INTERNATIONAL STANDARD

ISO 10997

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Passenger vehicles — Side impact with deformable moving barrier — Full scale test

Voitures particulières — Choc latéral avec barrière mobile déformable — Essai grandeur nature

Reference number
ISO 10997:1996(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 10997 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 10, *Impact test procedures*.

Annex A forms an integral part of this International Standard.

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Passenger vehicles — Side impact with deformable moving barrier — Full scale test

1 Scope

This International Standard describes a full scale test method for side (lateral) impact testing of passenger cars as defined in ISO 3833 with a front seat dummy. It is intended to facilitate uniform testing at different test facilities.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1176:1990, *Road vehicles — Masses — Vocabulary and codes.*

ISO 3833:1977, *Road vehicles — Types — Terms and definitions.*

ISO 6487:1987, *Road vehicles — Measurement techniques in impact tests — Instrumentation.*

ISO 6549:1980, *Road vehicles — Procedure for H-point determination.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 movable deformable barrier, MDB: Energy-absorbing movable barrier used to impact either side of the test vehicle.

3.2 impact point: Point marked on the side of the test vehicle as the target to be impacted by a selected point on the MDB.

4 Test facility and equipment

4.1 Impact test site

The impact test site shall be a level, smooth and hard surface which is of sufficient area for the MDB to reach the specified speed prior to impact and to permit deceleration by the MDB and the test vehicle while remaining on the surface of the test site.

The surface immediately on the impacted side of the stationary test vehicle shall be horizontal, flat and smooth for a length of at least 10 m in the direction of impact. There shall be no more than 1 % slope measured over a 1 m length for at least the last 10 m.

4.2 MDB characteristics

The MDB shall have an energy-absorbing face to represent the crush characteristics of the front of an average passenger car. The dimensions of the energy-absorbing impactor face shall be

width	1 500 mm ± 20 mm
height	500 mm ± 10 mm
depth	440 mm min.
surface	two flat parallel faces offset 60 mm ± 5 mm

Horizontally adjacent block faces shall lie in the same vertical plane within ± 5 mm.

The ground clearance at the lower edge of the MDB face shall be 260 mm ± 10 mm.

This layout is shown in figure 1. The deformation and the energy-absorbing characteristics of the impactor face and each of its six blocks are shown in figures 2 and 3.

The carriage to which the energy-absorbing MDB face is attached is shown in figure 4. The vertical plane of symmetry of the MDB face shall be coincident with the longitudinal vertical plane of the carriage with a tolerance of ± 10 mm.

The total mass of the MDB face, carriage and ballast as necessary shall be 1 100 kg ± 10 kg.

4.3 Impactor calibration

The supplier of the MDB face shall provide a certificate of calibration. The supplier shall also provide an analysis of his product's conformance to the calibration requirements. The calibration procedure is defined in annex A. The performance characteristics of the MDB face are acceptable if each block and the entire face fall within the force-deflection corridors shown in figure 2. Alternatively the performance characteristics are acceptable if each block and the entire face fall within the energy-deflection corridors shown in figure 3.

Dimensions in millimetres

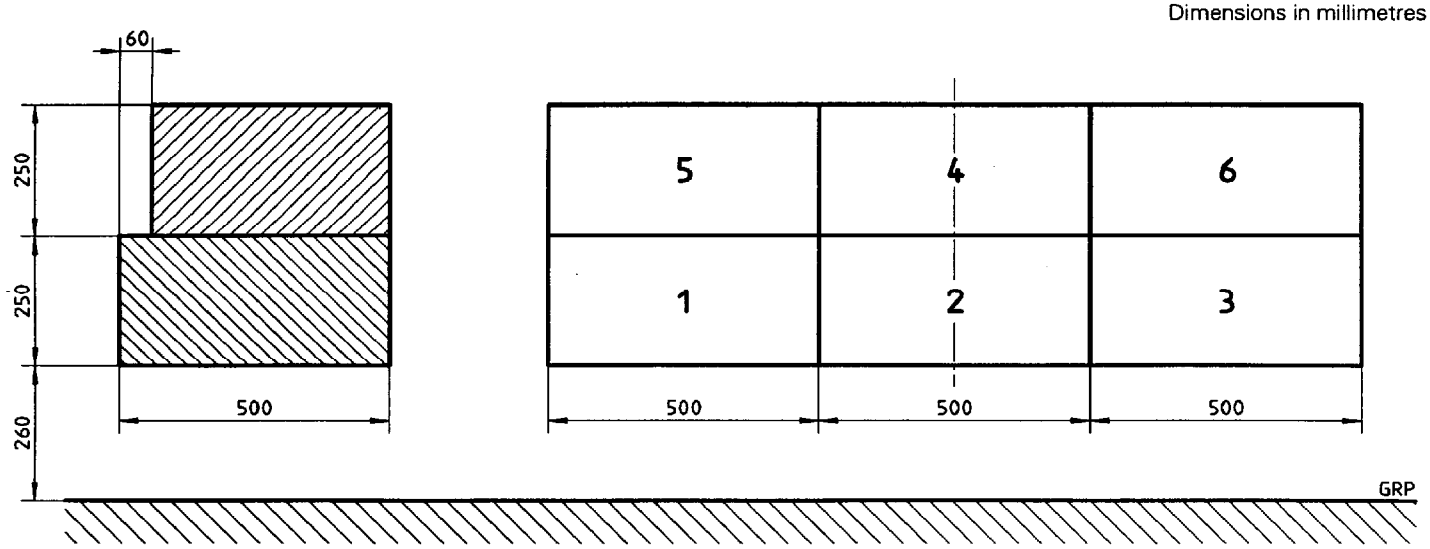
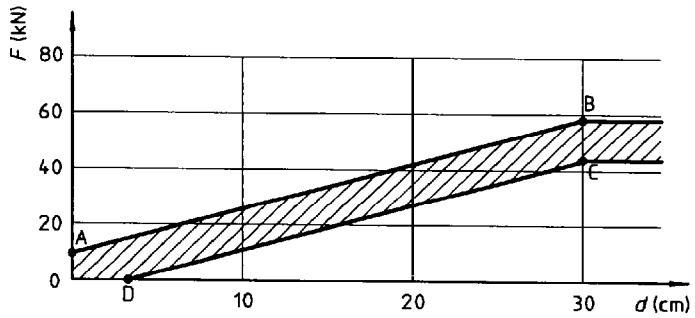


Figure 1 — Design of energy-absorbing MDB face

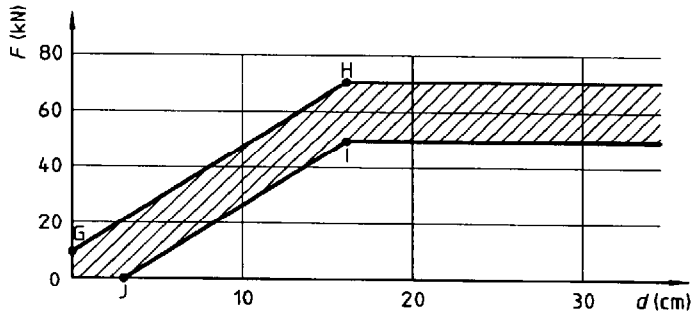
Force is expressed in kilonewtons

Blocks 1 and 3



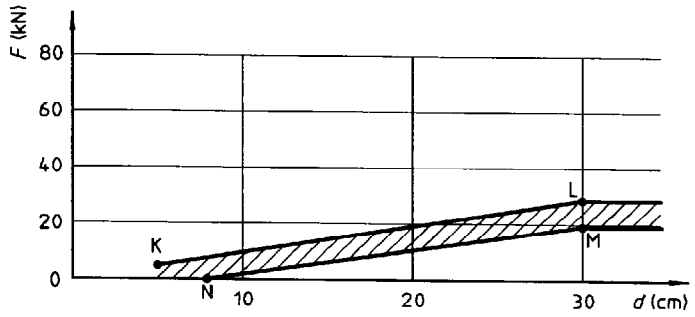
	d	F
A	0	10
B	30	58
C	30	43
D	3	0

Block 2



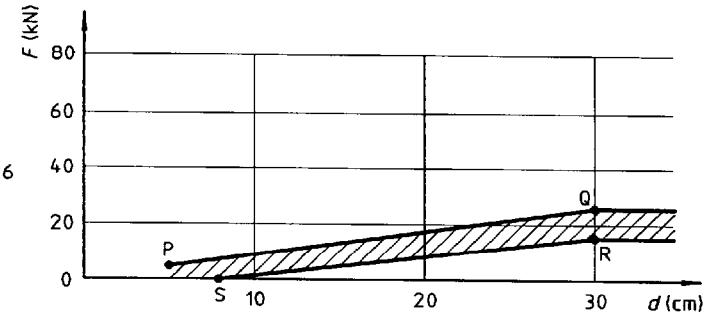
	d	F
G	0	10
H	16	70
I	16	50
J	3	0

Block 4



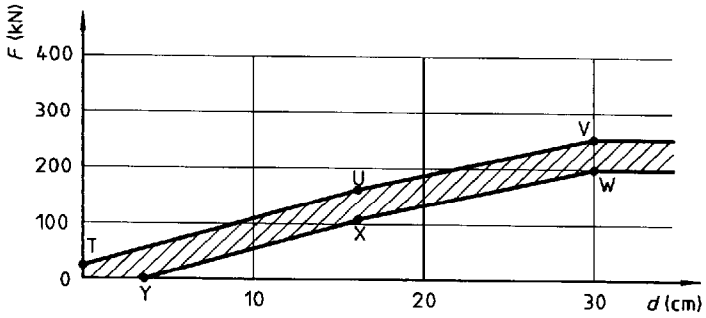
	d	F
K	5	5
L	30	28,5
M	30	18,5
N	8	0

Blocks 5 and 6



	d	F
P	5	5
Q	30	25,5
R	30	15,5
S	8	0

Total

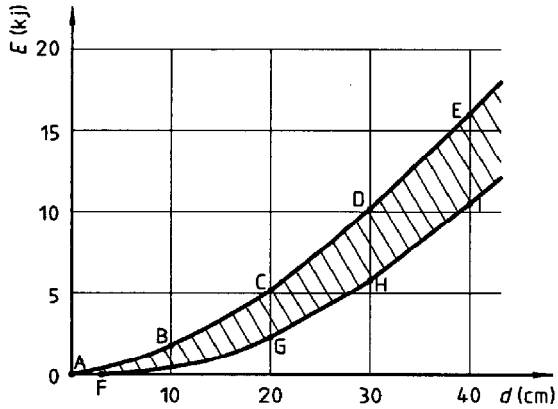


	d	F
T	0	25
U	16	165
V	30	255
W	30	205
X	16	115
Y	3	0

Figure 2 — Force/deflection

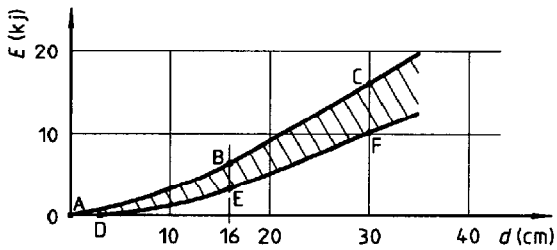
Energy is expressed in kilojoules

Blocks 1 and 3



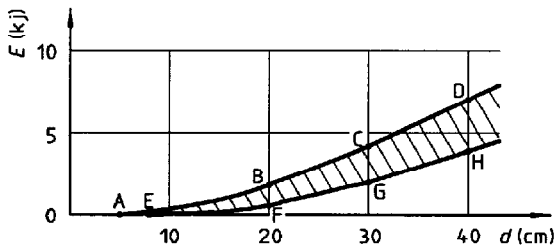
	d	E
A	0	0
B	10	1,8
C	20	5,2
D	30	10,2
E	40	16
F	3	0
G	20	2,3
H	30	5,8
I	40	10,1

Block 2



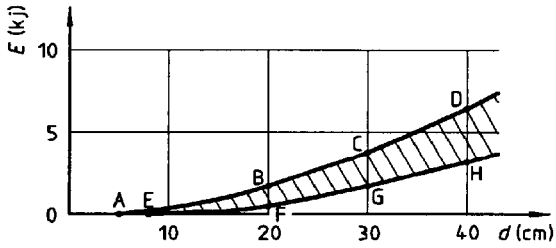
	d	E
A	0	0
B	16	6,4
C	30	16,2
D	3	0
E	16	3,25
F	30	10,25

Block 4



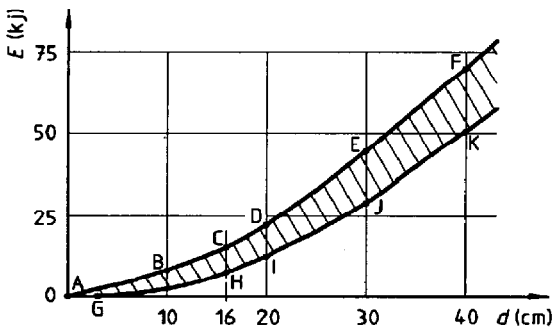
	d	E
A	5	0
B	20	1,8
C	30	4,2
D	40	7
E	8	0
F	20	0,6
G	30	2
H	40	3,9

Blocks 5 and 6



	d	E
A	5	0
B	20	1,7
C	30	3,8
D	40	6,4
E	8	0
F	20	0,5
G	30	1,7
H	40	3,2

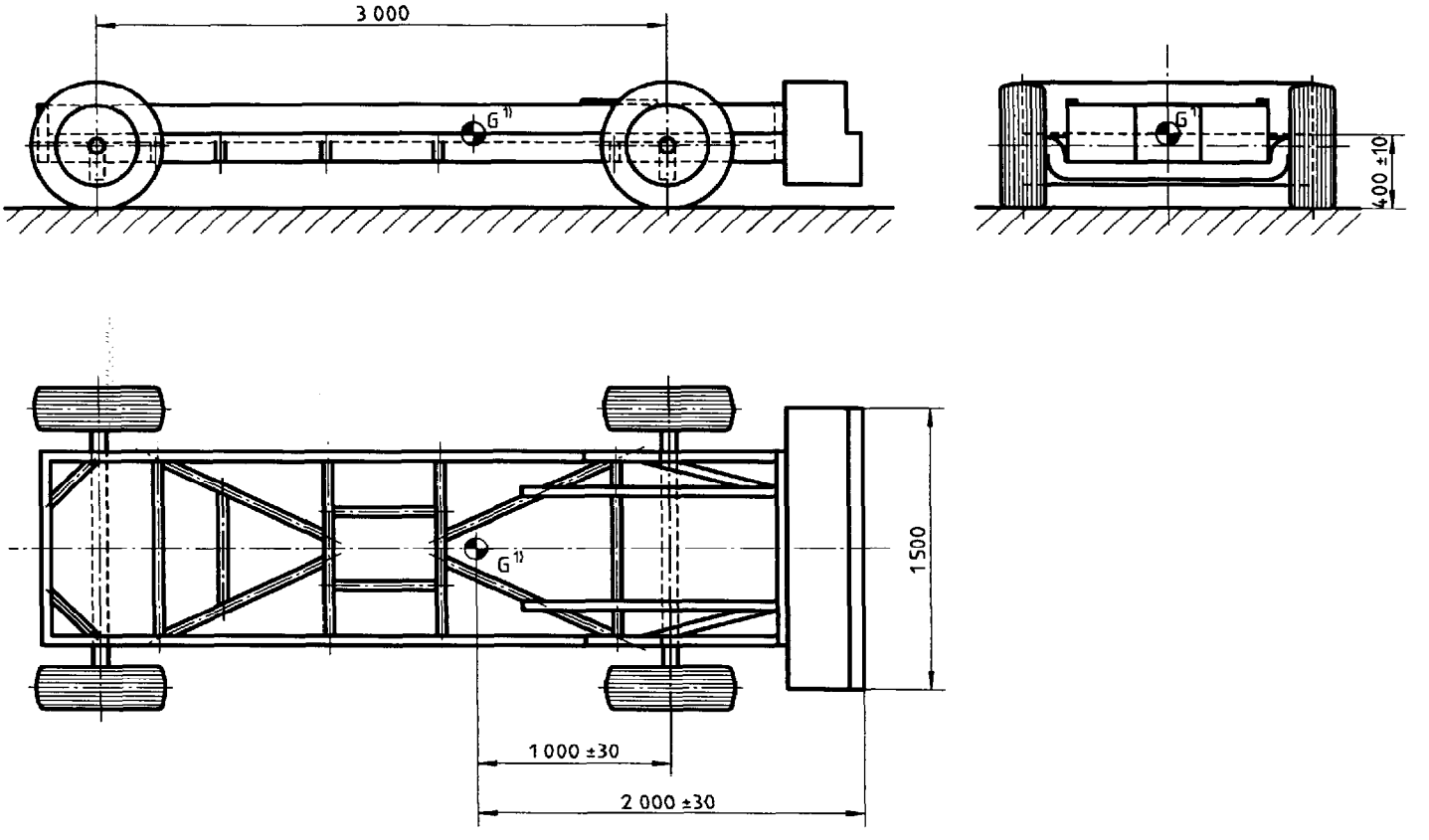
Total



	d	E
A	0	0
B	10	6,9
C	16	15,2
D	20	22,3
E	30	44,6
F	40	70,1
G	3	0
H	16	7,5
I	20	12,6
J	30	29,9
K	40	50,4

Figure 3 — Absorbed energy/deflection

Dimensions in millimetres
Tolerances ± 20 mm unless otherwise stated



1) Centre of gravity of the carriage, the ballast and the MDB face.

Figure 4 — Example of MDB carriage

4.4 Propulsion of MDB

The MDB shall be towed to a point no closer than 0,5 m from contact with the test vehicle, at which point it shall be released to travel freely. The MDB shall not be braked until after 200 ms from the time of contact. At the moment of impact, the MDB shall be moving at the prescribed velocity.

4.5 Impact point on test vehicle

The test vehicle may be impacted from either side. The impact point shall be visibly marked on the outside of the test vehicle.

The transverse plane of the vehicle passing through the R-point, as defined in ISO 6549, of the front seated occupant shall be coincident with the longitudinal median vertical plane of the MDB.

The maximum offset between the MDB and prescribed impact point shall be ± 30 mm.

The ground clearance at the lower edge of the MDB face, at the time of impact, shall be 260 mm ± 10 mm.

4.6 Angle of impact

The side impact shall be performed at an impact angle of 90° as shown in figure 5.

At the time of impact, the face of the MDB shall be parallel to the longitudinal centreline of the test vehicle with a maximum angular deviation of 3°.

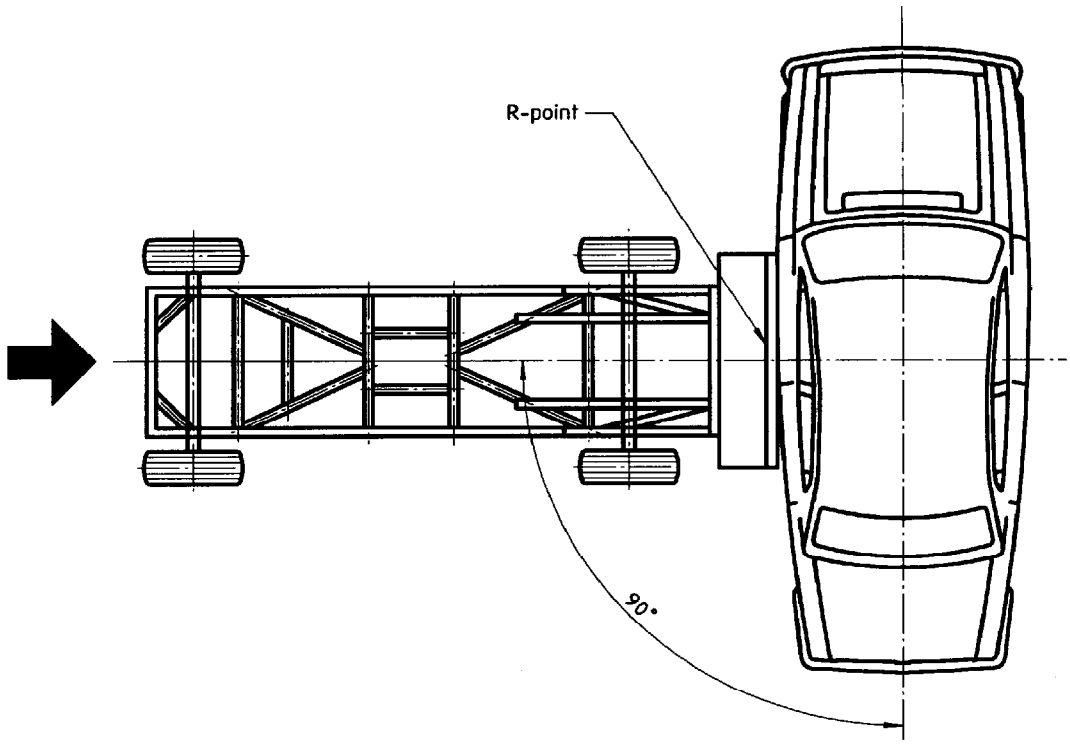


Figure 5 — Configuration of side impact test

4.7 Tolerances on impact speed

The impact speed shall be measured within 0,5 m of the test vehicle. The impact speed tolerance shall be ± 1 % of the desired speed.

5 Preparation of test vehicle

5.1 Mass of test vehicle

The vehicle test mass, m_t, shall be calculated as follows:

$$m_t = \text{ISO-M06} + m_l + m_d$$

where

ISO-M06 is as defined in ISO 1176:1990, definition 4.6, in kilograms;

m_l is rated cargo and luggage mass, in kilograms, equal to

ISO-M09 — (68 kg × DSC)

in which

ISO-M09 is as defined in ISO 1176:1990, definition 4.9, in kilograms,

DSC is the designated seating capacity of the test vehicle;

m_d is the test dummy mass.

The vehicle shall be ballasted to achieve the test mass to within ± 10 kg. The ballast shall be located and secured to the vehicle so that it does not alter the structural characteristics of the impacted side of the vehicle.

At the time of impact, the vehicle shall be at the normal ride height and attitude with the engine idling and with the mass equivalent to two 50th percentile adult male front occupants. This height and attitude shall be as defined by the manufacturer.

The instrumentation and cameras required for testing shall not change the axle mass ISO-M11 (see ISO 1176:1990, definition 4.11) by more than 20 kg.

5.2 Condition of test vehicle

The test vehicle shall be stationary. The doors shall be fully closed and latched, but not locked. The window adjacent to the test dummy shall be closed, with the glass in place.

Adjustable seats shall be in the adjustment position midway between the foremost and rearmost positions, and, if separately adjustable in a vertical direction, at the position defined by the manufacturer. If on the same model adjustable and fixed seats exist, the vertical position of the fixed seat shall be used. If an adjustment position does not exist midway between the foremost and rearmost positions, the adjustment position closest to the rear of the midpoint shall be used.

Adjustable seat backs shall be in the manufacturer's nominal design riding position. If the vehicle is equipped with adjustable head restraints, each shall be adjusted to its highest adjustment position.

Adjustable steering controls shall be adjusted so that the steering-wheel hub is located in the manufacturer's nominal design riding position.

The parking brake shall be disengaged. The transmission shall be in neutral.

All tyres shall be inflated to the manufacturer's specifications.

If the test vehicle has a convertible top, the convertible structure shall be in the "up" position for the test.

If the test vehicle has seats equipped with adjustable side bolsters or wings, these shall be adjusted to their nominal position defined by the manufacturer. If the nominal position does not allow the test device to be positioned, the adjustable seat side bolsters or wings shall be adjusted to fit the test device.

6 Description of test dummy

The dummy which may be used is either BIOSID or EUROSID 1.[1)]

7 Installation of test dummy

7.1 Seat and preparation

Locate the H-point in the vehicle in accordance with ISO 6549. If this can only be done in the rearmost position of the seat, locate the H-point relative to the seat prior to moving the seat forward into the test position as described in 5.2. Correlate the H-point of the seating position used for the test with the package drawing H-point. Locate the lateral centreline of the seating position.

1) These are trade-names. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

Mark the test dummy for its midsagittal plane, the centre of gravity of the head and the H-point. Mark a hip pivot point on the dummy, or another mark that approximately coincides with the ISO 6549 manikin H-point. Use instrumentation to measure the test dummy's pelvic angle.

The dummy's upper torso or head may be lightly taped to the seat back so that it does not move relative to the seat during final instrumentation checks, etc. The tape may be left in place for the test providing it will break when subjected to a load of 50 N.

If the positioned dummy sits in the seat longer than 3 h before a test, check the head centre of gravity vertical position. If it has changed by more than 6 mm, reposition the dummy.

7.2 Torso

7.2.1 Test dummy in driver position

7.2.1.1 Bench seat

The upper torso of the test dummy rests against the seat back. The midsagittal plane of the test dummy is vertical and parallel to the vehicle's longitudinal centreline, and passes through the centre of the steering-wheel. If the seat has a contour, the test dummy shall be centred in the contour as determined in ISO 6549.

7.2.1.2 Bucket seat

The upper torso of the test dummy rests against the seat back. The midsagittal plane of the test dummy is vertical and coincides with the longitudinal centreline of the bucket seat.

7.2.2 Test dummy in front outside passenger position

7.2.2.1 Bench seat

The upper torso of the test dummy rests against the seat back. The midsagittal plane of the test dummy is vertical and parallel to the vehicle's longitudinal centreline, and the same distance from the vehicle's longitudinal centreline as would be the midsagittal plane of a test dummy positioned in the driver position under 7.2.1.1. If the seat has a contour, the test dummy shall be centred in the contour as determined in ISO 6549.

7.2.2.2 Bucket seat

The upper torso of the test dummy rests against the seat back. The midsagittal plane of the test dummy is vertical and parallel to the vehicle's longitudinal centreline, and coincides with the longitudinal centreline of the bucket seat.

7.3 H-point of dummy

The H-point of the test dummy shall be within 14 mm vertically and 14 mm horizontally of the H-point determined by using the equipment and procedure specified in ISO 6549 except that the length of the lower leg and thigh segments of the H-point machine shall be adjusted to 415 mm and 400 mm respectively.

7.4 Legs

The upper legs of the test dummy shall rest against the seat cushion to the extent permitted by placement of the feet. To the extent practicable, the left leg of a test dummy in the driver position and both legs of the test dummy in the outside passenger position shall be in vertical longitudinal planes. Final adjustment to accommodate placement of feet in accordance with 7.6 for various passenger compartment configurations is permitted.

7.5 Arms

The test dummy's arms, if it is so equipped, shall be in the desired position.

7.6 Feet

7.6.1 Test dummy in driver position

The right foot of the test dummy shall rest on the undepressed accelerator pedal with the heel resting as far forward as possible on the floorpan. The left foot shall be set perpendicular to the lower leg and placed as far forward as possible such that the heel rests on the floorpan.

7.6.2 Test dummy in front outside passenger position

Both feet of the test dummy shall be placed on the vehicle's toeboard with the heels resting on the floorpan as close as possible to the intersection of the toeboard and floorpan. If the feet cannot be placed flat on the toeboard, they shall be set perpendicular to the lower legs and placed as far forward as possible such that the heels rest on the floorpan.

7.7 Restraint usage

If occupant restraint systems are fitted to the car, they shall be used during the test.

8 Impact response measurements

Data acquisition shall be in accordance with ISO 6487. Obtain the data specified in tables 1 to 3.

Table 1

Accelerometer location	Directions	Acceleration min.	CFC[1] Hz
Acceleration of test vehicle sill, far side	3 axes	100 *g*	60
Acceleration of MDB carriage centre of gravity	3 axes	100 *g*	60
Acceleration on inner panel of door[2]	*Y* axis	500 *g*	1 000

1) Channel frequency class, as defined in ISO 6487:1987, definition 4.5.

2) Accelerometers on the inner panel should be located close to the thoracic and/or pelvic impact point without causing any interaction with the dummy.

Table 2

Other measurements	Directions	Measurement min.	CFC[1] Hz
Speed of the MDB	Perpendicular to test vehicle	—	—
Intrusion	*Y* axis	500 mm	180

1) Channel frequency class, as defined in ISO 6487:1987, definition 4.5.

2) Accelerometers on the inner panel should be located close to the thoracic and/or pelvic impact point without causing any interaction with the dummy.

Table 3

Dummy measurements	Directions	Number of data channels[1]
Required		
Head[2]:		
Acceleration at centre of gravity	3 axes	3
Thorax:		
Displacement of ribs	Y axis	3
Acceleration of ribs	Y axis	3
Acceleration of upper spine	Y axis	1
Acceleration of lower spine	Y axis	1
Abdomen:		
Force (EUROSID 1)		3
or deflection (BIOSID)		2
Pelvis:		
Pubic symphysis load	—	1
Acceleration	3 axes	3
Optional		
Neck:		
Top forces and moments[3]	F_y, F_z, M_x	3
Shoulder:		
Force (BIOSID)	Y axis	1

1) As defined in ISO 6487:1987, definition 4.1. The CFC to be used will be according to the criteria measured.
2) Dummy head contact with the vehicle interior shall be identified by chalking or painting the outside of the dummy head.
3) The directions are defined in ISO 6487:1987, figure 1.

Annex A
(normative)

Calibration procedure of energy-absorbing face of MDB

A.1 Scope

This annex contains a procedure for the calibration of the energy-absorbing face of the MDB. It consists of a test against a dynamometric wall supported by a fixed rigid barrier.

A.2 Installation

A.2.1 Test ground

The test area shall be large enough to accomodate the runup track of the mobile deformable barrier, the rigid barrier and the technical equipment necessary for the test.

The last part of the track, for at least 10 m before the rigid barrier, shall be horizontal, flat and smooth. There shall be no more than 1 % slope measured over a 1 m length for at least the last 10 m.

A.2.2 Characteristics of mobile barrier

The total mass for calibration purposes shall be 950 kg ± 10 kg.

NOTE — This is different from the mass used for the test procedure.

The MDB carriage is the same as that defined in figure 4.

A.2.3 Fixed barrier and dynamometric wall

The barrier impacted surface shall be flat, and at least 3 m wide and 1,5 m high. The rigid barrier shall have a mass of at least 70 000 kg.

The front face shall be vertical, perpendicular to the axis of the runup track and covered with load cells capable of measuring the load/time history of each block of the moving deformable barrier impactor during impact. Cell mounting and plate surfaces, including any protective covering of the surfaces, shall be in accordance with the recommendations set out in annex A of ISO 6487:1987.

The barrier shall be anchored to the ground and its displacement at impact limited to ± 2 mm.

A.3 Propulsion of mobile barrier

At the time of impact, the face of the MDB shall be parallel to the longitudinal centreline of the barrier with a maximum angular deviation of 3°. Impact alignment shall be accurate to ± 10 mm between the MDB face and the prescribed impact point.

A.4 Measurements

A.4.1 Speed

The impact speed shall be 35 km/h ± 2 km/h measured within 0,5 m of the dynamometric wall within the instrumentation tolerance specified in ISO 6487.

A.4.2 Loads

Measuring instruments shall meet the requirements specified in ISO 6487:1987.

CFC for all blocks = 60

CAC for blocks 1 and 3 = 120 kN

CAC for blocks 4, 5 and 6 = 60 kN

CAC for block 2 = 140 kN

A.4.3 Acceleration of barrier

CFC = 1 000 (before integration)

CFC = 60 (after double integration)

CAC = 100 g

ICS 43.020

Descriptors: road vehicles, private cars, tests, impact tests, testing conditions, test dummies.

Price based on 12 pages