INTERNATIONAL STANDARD

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Road vehicles — Pedestrian protection — Child head impact test method

Véhicules routiers — Protection des piétons — Méthode d'essai de choc de la tête d'un enfant

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 16850 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 10, *Impact test procedures*.

Introduction

The intent of this International Standard is to help reduce pedestrian head injuries by providing a standardized test method which will allow different test organizations to use the results from pedestrian impact tests conducted by other organizations.

The test method specified applies to children.

Road vehicles — Pedestrian protection — Child head impact test method

1 Scope

This International Standard specifies a test method to simulate the child impact of a child pedestrian to the bonnet of passenger vehicles or some light truck vehicles, as defined in ISO 3833.

The purpose of this test method is to simulate frontal impact of a vehicle, laterally to a pedestrian.

The impact device to be used in this test method will be robust for a vehicle impact velocity of up to 11 m/s.

While the test method specified addresses the reduction of a child pedestrian head injury risk, it does not test for injuries to other regions of the pedestrian. The evaluation of injury risk to other pedestrian body regions is determined using other test methods.

This test method does not consider downward pitching of the vehicle due to pre impact braking.

This test method and the corresponding HIC measurement utilize a free flight head form impactor, and does not consider the kinematics of the pedestrian body as a whole, nor does it consider the subsequent post-impact kinematics and potential injury risk.

NOTE The test method covers a child pedestrian's head in a simulated impact with a motorized road vehicle. Research suggests that safety improvements in vehicles derived from such pedestrian impact tests may be beneficial also to bicyclists in vehicle front impact.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3784, *Road vehicles — Measurement of impact velocity in collision tests*

ISO 3833, *Road vehicles — Types — Terms and definitions*

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

3 Terms and definitions

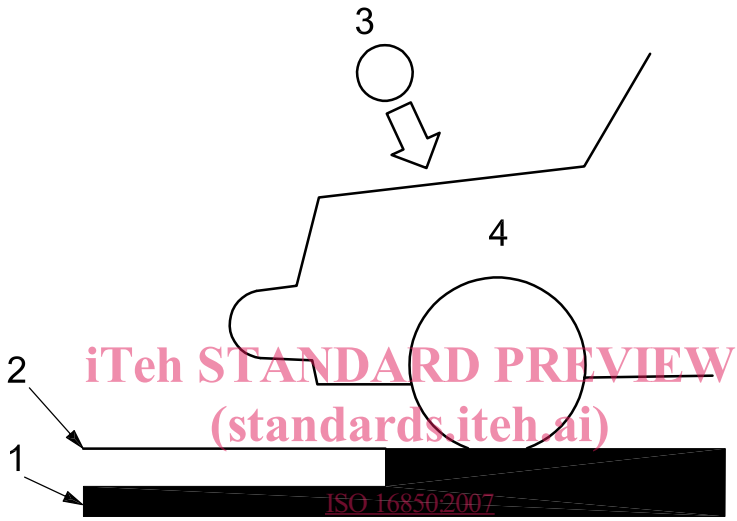
For the purposes of this document, the following terms and definitions apply.

3.1
normal ride attitude
vehicle attitude in driving order positioned on the ground, with the tyres inflated to recommended pressures, the front wheels in the straight-ahead position, with maximum capacity of all fluids necessary for operation of the vehicle (with all standard as provided by the vehicle manufacturer), with one adult male 50th percentile dummy or an equivalent mass placed on the driver's seat, and with one adult male 50th percentile dummy or

an equivalent mass placed on the passenger's seat, and the suspension set in normal running conditions specified by the manufacturer (especially for vehicles with an active suspension or a device for automatic levelling)

3.2
ground reference plane
horizontal plane, either real or imaginary, that passes through all tyre contact points of a vehicle while the vehicle is in its normal ride attitude (see Figure 1)

NOTE If the vehicle is resting on the ground, then the ground plane and the ground reference plane are one and the same. If the vehicle is raised off the ground such as to allow extra clearance below the bumper, then the ground reference plane is above the ground plane.



Key
1 ground
2 ground reference plane
3 impactor
4 vehicle

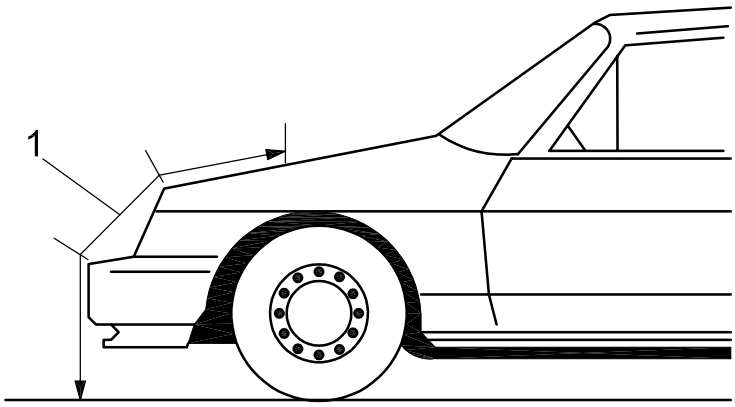
Figure 1 — Configuration of ISO head impact test method

3.3
bonnet top
outer structure that includes the upper surfaces of the bonnet and of the wings (outer fenders), the scuttle (cowl top) and the lower edge of the windscreen

3.4
wrap around distance
WAD
geometric trace described on the top of the bonnet by one end of a long flexible tape, the other end held in contact with the ground reference plane when it is held in a vertical fore and aft plane of the vehicle and traversed across the front of the bonnet and bumper of the vehicle when it is in the normal ride attitude (see Figure 2)

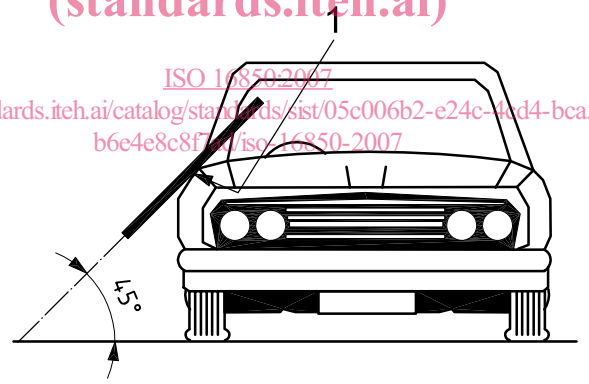
NOTE The tape is held taught throughout the operation with one end held in contact with the ground reference plane, vertically below the front face of the bumper and the other end held in contact with the bonnet top. The length of the tape is the same as values of wrap around distance required in 5.2.

3.5
bonnet side reference line
BSRL
geometric trace of the highest points of contact between a straight edge and the side of a bonnet, when the straight edge, held parallel to the lateral vertical plane of the vehicle and inclined inwards 45° is traversed down the side of the bonnet, while maintaining contact with the surface of the body shell (see Figure 3)



Key
1 wrap around distance

Figure 2 — Determination of wrap around distance



Key
1 bonnet side reference line

Figure 3 — Determination of bonnet side reference line

3.6
head injury criterion
HIC
calculated value describing the injury risk to pedestrian head colliding with a vehicle, and calculated from the head resultant acceleration time history

3.7
bonnet rear reference line
BRRL
geometric trace of the most rearward points of contact between a 165 mm diameter sphere and the front structure of the vehicle when the sphere is traversed across the front structure of the vehicle while maintaining contact with the windscreen

4 Test equipment

4.1 Impact test site

The test shall be conducted on a flat, smooth and hard surface with a slope not exceeding 1 %.

4.2 Head form impactor

The head form impactor described in 5.1 shall be used in this test method.

5 Requirements

5.1 Head form impactor

5.1.1 Size and mass

The contact surface of the head form impactor shall be spherical. The diameter shall be 165 mm with a tolerance of ± 1 mm as shown in Figure 4. This diameter includes the thickness of any flesh if needed in the design. The mass shall be (3,5 ± 0,07) kg. The centre of gravity of the head form impactor shall be located in the geometric centre of the sphere with a tolerance of ± 5 mm. The moment of inertia shall be in the range of 0,007 5 kgm^2 to 0,020 0 kgm^2.

NOTE The mass of the headform is that of the 6-year-old child which is defined in the paper referenced in the Bibliography [3].

5.1.2 Instrumentation

One triaxial (or three uniaxial) accelerometers for head form impactor shall be attached in the recess at the centre of the head form impactor. Tolerances of the accelerometers from the geometric centre of the spherical surface shall be ± 10 mm in the direction of impact, and ± 1 mm in the direction perpendicular to the impact.

The instrumentation response values CFC and CAC for the accelerometers shall be 1 000 Hz and 500 g respectively as defined in ISO 6487.

5.2 Impact area

The bonnet top shall be bounded by the geometric trace of the 1 000 mm wrap around distance in the front, as defined in 3.4, and the bonnet side reference lines, as defined in 3.5, in which the angle of the straight edge inclined inwards shall be 45° and rear boundary shall be the wrap around distance of 1 700 mm or the BRRL as defined in 3.7.

5.3 Impact angle for child head form impactor

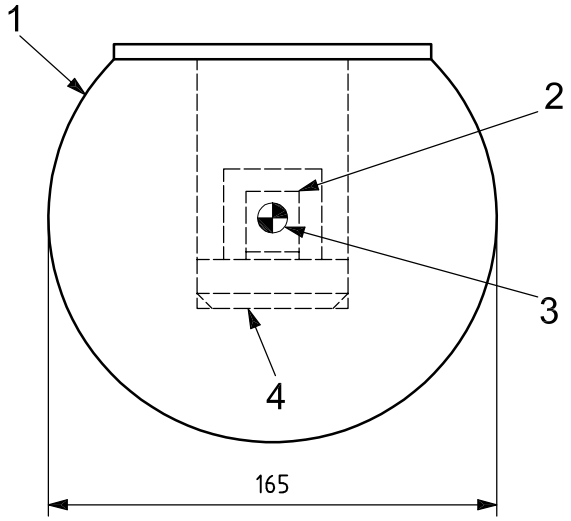
The child head form impactor shall be propelled at a given angle into the bonnet top so as to ensure that the impact angle at the impact moment is as specified in 7.2.

5.4 Child head form impactor calibration

The child head form impactor shall meet the calibration requirements specified in Annex B.

NOTE The head form is a spherical representation of a 6-year-old child. The diameter of the head form is the circumference of the 6-year-old head divided by pi. The calibration requirements of the headform are those of the 6-year-old child which are defined in the paper referenced in the Bibliography [3].

Dimensions in millimetres



Key

1 spherical
2 accelerometer
3 impactor centre of gravity
4 accelerometer mount

Figure 4 — Child head form impactor

5.5 Propulsion of child head form impactor

The child head form impactor shall be propelled into a stationary vehicle. The method of child head form impactor propulsion is at the discretion of the test office. However, the child head form impactor should be launched to free flight at a required velocity.

5.6 Temperature conditions

The child head form impactor shall have a temperature of (20 ± 2) °C at the time of impact.

5.7 Rear face of child head impactor

The rear face of the child head impactor is a plane at the outer surface which is perpendicular to the direction of travel, and typically perpendicular to the axis of one of the accelerometers, as well as being a flat plate used for access to the accelerometers and an attachment point for the propulsion system.

6 Preparation of test vehicle

6.1 Either a complete vehicle or a cut-body shall be used for the test. The cut-body should include all the parts of the vehicle structure and components that may be involved in a pedestrian child head impact.

6.2 The parking brake shall be applied, or the cut-body shall be securely mounted.

6.3 Sufficient time shall be allowed before testing for the temperature of all vehicle components to stabilize (see 7.1).