INTERNATIONAL STANDARD

ISO 15829

Second edition
2013-06-15

Road vehicles — Side impact test procedures for the evaluation of occupant interactions with side airbags by pole impact simulation

Véhicules routiers — Modes opératoires d'essai de choc latéral pour l'évaluation des interactions des occupants avec les sacs gonflables latéraux par simulation d'une collision contre un poteau

Reference number
ISO 15829:2013(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

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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 15829 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 10, *Impact test procedures*.

This second edition cancels and replaces the first edition (ISO 15829:2004), which has been technically revised.

Introduction

Side airbags/curtains (SAB) are deployable devices intended to help reduce the risk of injury to the head or the chest or the pelvis of vehicle occupants in side impact collisions. Side impact accident data indicate that the vehicle side is most likely to contact a passenger car, a truck or a fixed object, such as a pole or a tree. Accident data also indicate that serious to fatal injury in side impact is most likely to occur to the head and chest regions.

Road vehicles — Side impact test procedures for the evaluation of occupant interactions with side airbags by pole impact simulation

1 Scope

This International Standard specifies dynamic side impact test procedures with poles for evaluating the effects of the interaction between side airbags and occupants of road vehicles.

2 Normative references

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

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

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

ISO 8721, *Road vehicles — Measurement techniques in impact tests — Optical instrumentation*

ISO/TR 27957, *Road vehicles — Temperature measurement in anthropomorphic test devices — Definition of the temperature sensor locations*

ISO 15830-4[1)], *Road vehicles — Design and performance specifications for the WorldSID 50th percentile male side impact dummy — Part 4: User's manual*

ISO 17949, *Impact test procedures for road vehicles — Seating and positioning procedures for anthropomorphic test devices — Procedure for the WorldSID 50th percentile male side-impact dummy in front outboard seating positions*

3 Terms and definitions

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

3.1
side airbag
SAB
airbag designed primarily to help reduce occupant injury potential where the significant collision force vector is lateral

3.1.1
head airbag
curtain airbag
airbag that deploys between the occupants' head and the vehicle side structure or an external object that could contact the head

3.1.2
chest airbag
thorax airbag
airbag that deploys between the occupant's upper torso and the vehicle side structure

1) To be published.

3.1.3
pelvic airbag
airbag that deploys between an occupant's pelvis/thigh area and the vehicle side structure

3.1.4
combination airbag
airbag that deploys to help protect two or more body areas of an occupant

EXAMPLE Head and chest combination airbag.

3.2
rigid pole
vertically-oriented, cylindrical, rigid structure, extending beyond the anticipated lower and upper boundary of the deformed test vehicle, in the region of impact

4 Test facility and equipment

4.1 Impact test site

The impact test track shall be a horizontal, smooth and hard surface, which is of sufficient length and area to allow for a monotonic acceleration of the test vehicle to the specified impact speed and to permit post impact deceleration and displacement of the test vehicle without secondary impacts.

4.2 Pole

The pole shall be 254 mm ± 3 mm in diameter. The supporting structure of the pole shall not interfere with the test vehicle during the collision and shall be designed to reduce the risk of a secondary impact

5 Test configurations

5.1 Angle of impact

a) Oblique tests shall be performed with an impact angle of 75 ° ± 3 °.

b) Perpendicular tests shall be performed with an impact angle of 90 ° ± 3 °.

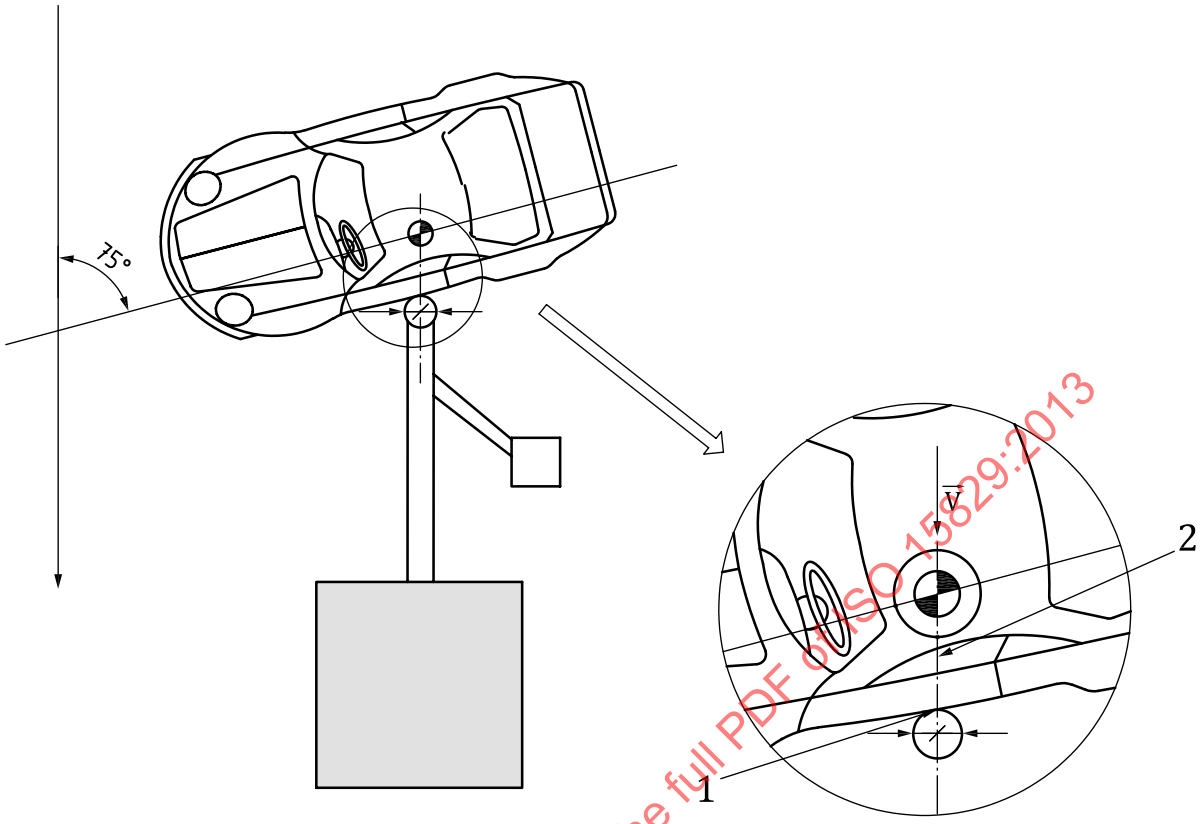
5.2 Locus of the impact on the test vehicle

The test vehicle may be impacted from either side.

The vehicle should be positioned so that the CG of the head is aligned with the centre of the pole, along the direction of impact (75° or 90° from the longitudinal axis of the vehicle).

5.2.1 Impact reference line for oblique test

A vertical impact reference line shall be established on the test vehicle at the intersection of a vertical plane drawn through the dummy head CG of the front outboard designated dummy. The plane should be oriented at 75° with respect to the front, longitudinal axis of the vehicle (front outboard designated seating position) and the exterior door surface (See Figure 1).



Key

1 First contact with vehicle

2 Alignment of CG with pole

NOTE 1 The impact reference line is established after the dummy is in its final position.

NOTE 2 The vertical impact reference line should be aligned with the centreline of the rigid pole.

NOTE 3 The maximum offset optimal value is set to ± 10 mm.

NOTE 4 The offset value should be kept within ± 25 mm for the test to be considered acceptable. However if the offset value is over ± 10 mm, some care should be taken in the interpretation of the results.

Figure 1 — Test configuration for 75° angle impact

5.2.2 Impact Reference Line for perpendicular test

A vertical impact reference line shall be established on the test vehicle at the intersection of the vertical transverse plane through the dummy head CG (front outboard designated seating position) and the exterior door surface (See Figure 2).

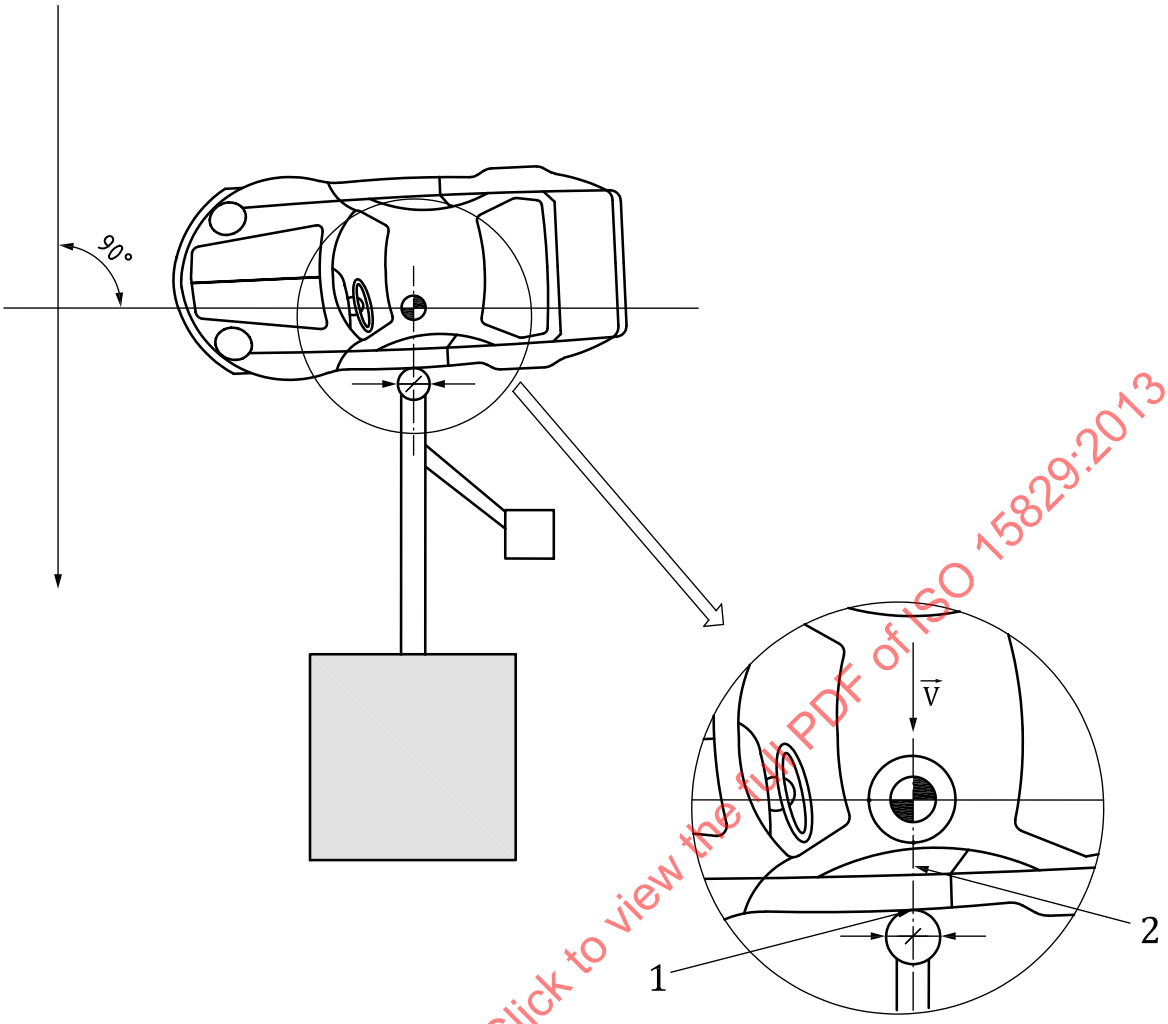


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Figure 2 — Test configuration for 90° angle impact

5.3 Impact velocity

The final velocity shall be measured after release and within the 1500 mm from the point of contact.

For perpendicular impacts the impact velocity shall be 29 km/h ± 0.5 km/h

For 75 degree oblique impacts the impact velocity shall be 32 km/h ± 0.5 km/h

6 Preparation of the test vehicle

6.1 Mass of the test vehicle

$$m_t = m_k + m_l + m_d$$

where

m_k is the complete vehicle kerb mass or unloaded vehicle weight (ISO-M06), as defined in ISO 1176:1990, 4.6, in kilograms;

m_l is the rated cargo and luggage mass in kilograms;

the cargo mass is the maximum admissible weight minus the maximum standard occupant mass, or 136 kg, whichever is less (see 6.1.1);

m_d is the mass of the selected side impact test dummy as defined in the user manual of the dummy.

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 parts of the vehicle expected to deform during the test.

Given that the mass distribution in the vehicle can influence the vehicle response, it is recommended that the wheel mass be documented.

6.1.1 Methods for calculating cargo mass (m_l) depending on the information available

The value (ml) of the cargo mass shall be between 0 and 136 kg.

Method A

$$m_l = \max\{ \min [m_p - (68 \times C_{DS}); 136\text{kg}], 0\}$$

where

m_p is the vehicle capacity weight or maximum design pay mass (ISO-M09) as defined in ISO 1176:1990, 4.9, in kilograms;

C_{DS} is the designated seating capacity of the test vehicle.

Method B: Published cargo mass

Cargo mass (_____kg)

Method C: Published vehicle capacity weight (combined weight of cargo and occupants or maximum design pay mass)

A = Vehicle capacity weight = _____ kg

B = () C_{DS} X 68 kg: _____ kg

A (__ kg) – B (____ kg) = **Cargo mass** (_____kg)

Method D: Published GVWR:

A = GVWR = _____ kg

B = () C_{DS} X 68 kg = _____ kg

C = Unloaded vehicle mass (kerb weight) = _____ kg

A (_____kg) – B (_____kg) – C (_____ kg) = **Cargo mass** (____ kg)

6.2 Condition of the test vehicle

6.2.1 General conditions

The test vehicle doors shall be fully closed and latched. Window(s) adjacent to the test dummy shall be open, with the opening mechanism in the full down position. Window slot can be covered with tape to prevent glass spray.

If the test vehicle has a sunroof it must be in the closed position. Apply an adhesive film to protect the interior from glass splatter. The roof liner shall be in the closed position for additional protection.

Similarly, removable roof panels shall be in place and latched. Apply an adhesive film to protect the interior from glass splatter.

Unless specified in the seating procedure, the steering wheel shall be adjusted to the mid-mid position.

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

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

Frontal airbags may be deactivated and appropriate resistors inserted if deployment is thought to cause interference with camera views.

Should interior panels be removed during vehicle preparation caution should be exercised when replacing such panels to ensure the design performance is not affected. For example: airbag deployment, dummy interaction with panel(s).

6.2.2 Seat and dummy positioning

As per dummy seating procedure specified in ISO 17949.

7 Test devices

Side impact dummies shall be the WorldSID 50th percentile male dummy as specified in ISO 15830-4.

The test dummy temperature should be within a temperature range and at a relative humidity specified by the dummy's manufacturer.

8 Instrumentation

8.1 General

All measurements shall be recorded and filtered according to ISO 6487, ISO 8721, ISO/TR 27957. These measurements should be continuous functions of time, so that other quantities referred to in the references may be derived.

8.2 Vehicle instrumentation

The necessary instrumentation is as follows:

— a tri-axial accelerometer at the centre of gravity of the vehicle or as close as possible on the vehicle sructure,

— a tri-axial accelerometer at the base of the non-struck side B-pillar, and optionally at the base of the struck side B-pillar.

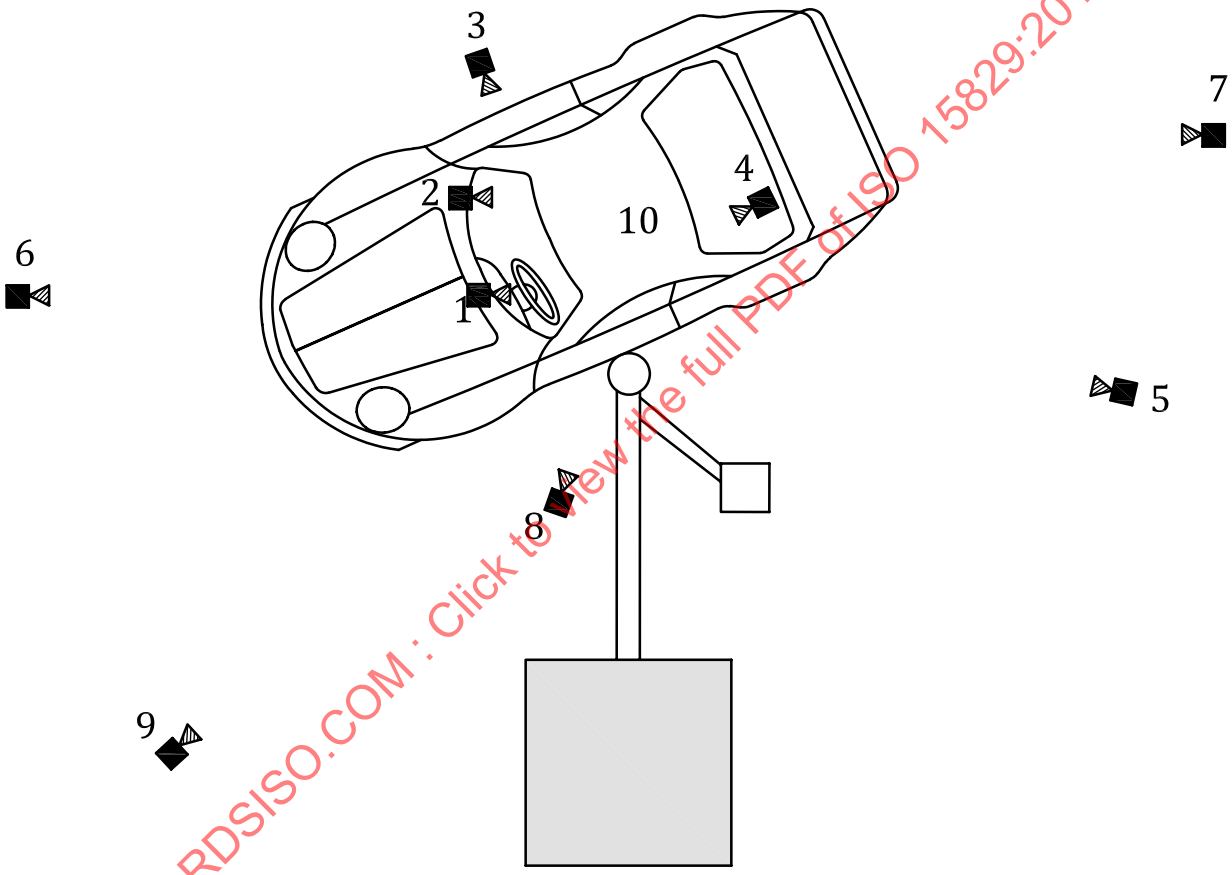
Airbag deployment time shall be recorded.

8.3 High speed photography

The airbag deployment and dummy interactions are monitored by high speed cameras operating at a minimum speed of one thousand (1 000) frames per second.

Minimum recommended camera resolution is 1024 X 1024.

The recommended camera locations are shown in Figure 3.



Key

1 Driver frontal view to capture head and shoulder interaction with side structure
2 Oblique frontal view (3/4 view) of driver for kinematics
3 Passenger side view of driver for kinematics
4 Rear B-pillar view to capture curtain interaction with B-pillar trim
5 Rear external view of pole interaction with vehicle body and pole
6 Front view of vehicle
7 Rear view of vehicle
8 Oblique view of pole
9 Extended view of pole and vehicle
10 Plan view (overhead view)

Figure 3 — Camera views

9 Impact response measurements

The dummy measurements shall be according to Table 1.

NOTE Mandatory measurements are those needed to calculate a criterion or associated to an injury mechanism. Other measurements are optional and can be used to analyse the dummy dynamics and kinematics.

Table 1 — Dummy measurements

Segment	Measures	Mandatory measurements[a]	Criteria	Optional measurements
Head	CG linear acceleration			a_x, a_y, a_z
	Rotational acceleration			α_x, α_y, α_z
	Rotational velocity			ω_x, ω_y, ω_z
Neck	OC joint (upper neck) loads			F_x, F_y, F_z M_x, M_y, M_z
	C7/T1 (lower neck) loads			F_x, F_y, F_z M_x, M_y, M_z
Shoulder	Shoulder force	F_y	Force	a_x, a_y, a_z
	Shoulder rib linear acceleration			D_y
	Shoulder rib displacement			
Thorax				
	Upper, middle, lower thorax rib deflection	D_1, D_2, D_3	Maximum deflection	
Spine	T1 linear acceleration			a_x, a_y, a_z
	T4 linear acceleration			a_x, a_y, a_z
	T12 linear acceleration			a_x, a_y, a_z
	Spine box rotational acceleration			α_x, α_z
Abdomen				
	Upper abdominal rib deflection	D_4, D_5	Maximum deflection	
Lumbar spine	Lower lumbar spine loads			F_x, F_y, F_z M_x, M_y, M_z
Pelvis	Pubic symphysis loads	F_y	F_{pubis}	a_x, a_y, a_z
	CG linear accelerations			
	Sacroiliac loads			F_x, F_y, F_z M_x, M_y, M_z
Upper Leg	Femur neck forces			F_x, F_y, F_z
	Mid femur loads			F_x, F_y, F_z M_x, M_y, M_z
	Outboard knee force			F_y
	Inboard knee force			F_y
	Knee angular displacement			ϕ_y

[a] Mandatory measurements are those needed to calculate a criterion associated to injury risk curves as proposed in ISO/TR 12350.