out of the retractor and allow it to retract; Repeat this operation four times. Apply a tension load of between 8.9 and 17.8 N to the lap belt. If the belt system is equipped with a tension-relieving device, introduce the maximum amount of slack into the upper torso belt that is recommended by the manufacturer for normal use in the owner's manual for the vehicle. If the belt system is not equipped with a tension-relieving device, allow the excess webbing in the shoulder belt to be retracted by the retractive force of the retractor.

Appendix 4

TEST PROCEDURE WITH TROLLEY

1. TEST INSTALLATION AND PROCEDURE

1.1 Trolley

The trolley shall be so constructed that no permanent deformation appears after the test. It shall be so guided that, during the impact phase, the deviation in the vertical plane does not exceed 5° and 2° in the horizontal plane.

1.2 State of the structure

1.2.1 General

The structure tested shall be representative of the series production of the vehicles concerned. Some components may be replaced or removed where such replacement or removal clearly has no effect on the test results.

1.2.2 Adjustments

Adjustments shall conform to those set out in Paragraph 1.4.3 of Appendix 1 to this Directive, taking into account what is stated in Paragraph 1.2.1.

1.3 Attachment of the structure

1.3.1 The structure shall be firmly attached to the trolley in such a way that no relative displacement occurs during the test.

1.3.2 The method used to fasten the structure to the trolley shall not have the effect of strengthening the seat anchorages or restraint devices, or of producing any abnormal deformation of the structure.

1.3.3 The attachment device recommended is that whereby the structure rests on supports placed approximately in the axis of the wheels or, if possible, whereby the structure is secured to the trolley by the fastenings of the suspension system.

1.3.4 The angle between the longitudinal axis of the vehicle and the trolley shall be 12° ± 2° from the struck vehicle.

1.4 Dummies

The dummies and their positioning shall conform to the specifications in Appendix 1, Paragraph 2.

1.5 Measuring apparatus

1.5.1 Deceleration of the structure

The position of the transducers measuring the deceleration of the structure during the impact shall be parallel to the longitudinal axis of the trolley according to the specifications of Appendix 5 (CFC 180).

1.5.2 Measurements to be made on the dummies

All the measurements necessary for checking the listed criteria are set out in Appendix 1, Paragraph 5.

1.6 Deceleration curve of the structure

The deceleration curve of the structure during the impact phase shall be such that the "variation of speed in relation to time" curve obtained by integration at no point differs by more than ± 1 m/s from the "variation of speed in relation to time" reference curve of the vehicle concerned as defined in Figure 1 of this Appendix. A displacement with regard to the time axis of the reference curve may be used to obtain the structure velocity inside the corridor.

1.7 Reference curve $\Delta V = f(t)$ of the vehicle concerned

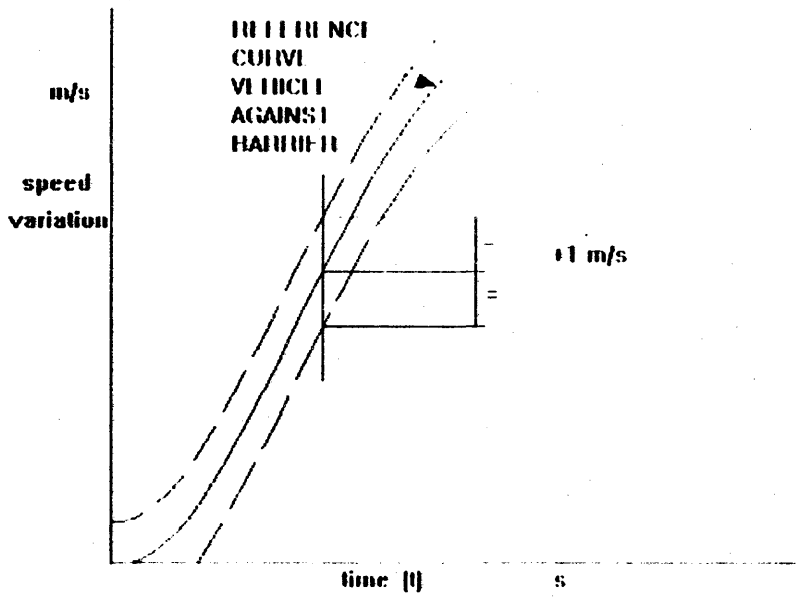
This reference curve is obtained by integration of the deceleration curve of the vehicle concerned measured in the frontal collision test against a barrier as provided for in Paragraph 6 of Appendix 1 to this Directive.

1.8 Equivalent method

The test may be performed by some other method than that of deceleration of a trolley, provided that such method complies with the requirement concerning the range of variation of speed described in Paragraph 1.6.

Appendix 4 - Figure 1

EQUIVALENCE CURVE - TOLERANCE BAND FOR CURVE V = f(t)



Appendix 5

TECHNIQUE OF MEASUREMENT IN MEASUREMENT TESTS: INSTRUMENTATION

1. DEFINITIONS

1.1 Data channel

A data channel comprises all the instrumentation from a transducer (or multiple transducers whose outputs are combined in some specified way) up to and including any analysis procedures that may alter the frequency content or the amplitude content of data.

1.2 Transducer

The first device in a data channel used to convert a physical quantity to be measured into a second quantity (such as an electrical voltage) which can be processed by the remainder of the channel.

1.3 Channel amplitude class: CAC

The designation for a data channel that meets certain amplitude characteristics as specified in this Appendix. The CAC number is numerically equal to the upper limit of the measurement range.

1.4 Characteristic frequencies F_H, F_L, F_N

These frequencies are defined in Figure 1.

1.5 Channels frequency class: CFC

The channel frequency class is designated by a number indicating that the channel frequency response lies within the limits specified in Figure 1. This number and the value of the frequency F_H in Hz are numerically equal.

1.6 Sensitivity coefficient

The slope of the straight line representing the best fit to the calibration values determined by the method of least square within the channel amplitude class.

1.7 Calibration factor of a data channel

The mean value of the sensitivity coefficients evaluated over frequencies which are evenly spaced on a logarithmic scale between F_L and $0.4\ F_H$

1.8 Linearity error

The ratio, in per cent, of the maximum difference between the calibration value and the corresponding value read on the straight line defined in Paragraph 1.6. at the upper limit of the channel amplitude class.

1.9 Cross sensitivity

The ratio of the output signal to the input signal, when an excitation is applied to the transducer perpendicular to the measurement axis. It is expressed as a percentage of the sensitivity along the measurement axis.

1.10 Phase delay time

The phase delay time of a data channel is equal to the phase delay (in radians) of a sinusoidal signal, divided by the angular frequency of that signal (in radians/s).

1.11 Environment

The aggregate, at a given moment, of all external conditions and influences to which the data channel is subjected.

2. PERFORMANCE REQUIREMENTS

2.1 Linearity error

The absolute value of the linearity error of a data channel at any frequency in the CFC, shall be equal to or less than 2.5 % of the value of the CAC, over the whole measurement range.

2.2 Amplitude against frequency

The frequency response of a data channel shall lie within the limiting curves given in Figure 1. The zero dB line is determined by the calibration factor.

2.3 Phase delay time

The phase delay time between the input and the output signals of a data channel shall be determined and shall not vary by more than 0.1 F_{11} s between 0.03 F_{11} and F_{11}

2.4 Time

2.4.1 Time base

A time base shall be recorded and shall at least give 10 ms with an accuracy of 1 %.

2.4.2 Relative time delay

The relative time delay between the signal of two or more data channels, regardless of their frequency class, must not exceed 1 ms excluding delay caused by phase shift.

Two or more data channels of which the signals are combined shall have the same frequency class and shall not have relative time delay greater than 0.1 F_{11} s.

This requirement applies to analogue signals as well as to synchronisation pulses and digital signals.

2.5 Transducer cross sensitivity

The transducer cross sensitivity shall be less than 5 % in any direction.

2.6 Calibration

2.6.1 General

A data channel shall be calibrated at least once a year against reference equipment traceable to known standards. The methods used to carry out a comparison with reference equipment shall not introduce an error greater than 1 % of the CAC. The use of the reference equipment is limited to the frequency range for which they have been calibrated. Subsystems of a data channel may be evaluated individually and the results factored into the accuracy of the total data channel. This can be done for example by an electrical signal of known amplitude simulating the output signal of the transducer which allows a check to be made on the gain factor of the data channel, excluding the transducer.

2.6.2 Accuracy of reference equipment for calibration

The accuracy of the reference equipment shall be certified or endorsed by an official metrology service.

2.6.2.1 Static calibration

2.6.2.1.1 Accelerations

The errors shall be less than ± 1.5 % of the channel amplitude class.

2.6.2.1.2 Forces

The error shall be less than ± 1 % of the channel amplitude class.

2.6.2.1.3 Displacements

The error shall be less than ± 1 % of the channel amplitude class.

2.6.2.2 Dynamic calibration

2.6.2.2.1 Accelerations

The error in the reference accelerations expressed as a percentage of the channel amplitude class shall be less than ± 1.5 % below 400 Hz, less than ± 2 % between 400 Hz and 900 Hz, and less than ± 2.5 % above 900 Hz.

2.6.2.3 Time

The relative error in the reference time shall be less than 10^{-5}.

2.6.3 Sensitivity coefficient and linearity error

The sensitivity coefficient and the linearity error shall be determined by measuring the output signal of the data channel against a known input signal for various values of this signal. The calibration of the data channel shall cover the whole range of the amplitude class.

For bi-directional channels, both the positive and negative values shall be used.

If the calibration equipment cannot produce the required input owing to the excessively high values of the quantity to be measured, calibrations shall be carried out within the limits of the calibration standards and these limits shall be recorded in the test report.

A total data channel shall be calibrated at a frequency or at a spectrum of frequencies having a significant value between F_L and 0.4 F_H

2.6.4 Calibration of the frequency response

The response curves of phase and amplitude against frequency shall be determined by measuring the output signals of the data channel in terms of phase and amplitude against a known input signal, for various values of this signal varying between F_L and 10 times the CFC or 3000 Hz, whichever is lower.

2.7 Environmental effects

A regular check shall be made to identify any environmental influence (such as electric or magnetic flux, cable velocity, etc.). This can be done for instance by recording the output of spare channels equipped with dummy transducers. If significant output signals are obtained corrective action shall be taken, for instance by replacement of cables.

2.8 Choice and designation of the data channel

The CAC and CFC define a data channel.

The CAC shall be 1, 2 or 5 to a power of ten.

3. MOUNTING OF TRANSDUCERS

Transducers should be rigidly secured so that their recordings are affected by vibration as little as possible. Any mounting having a lowest resonance frequency equal to at least 5 times the frequency F_{II} of the data channel considered shall be considered valid. Acceleration transducers in particular should be mounted in such a way that the initial angle of the real measurement axis to the corresponding axis of the reference axis system is not greater than 5° unless an analytical or experimental assessment of the effect of the mounting on the collected data is made. When multi-axial accelerations at a point are to be measured, each acceleration transducer axis should pass within 10 mm of that point, and the centre of seismic mass of each accelerometer should be within 30 mm of that point.

4. RECORDING

4.1 Analogue magnetic recorder

Tape speed should be stable to within not more than 0.5 % of the tape speed used. The signal-to-noise ratio of the recorder should not be less than 42 dB at the maximum tape speed. The total harmonic distortion should be less than 3 % and the linearity error should be less than 1 % of the measurement range.

4.2 Digital magnetic recorder

Tape speed should be stable to within not more than 10 % of the tape speed used.

4.3 Paper tape recorder

In case of direct data recording the paper speed in mm/s should be at least 1.5 times the number expressing F_{II} in Hz. In other cases the paper speed should be such that equivalent resolution is obtained.

5. DATA PROCESSING

5.1 Filtering

Filtering corresponding to the frequencies of the data channel class may be carried out during either recording or processing of data. However, before recording, analogical filtering at a higher level than CFC should be effected in order to use at least 50 % of the dynamic range of the recorder and to reduce the risk of high frequencies saturating the recorder or causing aliasing errors in the digitilizing process.

5.2 Digitilizing

5.2.1 Sampling frequency

The sampling frequency should be equal to at least $8\ F_{II}$. In the case of analogue recording, when the recording and reading speeds are different, the sampling frequency can be divided by the speed ratio.

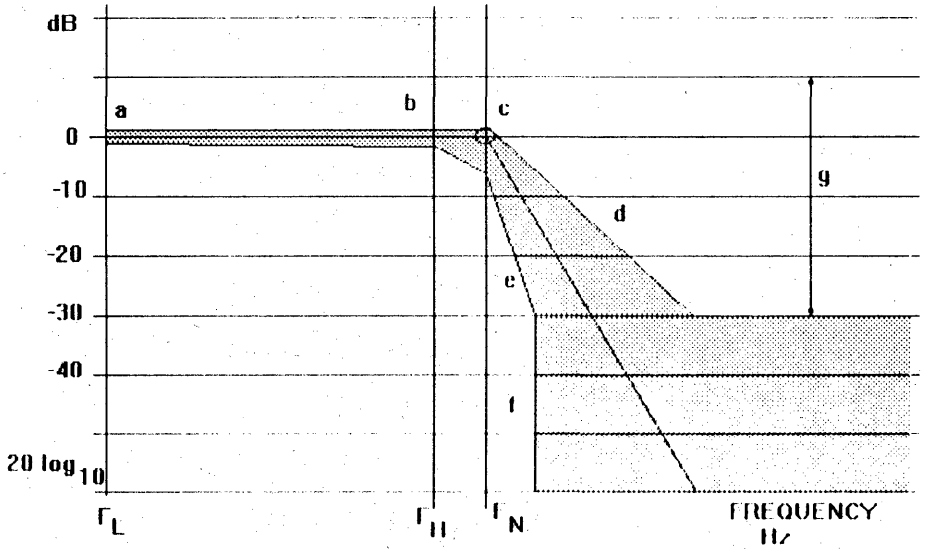
5.2.2 Amplitude resolution

The size of digital words should be at least 7 bits and a parity bit.

6. PRESENTATION OF RESULTS

The results should be presented on A4 size paper (210 x 297 mm). Results presented as diagrams should have axes scaled with a measurement unit corresponding to a suitable multiple of the chosen unit (for example, 1, 2, 5, 10, 20 mm). SI units shall be used, except for vehicle velocity, where km/h may be used, and for accelerations due to impact where g, with g = 9.81 m/s^2, may be used.

Figure 1. Frequency response curve



ANNEX III

OUTLINE REQUIREMENTS

Offset Deformable Barrier Test

In accordance with Article 4 of this Directive, the outline requirements of the Offset Deformable Barrier Test (ODBT), as developed by EEVC, are set out in this Annex and will be finalised when the validation stage of the work of is complete.

Annex III will follow the general arrangement of Annex II, and include the following items particular to the ODBT.

1. SCOPE

Unchanged

2. DEFINITIONS

Definitions of terms "overlap", "deformable barrier face", vehicle width" and "offset of the impact" shall be included.

3. SPECIFICATIONS

The performance requirements to be met shall be defined and shall include *inter alia* Head Performance Criterion (HPC), Thorax Compression Criterion (TCC), Viscous Criterion (VC), Neck Injury Criterion (NIC), Femur Force Criterion (FFC), Tibia Compression Force Criterion (TFCC) and residual steering wheel displacement.

Addendums shall be added for the NIC & FFC and the procedure for calculating VC.

Appendix 1 - Test Procedure

The design specification of the barrier to be used shall be defined in an addendum to this Appendix. This will include the size, shape, material and internal construction of the complete assembly that shall be attached to the front face of the concrete test block. A procedure for certifying the aluminium honeycomb structure shall also be included.

The test speed shall be in the range 56-60 km/h and the vehicle overlap shall be 40%.

Measurements shall be made in the femur and tibia of the dummy.

Appendix 2 - Determination of Performance Criteria

A time base for the determination of the femur performance criteria shall be added together with a new paragraph to cover Tibia Compressive Force Criterion.

Appendix 3 - Installation of Dummies and Restraint Systems

Unchanged

Appendix 4 - Test Procedure with Trolley

The angle between the longitudinal axis of the vehicle and the direction of motion of the trolley shall be $0°\pm1°$.

Appendix 5 - Technique of Measurement

Unchanged

IMPACT STATEMENT ON COMPETITIVENESS AND JOBS

Draft Council and Parliament Directive introducing provisions for the front-impact resistance of motor vehicles and amending directive 70/156/EEC in respect of the type approval of motor vehicles and their trailers.

I. What is the main justification of the measure?

the reduction in serious and fatal injuries sustained by occupants of motor vehicles and the harmonisation of national laws.

II. Characteristics of the companies involved. More particularly

Do they include a large number of small and medium-sized businesses? *No*

Are there any significant concentrations in regions

- eligible for Member State regional aid? *No*
- eligible under the European Regional Development Fund? *No*

III. What obligations are imposed on those companies?

To incorporate modifications to the frontal structure of new vehicle designs to withstand the impacting forces envisaged in this test procedure.

IV. What obligations are likely to be imposed indirectly upon those companies via the local authorities?

No additional obligation.

V. Do any special measures apply to small and medium-sized businesses? *No*

VI. What is the foreseeable outcome:

- on company productivity? *No foreseeable effect.*
- on jobs? *No foreseeable effect.*

VII. Have both sides of industry been consulted? *Yes*

Opinion of both sides of industry: *Subject to appropriate lead times, industry could accept these measures.*

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