
**Road vehicles — Design and
performance specifications for the
WorldSID 50th percentile male side-
impact dummy —**

Part 2:

Mechanical subsystems

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*Véhicules routiers — Conception et spécifications de performance
pour le mannequin mondial (WorldSID), 50e percentile homme, de
choc latéral —*

ISO 15830-2:2013

Partie 2: Sous-systèmes mécaniques

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received. www.iso.org/patents

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The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 12, *Passive safety crash protection systems*.

This second edition cancels and replaces the first edition (ISO 15830-2:2005) which has been technically revised. Technical amendments have been incorporated throughout all four parts, resulting from extensive experience with the standard and design changes.

ISO 15830 consists of the following parts, under the general title *Road vehicles — Design and performance specifications for the WorldSID 50th percentile male side impact dummy*:

- *Part 1: Terminology and rationale*
- *Part 2: Mechanical subsystems*
- *Part 3: Electronic subsystems*
- *Part 4: User's manual*

Introduction

This second edition of ISO 15830 has been prepared on the basis of the existing design, specifications, and performance of the WorldSID 50th percentile adult male side-impact dummy. The purpose of the ISO 15830 series is to document the design and specifications of this side-impact dummy in a form suitable and intended for worldwide regulatory use.

In 1997, ISO/TC22/SC12 initiated the WorldSID 50th percentile adult male dummy development, with the aims of defining a global-consensus side-impact dummy, having a wider range of humanlike anthropometry, biofidelity, and injury monitoring capabilities, suitable for regulatory use. Participating in the development were research institutes, dummy and instrumentation manufacturers, governments, and vehicle manufacturers from around the world.

With regard to potential regulatory, consumer information, or research and development use of ISO 15830, users will need to identify which of the permissive (i.e. optional) sensors and other elements defined in ISO 15830-3 are to be used in a given application.

WorldSID drawings in electronic format are being made available. Details are given in ISO 15830-2:2013, Annex B.

In order to apply ISO 15830 properly, it is important that all four parts be used together.

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Road vehicles — Design and performance specifications for the WorldSID 50th percentile male side-impact dummy —

Part 2: Mechanical subsystems

1 Scope

This part of ISO 15830 specifies requirements for mechanical components, drawings and specifications, validation tests, and support equipment for the WorldSID 50th percentile side-impact dummy, a standardized anthropomorphic dummy for side-impact testing of road vehicles. It is applicable to impact tests involving

- passenger vehicles of category M₁ and goods vehicles of category N₁,
- impacts to the side of the vehicle structure, and
- impact tests involving use of an anthropomorphic dummy as a human surrogate for the purpose of evaluating compliance with vehicle safety standards.

2 Normative references (standards.iteh.ai)

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

ISO 15830-1, *Design and performance specifications for the WorldSID 50th percentile adult male side impact dummy — Part 1: Terminology and rationale*

ISO 15830-3:2013, *Design and performance specifications for the WorldSID 50th percentile adult male side-impact dummy — Part 3: Electronic subsystems*

ISO 15830-4, *Design and performance specifications for the WorldSID 50th percentile adult male side-impact dummy — Part 4: User's manual*

SAE J211-1:2007, *Instrumentation for impact test — Part 1: Electronic instrumentation*

SAE J2570:2001, *Performance specifications for anthropomorphic test device transducers*

49 CFR Part 572, subpart E, *Anthropomorphic test dummies, United States of America Code of Federal Regulations issued by the National Highway Traffic Safety Administration (NHTSA). Washington, DC, US*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15830-1 apply.

4 Mechanical requirements for WorldSID

4.1 Head

4.1.1 General description

The head assembly shall consist of the components and assemblies listed in head assembly drawing W50-10000.pdf (see [Annex B](#)).

4.1.2 Drawings and specifications

- The head assembly and components shall conform to head assembly drawing W50-10000.pdf (see [Annex B](#)) and the subassembly and component drawings listed therein.
- The total assembly shall have a mass of 4,22 kg ± 0,05 kg.
- The centre of gravity shall be located as indicated in [Figure 1](#).
- The materials used in the construction of the head assembly shall not contain lead or lead alloys.
- The flesh material and/or external surface characteristics shall enable positive attachment of adhesive targets.
- If present, cables exiting the head assembly shall exit at the rear and include a secure strain relief mechanism.

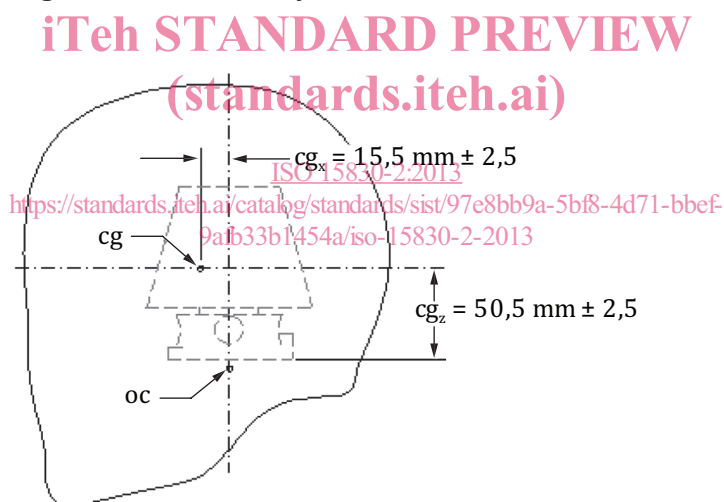


Figure 1 — Head centre of gravity location

4.1.3 Validation

When assembled according to ISO 15830-4, and tested using the procedure specified in [5.1](#), the head assembly shall meet the specifications given in [Table 1](#).

Table 1 — WorldSID head validation specifications

Frontal drop	
Variable	Absolute value
Peak resultant acceleration (G)	225 to 275
Peak lateral acceleration (a_y) (G)	<15
Maximum percentage, subsequent-to-main peak (%)	<10
Lateral drop	
Variable	Absolute value
Peak resultant acceleration at CG (G)	99 to 121
Peak longitudinal acceleration (a_x) (G)	<15
Maximum percentage, subsequent-to-main peak (%)	<10

4.2 Neck

4.2.1 General description

The neck assembly shall consist of the components and assemblies listed in neck assembly drawing W50-20000.pdf (see [Annex B](#)).

4.2.2 Drawings and specifications

- The neck assembly and components shall conform to neck assembly drawing W50-20000.pdf (see [Annex B](#)) and the subassembly and component drawings listed therein.
- The total assembly shall have a mass of $2,84 \text{ kg} \pm 0,15 \text{ kg}$.
- The materials used in the construction of the neck assembly shall not contain lead or lead alloys.
- The flesh material and/or external surface characteristics shall enable positive attachment of adhesive targets.
- If present, cables exiting the neck assembly shall include a secure strain relief mechanism.

4.2.3 Validation

When assembled according to ISO 15830-4, and tested using the procedure specified in [5.2](#), the neck assembly shall meet the specifications given in [Table 2](#).

Table 2 — WorldSID neck validation specifications

Variable	Absolute value
Maximum angular displacement of the head form relative to the pendulum, β (degrees)	50 to 61
Decay time of β to 0 degrees (ms)	58 to 72
Peak moment at occipital condyle (Nm)	55 to 68
Peak moment decay time to 0 Nm (ms) ^a	71 to 87
Peak forward potentiometer angular displacement (degrees)	32 to 39
Time of peak forward potentiometer angular displacement (ms) ^a	56 to 68
Peak rearward potentiometer angular displacement, θ_F (degrees)	30 to 37

Table 2 (continued)

Variable	Absolute value
Time of peak rearward potentiometer angular displacement, θ_R (ms) ^a	56 to 68
^a T=0 s at initial pendulum contact with honeycomb or alternative products which can be shown to lead to the same results.	

4.3 Thorax/abdomen/shoulder

4.3.1 General description

The thorax/abdomen/shoulder assembly shall consist of the components and assemblies listed in thorax/abdomen/shoulder assembly drawing W50-30000.pdf (see [Annex B](#)).

4.3.2 Drawings and specifications

- The thorax/abdomen/shoulder assembly and components shall conform to thorax/abdomen/shoulder assembly drawing W50-30000.pdf (see [Annex B](#)) and the subassembly and component drawings listed therein.
- The total assembly shall have a mass of 20,55 kg \pm 1,0 kg.
- The materials used in the construction of the thorax/abdomen/shoulder assembly shall not contain lead or lead alloys.
- The flesh material and/or external surface characteristics shall enable positive attachment of adhesive targets.
- If present, cables exiting the thorax/abdomen/shoulder assembly shall include a secure strain relief mechanism.

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4.3.3 Validation

4.3.3.1 Shoulder

When assembled according to ISO 15830-4, and tested using the procedure specified in [5.3.1](#) and [5.3.2](#), the shoulder assembly shall meet the specifications given in [Table 3](#).

Table 3 — WorldSID shoulder validation specifications

Variable	Absolute value
Peak pendulum force (kN)	2,6 to 3,3
Peak shoulder rib deflection (mm)	35 to 44

4.3.3.2 Thorax with half arm

When assembled according to ISO 15830-4, and tested using the procedure specified in [5.3.1](#) and [5.3.3](#), the thorax with half-arm assembly shall meet the specifications given in [Table 4](#).

Table 4 — WorldSID thorax with half-arm validation specifications

Variable	Absolute value
Peak pendulum force (kN)	4,9 to 5,8
Peak T4 acceleration along y axis (G)	28 to 37
Peak T12 acceleration along y axis (G)	22 to 28
Peak thorax rib 1 deflection (mm)	35 to 47
Peak thorax rib 2 deflection (mm)	46 to 56
Peak thorax rib 3 deflection (mm)	39 to 46

4.3.3.3 Thorax without arm

When assembled according to ISO 15830-4, and tested using the procedure specified in 5.3.1 and 5.3.4, the thorax without arm assembly shall meet the specifications given in Table 5.

Table 5 — WorldSID thorax without arm validation specifications

Variable	Absolute value
Peak pendulum force (kN)	3,2 to 3,8
Peak T4 acceleration along y axis (G)	14 to 20
Peak T12 acceleration along y axis (G)	14 to 22
Peak thorax rib 1 deflection (mm)	33 to 43
Peak thorax rib 2 deflection (mm)	35 to 43
Peak thorax rib 3 deflection (mm)	32 to 40

4.3.3.4 Abdomen

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When assembled according to ISO 15830-4, and tested using the procedure specified in 5.3.1 and 5.3.5, the abdomen without arm assembly shall meet the specifications given in Table 6.

Table 6 — WorldSID abdomen validation specifications

Variable	Absolute value
Peak pendulum force (kN)	2,7 to 3,1
Peak T12 acceleration along y axis (G)	15 to 20
Peak abdomen rib 1 deflection (mm)	33 to 40
Peak abdomen rib 2 deflection (mm)	30 to 36

4.4 Full arms

4.4.1 General description

The full arm assembly may be installed on either side of the dummy. If installed, it shall consist of the components and assemblies listed in full arm assembly drawings W50-61000.pdf (left) and W50-61001.pdf (right) (see Annex B).

4.4.2 Drawings and specifications

— The full arm assembly and components shall conform to full arm assembly drawings W50-61000.pdf (left) and W50-61001.pdf (right) (see Annex B) and the subassemblies and component drawings listed therein.

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- The total assembly shall have a mass of 3,72 kg ± 0,15 kg.
- The materials used in the construction of the full arm assembly shall not contain lead or lead alloys.
- The flesh material and/or external surface characteristics shall enable positive attachment of adhesive targets.
- If present, cables exiting the full arm assembly shall include a secure strain relief mechanism.

4.5 Half arms

4.5.1 General description

The half arm assembly shall consist of the components and assemblies listed in half arm assembly W50-62000.pdf (see [Annex B](#)).

4.5.2 Drawings and specifications

- The half arm assembly shall conform to half arm assembly drawing W50-62000.pdf (see [Annex B](#)) and the subassemblies and component drawings listed therein.
- The total assembly shall have a mass of 1,77 kg ± 0,09 kg.
- The materials used in the construction of the half arm assembly shall not contain lead or lead alloys.
- The flesh material and/or external surface characteristics shall enable positive attachment of adhesive targets.

4.6 Lumbar spine and pelvis

4.6.1 General description

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The lumbar spine and pelvis assembly shall consist of the components and assemblies listed in lumbar spine and pelvis assembly drawing W50-40000.pdf (see [Annex B](#)).

4.6.2 Drawings and specifications

- The lumbar spine and pelvis assembly shall conform to lumbar spine and pelvis assembly drawing W50-40000.pdf (see [Annex B](#)) and the subassemblies and component drawings listed therein.
- The total assembly shall have a mass of 17,75 kg ± 0,90 kg.
- The materials used in the construction of the pelvis assembly shall not contain lead or lead alloys.
- The flesh material and/or external surface characteristics shall enable positive attachment of adhesive targets.
- If present, cables exiting the pelvis assembly shall include a secure strain relief mechanism.

4.6.3 Validation

When assembled according to ISO 15830-4, and tested using the procedure specified in [5.3.1](#) and [5.3.6](#), the pelvis assembly shall meet the specifications given in [Table 7](#).

Table 7 — WorldSID pelvis validation specifications

Variable	Absolute value
Peak pelvis acceleration along y axis (G)	41 to 51
Peak pendulum force (kN)	6,3 to 7,8
Peak T12 acceleration along y axis (G)	10 to 14

4.7 Upper legs

4.7.1 General description

The upper leg assembly shall consist of the components and assemblies listed in upper leg assembly drawings W50-51000.pdf (right) and W50-51050.pdf (left) (see [Annex B](#)).

4.7.2 Drawings and specifications

- The upper leg assembly and components shall conform to upper leg drawings W50-51000.pdf (right) and W50-51050.pdf (left) (see [Annex B](#)) and the subassemblies and component drawings listed therein.
- The total assembly shall have a mass of 6,71 kg ± 0,30 kg.
- The materials used in the construction of the upper leg assembly shall not contain lead or lead alloys.
- The flesh material and/or external surface characteristics shall enable positive attachment of adhesive targets.
- If present, cables exiting the upper leg assembly shall include a secure strain relief mechanism.

4.8 Lower leg, ankle, and foot

4.8.1 General description

The lower leg, ankle, and foot assembly shall consist of the components and assemblies listed in lower leg, ankle, and foot assembly drawing W50-54054.pdf (right) and W50-54056.pdf (left) (see [Annex B](#)).

4.8.2 Drawings and specifications

- The lower leg assembly shall conform to lower leg, ankle, and foot assembly drawing W50-54054.pdf (right) and W50-54055.pdf (left) (see [Annex B](#)) and the subassemblies and component drawings listed therein.
- The total assembly shall have a mass of 5,09 kg ± 0,13 kg.
- The materials used in the construction of the lower leg assembly shall not contain lead or lead alloys.
- The flesh material and/or external surface characteristics shall enable positive attachment of adhesive targets.
- If present, cables exiting the lower leg assembly shall include a secure strain relief mechanism.

4.9 Clothing

4.9.1 General description

The clothing shall consist of the components and assemblies listed in clothing assembly drawing W50-80100.pdf (see [Annex B](#)).