PD CEN/TS 17342:2019



BSI Standards Publication

Road restraint systems - Motorcycle road restraint systems which reduce the impact severity of motorcyclist collisions with safety barriers

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National foreword

This Published Document is the UK implementation of CEN/TS 17342:2019. It supersedes PD CEN/TS 1317-8:2012, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/509/1, Road restraint systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

BSI, as a member of CEN, is obliged to publish CEN/TS 17342:2019 as a Published Document. However, attention is drawn to the fact that during the development of this Published Document the UK committee voted against its approval.

The UK committee is of the opinion that the term 'motorcyclist protection' used within CEN/TS 17342:2019 does not account for the overall diversity of road restraint systems. The Technical Specification does not call for this product to be validated at the same time as the EN 1317-5 vehicle restraint system product to be attached to the motorcycle is validated.

The UK committee has concerns that the validation testing may not follow a repeatable test and analysis procedure. To date there have been no interlaboratory test programmes and/or comparative test schemes assessing the repeatability of tests.

The UK committee also feels that the test equipment required for the test, and the risk of damage to the test equipment, may make the testing not feasible.

It is also felt that testing with a dummy in a sliding configuration does not fully identify the risk to motorcyclists when impacting a road restraint system. Further work is needed to investigate the risk to motorcyclists impacting a road restraint system in other configurations.

Furthermore, the Technical Specification makes no reference to existing UK motorcycle protection systems that have proved to be satisfactory when placed at situations where road curvature may cause difficulties for errant motorcyclists.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Published by BSI Standards Limited 2019

ISBN 978 0 539 00278 2

ICS 93.080.30; 13.200

Compliance with a British Standard cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 30 June 2019.

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Amendments/corrigenda issued since publication

Date	Text affected

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TECHNICAL SPECIFICATION

SPÉCIFICATION TECHNIQUE

TECHNISCHE SPEZIFIKATION

CEN/TS 17342

June 2019

ICS 13.200; 93.080.30

Supersedes CEN/TS 1317-8:2012

English Version

Road restraint systems - Motorcycle road restraint systems which reduce the impact severity of motorcyclist collisions with safety barriers

Dispositifs de retenue routiers - Dispositifs de retenue routiers pour motos réduisant la sévérité de choc en cas de collision de motocyclistes avec les barrières de sécurité

Rückhaltesysteme an Straßen - Rückhaltesysteme für Motorräder, die die Anprallheftigkeit an Schutzplanken für Motorradfahrer reduzieren

This Technical Specification (CEN/TS) was approved by CEN on 15 April 2019 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

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European foreword

This document (CEN/TS 17342:2019) has been prepared by Technical Committee CEN/TC 226 “Road equipment”, the secretariat of which is held by AFNOR.

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

This document supersedes CEN/TS 1317-8:2012.

The significant technical changes incorporated in this revision are updates of the European foreword, the Scope and Subclause 6.2, *Test site*.

CEN/TS 1317-8 needed to be brought into line with EN 1317 in development (merging of EN 1317-1:2010, EN 1317-2:2010, EN 1317-3:2010, EN 1317-5, EN 1317-7 and additional test methods for removable barrier sections).

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to announce this Technical Specification: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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Introduction

In order to improve safety, the design of roads may require the installation of road restraint systems, which are intended to contain and redirect errant vehicles safely for the benefit of the occupants and other road users, or pedestrian parapets designed to restrain and to guide pedestrians and other road users not using vehicles, on sections of road and at particular locations defined by the national or local authorities.

EN 1317-2 contains performance classes, impact test acceptance criteria and test methods for barriers. Whereas EN 1317-2 covers the performance of these systems with respect to cars and heavy vehicles, this document addresses the safety of the riders of powered two-wheeled vehicles impacting the barrier having fallen from their vehicle.

As powered two-wheeler riders may impact a barrier directly (in which case no protection is offered by the vehicle), special attention is given to these vulnerable road-users. In order to minimize the consequences to a rider of such an impact, it may be necessary to fit a barrier with a specific PTW rider protection system. Alternatively, a barrier might specifically incorporate characteristics limiting the consequences of a PTW rider impact.

Rider protection systems may be continuous (including barriers specifically designed with the safety of PTW riders in mind) or discontinuous. A discontinuous system is one which offers rider protection in specific localized areas of a barrier judged to be of higher risk. The most common example of a discontinuous system is one fitted locally to the posts of a post and rail type guardrail - adding nothing between the posts.

The purpose of this document is to define the terminology specific to it, to describe procedures for the initial type-testing of rider protection systems and to provide performance classes and acceptance criteria for them.

Accident statistics from several European countries have shown that riders are injured when impacting barriers either whilst still on their vehicles or having fallen and then sliding along the road surface. Whilst different statistical sources show one or the other of these configurations to be predominant, all known studies show both to constitute a major proportion of rider to barrier impact accidents. Some studies showing the sliding configuration to be predominant have led to the development and use of test procedures in some European countries, evaluating systems with respect to the sliding configuration. At the time of writing, a number of such protection systems were already on the European market. It is for this reason that it was decided to address the issue of sliding riders initially, in order to bring about the adoption of a European Standard in as timely a manner as possible. However, the rider on vehicle configuration should also be considered as soon as possible as a subsequent addition.

This document will be read in conjunction with EN 1317-1 and EN 1317-2.

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1 Scope

This document specifies requirements for the impact performance of systems designed for the reduction of impact severity for PTW riders impacting safety barriers whilst sliding along the ground, having fallen from their PTW vehicle. The protection systems concerned are those fitted to barriers or barriers that have an inherent PTW rider protection or risk reduction capability. This document excludes the assessment of the vehicle restraint capabilities of barriers and the risk that they represent to the occupants of impacting cars. The assessment of barrier performance with respect to impacting vehicles is covered by EN 1317-1 and EN 1317-2.

This document defines performance classes taking into account rider speed classes, impact severity and the working width of the system with respect to rider impacts.

For systems designed to be added to a standard barrier, the test results are valid only when the system is fitted to the model of barrier used in the tests since the performance will not necessarily be the same if the system is fitted to a different barrier.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

EN 1317-2[1], *Road restraint systems – Part 2: Performance classes, impact test acceptance criteria and test methods for safety barriers including vehicle parapets*

EN 1621-1, *Motorcyclists' protective clothing against mechanical impact – Part 1: Motorcyclists' limb joint impact protectors – Requirements and test methods*

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.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
biomechanical indices
indices obtained from the registers measured in the ATD, which are used to evaluate the severity of the impact

3.2
clothing
see 6.5.2

[1] Under revision.

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3.3
continuous motorcyclist protection system
MPS placed continuously along a barrier with the purpose of retaining and redirecting an impacting rider, usually preventing direct impact with aggressive elements of the barrier such as posts, anchorages or module connections, and that also prevents a sliding rider from passing between the posts of a barrier and coming into contact with any potential hazard that may be behind the barrier

3.4
discontinuous motorcyclist protection system
MPS placed locally around a potentially aggressive element of a barrier, such as a post, anchorage or module connection, with the purpose of reducing the severity of a direct impact of the rider against it

Note 1 to entry: This type of system is not intended to contain fallen PTW riders since the system is not present continuously along the length of the barrier.

3.5
dummy working width
W_d
distance between the foremost part of the un-deformed system and the maximum dynamic lateral position of any part of the system or ATD

Note 1 to entry: See 7.4.

3.6
impact severity
risk level of physical injury to a rider resulting from an impact

3.7
integrated motorcyclist protection system
motorcyclist protection system, either continuous or discontinuous, which forms an integral part of a barrier design rather than being a separate add-on fitted to an existing barrier

3.8
helmet
see 6.5.1

3.9
motorcyclist
rider of any powered two-wheeler

3.10
motorcyclist protection system
device installed on a barrier or in its immediate surroundings, the purpose of which is to reduce the severity of a PTW rider impact against the barrier

4 Symbols and abbreviations

For the purposes of this document, the following abbreviations apply.

CMPS	Continuous Motorcyclist Protection System
DMPS	Discontinuous Motorcyclist Protection System
MPS	Motorcyclist Protection System

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PTW	Powered Two-Wheeler
W_d	Dummy working width

5 Biomechanical indices for assessing the impact severity of a PTW rider against an MPS

5.1 General

In order to assess the severity and define the acceptance criteria, the following biomechanical indices shall be used.

The sign convention shown in Figure 1[2] shall be adopted.

5.2 Index representing the head injury risk: Head injury criterion (HIC36)

The Head Injury Criterion (HIC36) is an acceleration-based criterion defined by Formula (1):

$$HIC = \max\left[\frac{1}{t_2 - t_1} \times \int_{t1}^{t2} a \times dt\right]^{2,5} \times \left(t_2 - t_1\right) \quad (1)$$

where

a is the resultant acceleration at the centre of gravity of the head expressed as units of gravity (1 g = 9,81 m/s²)

$$a = \sqrt{a_x^2 + a_y^2 + a_z^2} \quad (2)$$

a_x is the acceleration X-axis;

a_y is the acceleration Y-axis;

a_z is the acceleration Z-axis.

The (HIC36) values for calculation intervals (t2 – t1) greater than 36 are not taken into account for the calculation of maximum values, i.e. (t2 – t1) ≤ 36 ms.

5.3 Indices representing neck injury risk

The indices representing neck injury risk are:

— anterior-posterior shear force (F_x),

— lateral shear force (F_y),

— tension-compression force (F_z),

— lateral bending moment calculated about the occipital condyle (Moc_x),

— flexion/extension moment calculated about the occipital condyle (Moc_y),

— torsion moment (M_z).

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2 According to SAE J1733.

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The above indices shall be determined using the "upper neck load cell".

The moments about the occipital condyles Moc_x and Moc_y are calculated from the moments M_x and M_y expressed in Nm and the forces F_x and F_y expressed in N according to the expressions:

$$Moc_x = M_x + F_y \times D \quad (3)$$

$$Moc_y = M_y - F_x \times D \quad (4)$$

where

M_x is the lateral bending moment on the neck;

M_y is the flexion/extension moment on the neck;

D is the distance for the transfer to the occipital condyle of the moments of bending measured. It shall adopt the specific value mentioned in 6.4.

The types of movement resulting in positive values of neck forces and moments are:

— $+F_X$: head backwards, chest forward (forward-backward shear),

— $+F_Z$: head upwards, chest downward (traction),

— $+M_X$: left ear towards left shoulder (lateral bending),

— $+M_Y$: chin towards sternum (flexion).

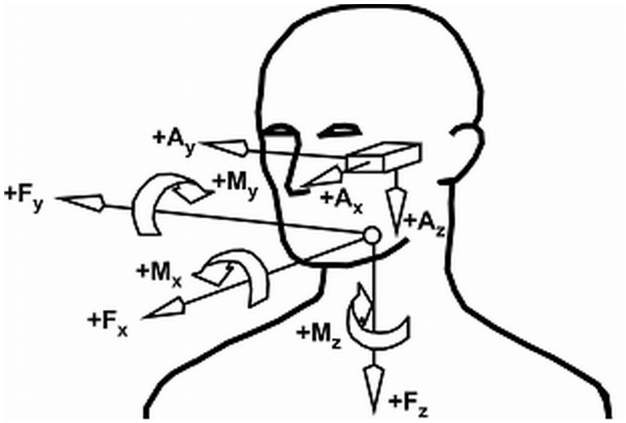


Figure 1 — Sign convention for accelerations, forces and moments in the ATD

6 Test methods

6.1 General

The full-scale impact test consists of launching an ATD at a given speed against a barrier with MPS (or integrated system), in a suitable test area. At the moment of impact, the ATD is sliding with its back and legs stably in contact with the ground.

6.2 Test site

The test area, including all areas over which the ATD is displaced during the test and the ground under any part of the test installation, shall be generally flat with a gradient not exceeding 2,5 %. The test area shall be clear of dust, debris, standing water, ice and snow at the time of the test in the entire area over which the ATD is displaced during the test. No part of the test item shall be in contact with any ice or snow that could modify the deformation or performance of the test item during the test.

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The test zone shall have a level hardened paved surface in the area on which the ATD is launched and along the traffic side of the test installation over an area sufficient to incorporate the entire ATD trajectory of the test. The test zone shall incorporate a smooth area along the approach path of the ATD to facilitate sliding of the ATD before impact.

A dimensioned sketch plan(s) of the test area shall be included in the test report which shall show the testing area including the test installation (including barrier), position of all cameras, path of the ATD, impact point and the dimensioned locations for all test item parts exceeding 2,0 kg that broke away during the test.

The dimensions of the edge detail shall be sufficient to demonstrate the actual performance of the vehicle and the tested system on the edge of a bridge, or structure.

The test shall demonstrate the minimum width of structure behind the traffic face of the vehicle parapet that is required to safely contain a PTW rider.

Appropriate measures shall be taken in order to minimize dust generation from the test area and the test vehicle during the impact test so that photographic records will not be obscured.

Appropriate measures shall be taken to ensure that in the exit area, and during the impact, the ATD does not make contact with any independent obstruction which could have an effect on the ATD interaction with the test item or the ATD trajectory.

6.3 Propulsion system

The ATD shall not be restrained, other than by the friction of the paved surface, guided or propelled by any force external to it at the point of impact.

6.4 ATD and instrumentation

The ATD used for the tests shall be a modified Hybrid III 50th percentile male ATD as described and according to the conditions of use given in Annex B.

All necessary measurements to evaluate the biomechanical indices shall be carried out with measurement systems compliant with ISO 6487.

The resultant acceleration measured at the centre of gravity of the ATD's head shall be calculated from the tri-axial components of the acceleration recorded with Channel Frequency Class 1 000 (CFC 1 000) and a Channel Amplitude Class of 500 g (CAC 500 g).

The neck forces and moments shall be measured by a six-channel upper neck load cell specifically designed to be fitted to the Hybrid III ATD. These forces and moments shall be recorded as follows:

— F_x and F_y with a CAC of 8 kN and a CFC of 1 000,

— F_z with a CAC of 13 kN and a CFC of 1 000;

— M_x, M_y and M_z with a CAC of 280 N m and a CFC of 600.

For the transfer of moments measured by the neck load cell to the occipital condyle, both the forces and moments shall have a CFC of 600.

For the distance D, the value of 0,017 78 m shall be adopted for those load cells installed in the existing space at the base of the skull and 0,008 763 m for those load cells mounted on the lower surface of the base of the skull.

An event indicator shall be used to signal the moment of first ATD contact with the test item. However, the method used shall not modify the ATD to test item contact (e.g. the use of a tape switch on the helmet is not acceptable).

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6.5 ATD clothing and equipment

6.5.1 Helmet

The ATD shall be equipped with an integral type, production motorcycle helmet weighing 1,300 kg ± 0,050 kg and with a polycarbonate shell. A reference helmet model is given in Annex E. The helmet shall meet the specifications given in Annex F. Annex E gives alternative helmet models that have been found to meet the requirements in Annex F.

NOTE In all cases, the helmet used will comply with the requirements set out in Regulation 22 of ECE/TRANS/505.

The surface of the helmet in contact with the test item shall be smooth, and free from protruding parts, vents, roughness or any other kind of unevenness, so that the contact conditions between the helmet and the test item are not influenced by any such feature.

The helmet shall be new for each test. No alteration of the original production helmet shall be undertaken. No stickers, paint or any other item or substance shall be applied to the helmet in any area of its surface which will be in contact with the test item.

The helmet shall be fitted onto the head of the ATD in accordance with Annex C. If helmet models other than those given in Annex E are used, the size shall be chosen in order to ensure that the fit of the helmet on the ATD head is as snug as possible, with the helmet held firmly onto the head.

Care should be taken to choose a helmet that will leave visible traces on the test item during contact, i.e. helmet with paint of a colour which contrasts with the test item colour.

6.5.2 Clothing

The ATD shall be dressed in a long-sleeved cotton t-shirt to be worn under a leather, one-piece motorcycle suit (or two-piece suit if the two pieces are joined together) conforming to EN 1621-1, leather gloves, and leather boots. The leather suit shall not be fitted with any additional protection devices (e.g. back supports or neck restraints) or features that influence the behaviour of the ATD or restrict the movement of its limbs any more than would be the case with a simple leather suit.

The sizes of all items of clothing shall be appropriate so as to fit the ATD correctly.

The upper and lower extremities shall be clearly visually identified by painting the clothing, boots and gloves using a paint colour contrasting with the test zones surroundings. Each lower extremity shall be identified by painting the trouser leg and boot from the knee down. Each upper extremity shall be identified by painting the sleeve, and if necessary part of the glove, from the centre of the elbow joint to the centre of the wrist joint.

There shall be a clear, visible distinction between the hand (from the wrist joint to the fingertips) and the rest of the upper extremity.

6.6 ATD mass including equipment

The total test ATD mass, including instrumentation, helmet, shirt, suit, gloves and boots, shall be 87,50 kg ± 2,50 kg.

6.7 Installation

For continuous systems, the length of the test item shall be sufficient to demonstrate the full performance characteristics of the MPS. After the test, the adequacy of the length of installation shall be checked by determining whether there is any permanent lateral or longitudinal displacement of the test item at its extremities.

Any end conditions (for example end anchorages) of the barrier or integrated MPS shall be identical to those used in the vehicle impact tests performed on the same barrier according to EN 1317-2. Any fixings

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(for example fixing of a CMPS to a barrier) of the MPS, or end conditions of a CMPS, shall be provided in accordance with the design of the MPS.

For DMPS, the minimum installation length of the supporting barrier shall be determined by the test house and agreed to by the manufacturer before the test. A minimum of two DMPS shall be installed on consecutive posts (or whichever other element supports the DMPS): one corresponding with the impact point and the other downstream of the impact.

Foundations for the test item shall meet the design specification.

When testing pretensioned MPSs, for which tension can be adjusted, any measurable applied tension or torque shall conform to that which is specified in the MPS installation manual and shall be recorded in the test report.

The height above the ground of the lower edge of the elements designed to restrain the PTW rider shall be measured in the impact zone and noted in the test report

NOTE This distance can influence the capacity of the system to restrain a rider.

6.8 Impact conditions

The full-scale impact tests are carried out by launching an ATD against the test item (in the case of a CMPS, against a straight length of test item) in accordance with a determined approach path and test conditions.

At the moment of the initial impact of the ATD against the test item, the surfaces of the helmet and the test item in the impact area shall be clean, dry, and free of any item or substance that may affect the contact between both surfaces.

The ATD shall impact the test item at a point approximately at the mid-point along the length of the test item or, in the case of a DMPS fitted to a barrier, approximately at the mid-point of the barrier. The exact position of the impact along the length of the test item shall be chosen by the test house in order to demonstrate the most severe impact conditions and the choice shall take into account any potentially hazardous feature of the test item.

The test shall be deemed to be completed when, following the impact (or impacts) the ATD has come completely to rest. Any secondary impacts, including any with the ground or hardened test zone surface, occurring before the ATD comes to rest shall be considered when determining the test results. If the ATD is connected to the data acquisition system by an umbilical cable, the ATD may be arrested to avoid damage occurring to the umbilical cable. Any such arresting of the ATD shall take place once the ATD is no longer in contact with the test item, after all injury criterion measurements have started to decrease or after any event resulting in a negative test result for the test item.

6.9 Launch configurations

6.9.1 General

Three theoretical approach paths are defined as below. If the test laboratory judges that the impact point identified in this document for a given test is not representative of the most severe testing conditions, the laboratory may change the impact point accordingly. In all cases, the impact point shall be identified in the test report its choice justified.

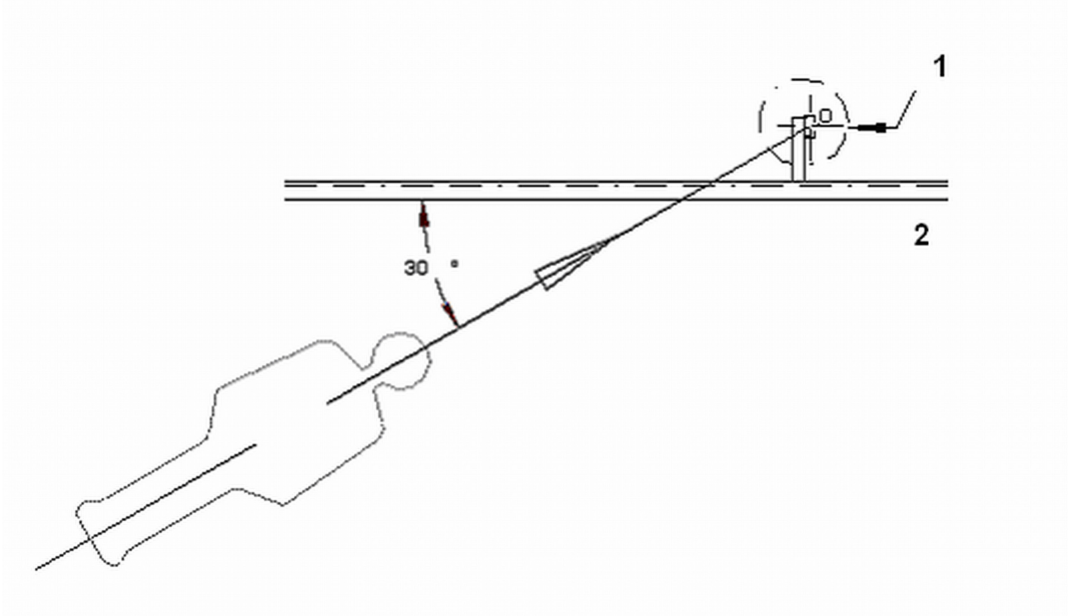
For each configuration, the ATD shall be launched lying face-up in a “supine decubitus” position, i.e. face up in a horizontal position and completely stretched out on its back, with its upper limbs parallel and adjacent to its trunk, with the palms of its hands oriented towards its trunk. The longitudinal centreline of the ATD spine shall coincide with the direction of the approach path and the head shall be oriented towards the theoretical impact point.

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6.9.2 Launch configuration 1: post-centred impact

The approach path of the ATD is defined by a line, parallel to the ground, passing through the centre (O) of the post section and forming a 30° angle with respect to the centreline of the un-deformed test item (see Figure 2). For a CMPS, if the test item is not, or is not fitted to, a post-and-rail type safety barrier, point O shall be the centre of an anchorage, a connection between elements of the test item or any other point deemed to result in the highest severity impact. For a DMPS, point O is the centre of the item onto which the MPS is fitted.

This launch configuration is applicable to all types of MPS and, is generally intended to represent the configuration resulting in the most severe impact-related injuries.



Key

1 discontinuous system

2 continuous system

Figure 2 — Launch configuration 1: post-centred impact

6.9.3 Launch configuration 2: post offset impact

The approach path of the ATD is defined by a line parallel to the ground and parallel to a line at 30° to the centreline of the un-deformed test item, passing through the point O (centre of the post section). The approach path shall be 20 cm upstream of the 30° line passing through point O (see Figure 3).

This configuration is only applicable when the test item is a DMPS. If the test item is not fitted to a post- and rail type safety barrier, point O shall be the centre of the item onto which the MPS is fitted.

The purpose of this configuration is to impact the edge of the DMPS which may be potentially aggressive and/or to achieve maximal deceleration of the ATD.

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