INTERNATIONAL STANDARD

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Third edition
2022-11

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

Part 3: Mechanical requirements for electronic subsystems

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

Partie 3: Exigences mécaniques pour sous-systèmes électroniques

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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 (see 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 (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 36, *Safety and impact testing*.

This third edition cancels and replaces the second edition (ISO 15830-3:2013), which has been technically revised.

The main changes are as follows:

— in Table 1 mounting specifications have been removed;

— in Table 1 specifications for sensor masses have been added;

— in Table 1 angular rate sensor has been added for the head, spine, and pelvis;

— in Table 1 rotational accelerometer has been replaced by angular accelerometer for the head, spine, and pelvis;

— in Table 1 IR-TRACC has been replaced by multidimensional measurement system for the shoulder, thorax, and abdomen;

— in Table 1 full arm sensors have been removed;

— in Table 1 ankle angular displacement sensor has been removed;

— in 4.1.3 all references to specific brands and models of sensors have been removed;

— in 4.2 DAS mass and mass distribution have been replaced by CAD targets for C.G. and mass moment of inertia for the thorax, pelvis, and upper leg assemblies;

— calculation method of distances from IR-TRACC voltage output has been removed;

— information regarding pin codes for connectors has been removed;

— information regarding sensor output polarities has been replaced by normative reference to SAE J1733.

A list of all parts in the ISO 15830 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This third edition of the ISO 15830 series 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, the WorldSID 50th percentile adult male dummy development was initiated, with the aims of defining a global-consensus side-impact dummy, with more humanlike anthropometry, improved biofidelity, and increased injury-monitoring capabilities, suitable for example, for regulatory use. Participating in the development were research institutes, dummy and instrumentation manufacturers, governments, and vehicle manufacturers from around the world.

The original WorldSID drawings were available in electronic format. The updates are not available.

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

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

Part 3: Mechanical requirements for electronic subsystems

1 Scope

This document specifies mechanical requirements for sensors and in-dummy data acquisition systems (DAS) of the WorldSID 50th percentile side-impact dummy, a standardized anthropomorphic dummy for near-side-impact tests of road vehicles.

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.

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

ISO 15830-4:2022, *Design and performance specifications for the WorldSID 50th percentile adult male side impact dummy — Part 4: User's manual*

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

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

SAE J1733, *Sign convention for vehicle crash testing*

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

3 Terms and definitions

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

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Mechanical requirements for electrical subsystems

4.1 Permissible sensors

4.1.1 General

All sensor locations and the mechanical specifications are specified as "permissible" (i.e. optional) because the decision to use or not to use a given sensor is to be left to the individual relevant regulatory authorities, consumer information organisations, and research or test laboratories. In this way, a given regulation (or laboratory protocol) can indicate which of the permissible sensor's locations described

in this part of the ISO 15830 series shall be used in a given test. See Clause A.1 for optional sensor locations.

The following sensors may be installed in the dummy. If installed, they shall comply with the mechanical specifications in the subclause given in Table 1 and the mass specifications given in Table 1. If these sensors are not installed, then structural or mass replacements shall be installed in the dummy in accordance with ISO 15830-4.

Refer to Clause A.2 for information on sensor handling.

4.1.2 Locations and mechanical specifications

Table 1 — Permissible WorldSID sensor locations and mechanical specifications

Body region	Sensor	Mechanical specification	Recommended number of channels	Mass [a] [g]
Head	Linear accelerometer	4.1.3.2	3	8 ± 1
Head	Angular rate sensor	4.1.3.3	3	45 ± 5[b]
Head	Angular accelerometer	4.1.3.4	3	105 ± 12 [c]
Head	Tilt sensor	4.1.3.5	2	<25
Head	Universal neck load cell (upper neck)	4.1.3.7	6	346 ± 20
Neck	Universal neck load cell (lower neck)	4.1.3.7	6	346 ± 20
Neck	T1 linear accelerometer	4.1.3.2	3	8 ± 1
Shoulder	Rib linear accelerometer	4.1.3.2	3	8 ± 1
Shoulder	Multidimensional measurement system	4.1.3.8	1 [d]	117 ± 15
Shoulder	Load cell	4.1.3.9	3	176 ± 13
Thorax	Upper rib linear accelerometer	4.1.3.2	3	8 ± 1
Thorax	Middle rib linear accelerometer	4.1.3.2	3	8 ± 1
Thorax	Lower rib linear accelerometer	4.1.3.2	3	8 ± 1
Thorax	Upper rib multidimensional measurement system	4.1.3.8	1 [d]	117 ± 15
Thorax	Middle rib multidimensional measurement system	4.1.3.8	1 [d]	117 ± 15
Thorax	Lower rib multidimensional measurement system	4.1.3.8	1 [d]	117 ± 15
Spine	T4 linear accelerometer	4.1.3.2	3	8 ± 1
Spine	T12 linear accelerometer	4.1.3.2	3	8 ± 1
Spine	Angular rate sensor	4.1.3.3	2	45 ± 5
Spine	Angular accelerometer	4.1.3.4	3	105 ± 12 [c]
Spine	Tilt sensor	4.1.3.5	2	<25
Abdomen	Upper rib linear accelerometer	4.1.3.2	3	8 ± 1
Abdomen	Lower rib linear accelerometer	4.1.3.2	3	8 ± 1
Abdomen	Upper rib multidimensional measurement system	4.1.3.8	1 [d]	117 ± 15

[a] This is the mass of the sensor, without the mass of the cable.

[b] The mass of the angular rate sensor mount is 38 g and the mass of a single-axis sensor is 2 g.

[c] The mass of an angular accelerometer single-axis sensor is 35 g.

[d] This is the minimum number of channels to fulfil the requirements of a multidimensional measurement system.

Table 1 *(continued)*

Body region	Sensor	Mechanical specification	Recommended number of channels	Mass [a] [g]
Abdomen	Lower rib multidimensional measurement system	4.1.3.8	1 [d]	117 ± 15
Lumbar spine/pelvis	Lumbar load cell	4.1.3.10	6	473 ± 35
Lumbar spine/pelvis	Pelvis linear accelerometer	4.1.3.2	3	8 ± 1
Lumbar spine/pelvis	Pelvis angular rate sensor	4.1.3.3	3	45 ± 5
Lumbar spine/pelvis	Angular accelerometer	4.1.3.4	3	105 ± 12 [c]
Lumbar spine/pelvis	Pubic load cell	4.1.3.11	1	145 ± 10
Lumbar spine/pelvis	Sacroiliac load cell	4.1.3.12	12	1 062 ± 75
Lumbar spine/pelvis	Tilt sensor	4.1.3.5	2	<25
Upper leg	Femoral neck load cell	4.1.3.13	3	254 ± 25
Upper leg	Universal leg load cell (mid femur)	4.1.3.14	6	467 ± 36
Upper leg	Knee lateral outboard contact force load cell	4.1.3.15	1	77 ± 6
Upper leg	Knee lateral inboard contact force load cell	4.1.3.15	1	77 ± 6
Upper leg	Knee angular displacement	4.1.3.16	1	15 ± 2
Lower leg	Universal leg load cell (upper tibia)	4.1.3.14	6	467 ± 36
Lower leg	Universal leg load cell (lower tibia)	4.1.3.14	6	467 ± 36
Spine box	Temperature logger	4.1.3.17	1	16 ± 4

[a] This is the mass of the sensor, without the mass of the cable.

[b] The mass of the angular rate sensor mount is 38 g and the mass of a single-axis sensor is 2 g.

[c] The mass of an angular accelerometer single-axis sensor is 35 g.

[d] This is the minimum number of channels to fulfil the requirements of a multidimensional measurement system.

4.1.3 Sensor specifications

4.1.3.1 General

All sensors described in Table 1 shall comply with:

— capacities in Annex B,

— SAE J1733 sign convention, and

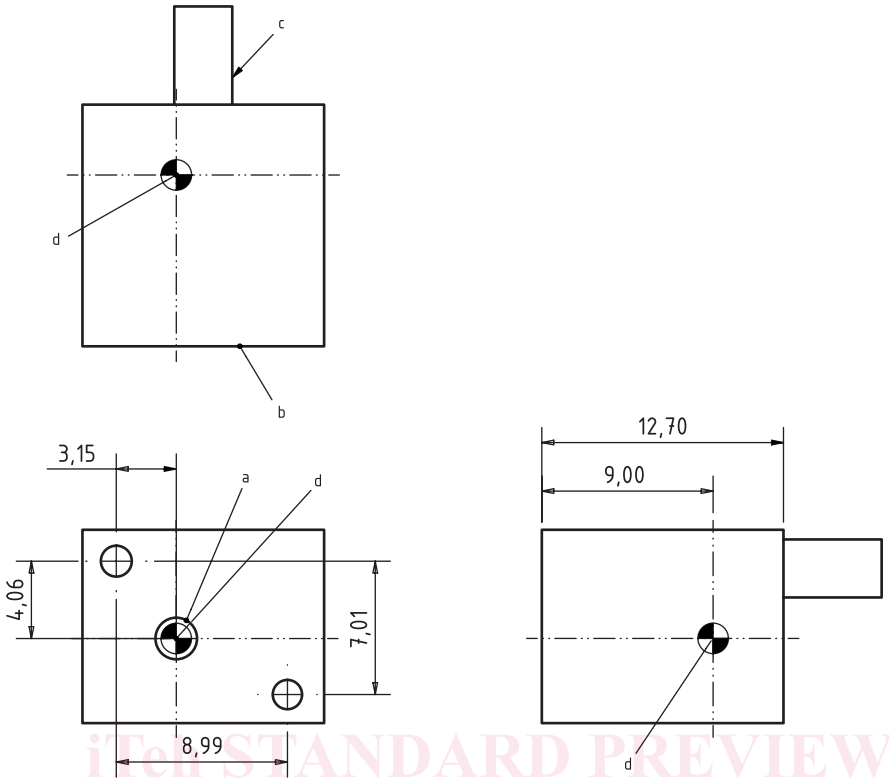
— SAE J2570 performance specifications.

4.1.3.2 Triaxial linear accelerometers

The WorldSID may be equipped with standardized triaxial linear accelerometers. The dimensions to mount the sensors and the location of the neutral axes are given in Figure 1. As the same type of sensor is applicable for different locations and in different mounting positions, the origin of the neutral axis shall be within the given tolerances.

The external dimensions of the accelerometer are not standardized because they may vary between different manufacturers. Only the location of the neutral axes with respect to the standardized mount points of the WorldSID is defined. The user shall take care that the sensor fits into the dummy.

Dimensions in millimetres



a Mounting hole.

b Mounting base.

c Cable.

d Neutral axis.

Figure 1 — Neutral axes of the triaxial linear accelerometer

4.1.3.3 Angular rate sensor

The WorldSID may be equipped with angular rate sensors. There are no additional WorldSID-related requirements.

Angular accelerometers may be used instead of angular rate sensors.

4.1.3.4 Angular accelerometer

The WorldSID may be equipped with angular accelerometers. There are no additional WorldSID-related requirements.

Angular rate sensors may be installed instead of angular accelerometers.

4.1.3.5 Tilt-angle sensor

The head, thorax and pelvis may be equipped with dual-axis tilt sensors about the x-axis and y-axis. There are no additional WorldSID-related requirements.

4.1.3.6 Head core with six axes sensor unit

The head core may include a triaxial linear accelerometer (4.1.3.2), a triaxial angular rate sensor (4.1.3.3), and a dual-axis tilt sensor (4.1.3.5). A triaxial angular accelerometer (4.1.3.4) may be used instead of an angular rate sensor.

A simplified geometry of head core and the positions of the neutral axes of the triaxial accelerometer are shown in Figure 2. There are no requirements for the neutral axes of the triaxial angular rate sensor and the dual-axis tilt sensors. The head core shown in ISO 15830-4:2022, Clause A.1 is an example.

Dimensions in millimetres

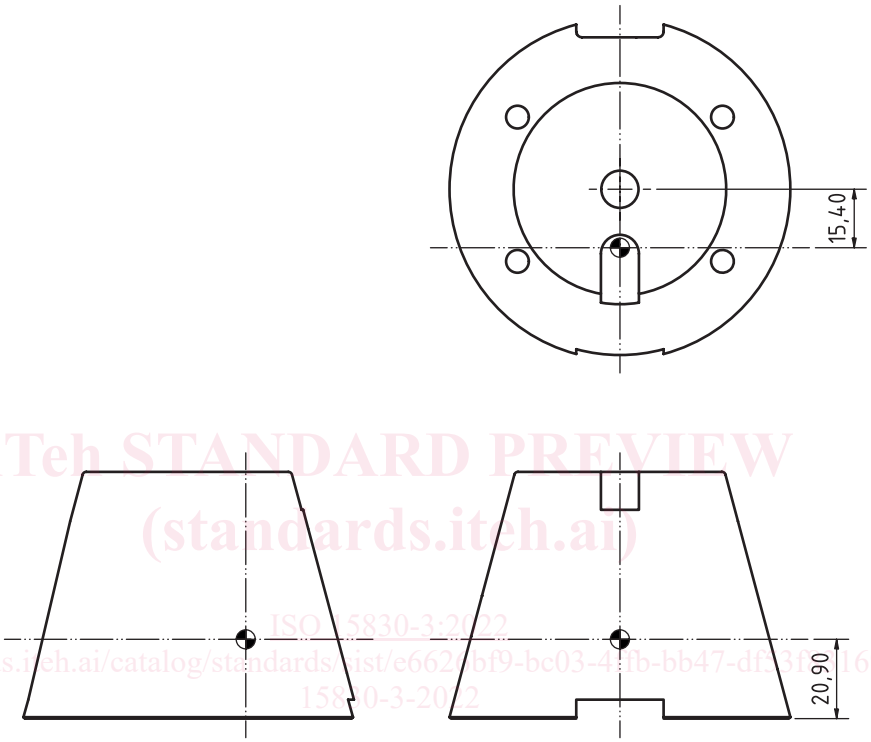
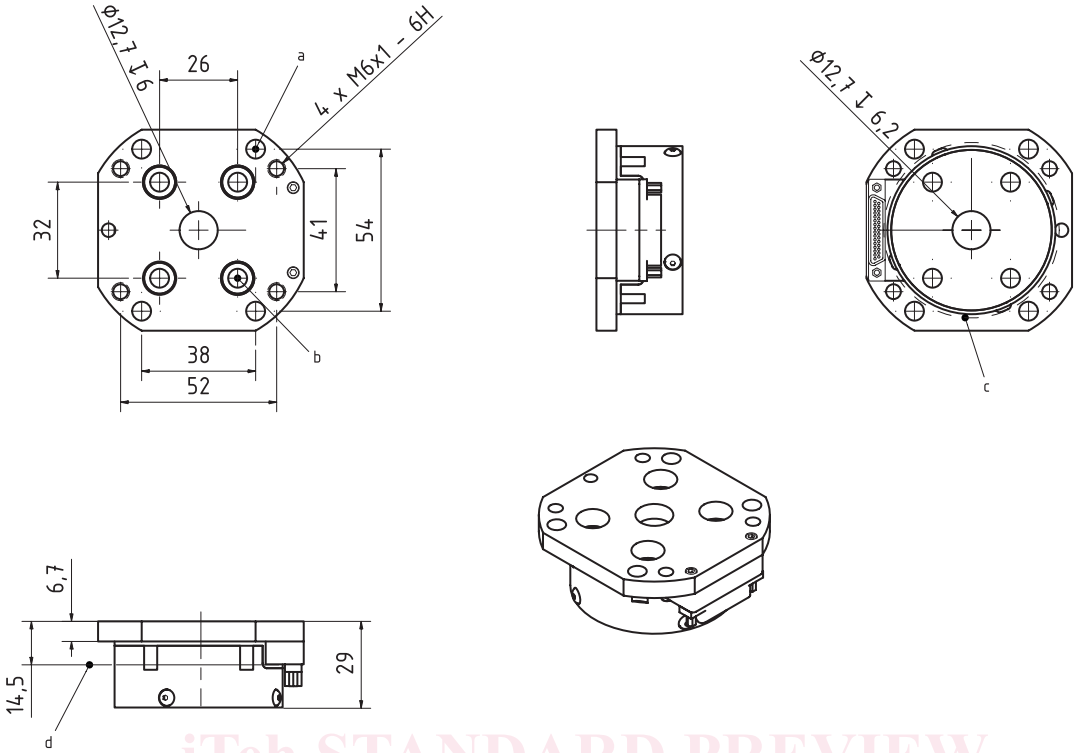


Figure 2 — Simplified head core with neutral axes

4.1.3.7 Universal neck load cell

The universal neck load cell may be used at the upper and lower neck. It shall fulfil the mechanical requirements shown in Figure 3.

Dimensions in millimetres



a Clearance holes for M6 screw through, 4 places.

b Clearance holes for M6 screw through, 4 places. Counterbore through top plate for SCHCS head. Spotface bottom plate.

c 58,5 mm diameter to clear screw heads.

d Neutral axis.

Figure 3 — Universal neck load cell

4.1.3.8 Multidimensional measurement system for shoulder, thorax and abdomen rib deflection

The measurement system shall provide a time history signal of the change of the distance between spine box (location A) and the rib at the mounting bracket of the rib accelerometer (location B). This distance is derived directly or by using a calculation depending on the sensor system. The metric to derive this distance belongs to the manufacturer of the multidimensional measurement system. Other sensor systems may provide more information. However, this is not covered by this document. ISO/TS 21002:2021, A.2.1 provides additional information about a multidimensional measurement system.

The two attachment points of the displacement measurement are shown in Figure 4. Mounting location A is on part W50-31020 for left side impacts and on part W50-31030 for right side impacts. The position B is located on part W50-32171 (shoulder rib) and part W50-32172 (thorax and abdominal ribs). The thorax assembly including a parts list is given in ISO 15830-4:2022, A.3.1.

Clearance to surrounding parts and sensors shall be ensured for all modes of deformation (pure lateral and oblique) of the ribs.