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

Part 3:

Electronic subsystems

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

ISO 15830-3:2013

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Partie 3: Sous-systèmes électroniques



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Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Electrical subsystems requirements	1
4.1 Permissible sensors	1
4.2 Permissible internal data acquisition system (DAS)	7
5 Methods	8
5.1 Calculation of IR-TRACC distances from the IR-TRACC voltage outputs	8
Annex A (normative) Load cell characteristics	9
Annex B (informative) Conventions for exemplar permissible load cells and angular displacement sensors	14
Annex C (informative) Conventions for permissible accelerometers	21
Annex D (normative) Information regarding sensor output polarities	23
Bibliography	41

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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

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

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 15830-3:2005) which has been technically revised. Technical amendments have been incorporated throughout all four parts, resulting from extensive experience with the International 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 regards 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 this part of ISO 15830 will be required for their tests.

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 3: Electronic subsystems

1 Scope

This part of ISO 15830 specifies requirements for electronic components of 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,
- impact tests involving the use of an anthropometric dummy as a human surrogate for the purpose of evaluating compliance with vehicle safety standards.

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

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

ISO 15830-2:2013, *Design and performance specifications for the WorldSID 50th percentile male side-impact dummy — Part 2: Mechanical subsystems*

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

SAE J1733, *Sign convention for vehicle crash testing*

3 Terms and definitions

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

4 Electrical subsystems requirements

4.1 Permissible sensors

4.1.1 General

NOTE All sensors 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 sensors described in this part of ISO 15830 must be used in a given test. It should also be noted that different connector configurations may be found in different WorldSID assemblies.

The following sensors may be installed in the dummy. If installed, they shall comply with the specifications given in Table 1. If these sensors are not installed, then structural or mass replacements shall be installed in the dummy.

4.1.2 Locations and specifications

Table 1 — Permissible WorldSID sensor locations and specifications

Body region	Sensor	Sensor specification	Mounting specification	Maximum number of channels
Head	Linear accelerometer	4.1.3.2	ISO 15830-2:2013, 4.1	3
Head	Rotational accelerometer	4.1.3.3	ISO 15830-2:2013, 4.1	3
Head	Tilt sensor (about x and y axes)	4.1.3.4	ISO 15830-2:2013, 4.1	2
Head	Upper neck load cell	4.1.3.5	ISO 15830-2:2013, 4.1	6
Neck	Lower neck load cell	4.1.3.5	ISO 15830-2:2013, 4.2	6
Neck	T1 linear accelerometer	4.1.3.2	ISO 15830-2:2013, 4.2	3
Shoulder	Rib linear accelerometer	4.1.3.2	ISO 15830-2:2013, 4.3	3
Shoulder	IR-TRACC	4.1.3.6	ISO 15830-2:2013, 4.3	1
Shoulder	Load cell (F_x, F_y, F_z)	4.1.3.7	ISO 15830-2:2013, 4.3	3
Full arm	Upper arm load cell	4.1.3.8	ISO 15830-2:2013, 4.4	6
Full arm	Lower arm load cell	4.1.3.8	ISO 15830-2:2013, 4.4	6
Full arm	Elbow load cell (M_x, M_y)	4.1.3.9	ISO 15830-2:2013, 4.4	2
Full arm	Elbow angular displacement	4.1.3.10	ISO 15830-2:2013, 4.4	1
Full arm	Elbow linear accelerometer	4.1.3.2	ISO 15830-2:2013, 4.4	3
Full arm	Wrist linear accelerometer	4.1.3.2	ISO 15830-2:2013, 4.4	3
Thorax	Upper rib linear accelerometer	4.1.3.2	ISO 15830-2:2013, 4.3	3
Thorax	Middle rib linear accelerometer	4.1.3.2	ISO 15830-2:2013, 4.3	3
Thorax	Lower rib linear accelerometer	4.1.3.2	ISO 15830-2:2013, 4.3	3
Thorax	Upper rib IR-TRACC	4.1.3.6	ISO 15830-2:2013, 4.3	1
Thorax	Middle rib IR-TRACC	4.1.3.6	ISO 15830-2:2013, 4.3	1
Thorax	Lower rib IR-TRACC	4.1.3.6	ISO 15830-2:2013, 4.3	1
Spine	T4 linear accelerometer	4.1.3.2	ISO 15830-2:2013, 4.3	3
Spine	T12 linear accelerometer	4.1.3.2	ISO 15830-2:2013, 4.3	3
Spine	Rotational accelerometer (about x- and z-axes)	4.1.3.3	ISO 15830-2:2013, 4.3	2
Spine	Tilt sensor (about x- and y-axes)	4.1.3.4	ISO 15830-2:2013, 4.3	2
Abdomen	Upper rib linear accelerometer	4.1.3.2	ISO 15830-2:2013, 4.3	3
Abdomen	Lower rib linear accelerometer	4.1.3.2	ISO 15830-2:2013, 4.3	3
Abdomen	Upper rib IR-TRACC	4.1.3.6	ISO 15830-2:2013, 4.3	1
Abdomen	Lower rib IR-TRACC	4.1.3.6	ISO 15830-2:2013, 4.3	1
Lumbar spine/ pelvis	Lumbar load cell	4.1.3.11	ISO 15830-2:2013, 4.6	6
Lumbar spine/ pelvis	Pelvis linear accelerometer	4.1.3.2	ISO 15830-2:2013, 4.6	3
Lumbar spine/ pelvis	Pubic load cell (F_y)	4.1.3.12	ISO 15830-2:2013, 4.6	1

Table 1 (continued)

Body region	Sensor	Sensor specification	Mounting specification	Maximum number of channels
Lumbar spine/pelvis	Sacro-iliac load cell	4.1.3.13	ISO 15830-2:2013, 4.6	12
Lumbar spine/pelvis	Tilt sensor (about x - and y -axes)	4.1.3.3	ISO 15830-2:2013, 4.6	2
Upper leg	Femoral neck load cell (F_x, F_y, F_z)	4.1.3.14	ISO 15830-2:2013, 4.7	3
Upper leg	Mid femur load cell	4.1.3.14	ISO 15830-2:2013, 4.7	6
Upper leg	Knee lateral outboard contact force load cell	4.1.3.16	ISO 15830-2:2013, 4.7	1
Upper leg	Knee lateral inboard contact force load cell	4.1.3.16	ISO 15830-2:2013, 4.7	1
Upper leg	Knee angular displacement	4.1.3.17	ISO 15830-2:2013, 4.7	1
Lower leg	Upper tibia load cell	4.1.3.15	ISO 15830-2:2013, 4.8	6
Lower leg	Lower tibia load cell	4.1.3.15	ISO 15830-2:2013, 4.8	6
Lower leg	Ankle angular displacement	4.1.3.18	ISO 15830-2:2013, 4.8	3
Spine box	Air temperature sensor	4.1.3.19	ISO 15830-2:2013, 4.3	1

4.1.3 Sensor specifications and mass

4.1.3.1 General

All load cells, accelerometers, and angular displacement transducers shall comply with SAE J2570, and load cells shall comply with the capacities and sign conventions in [Annex A](#).

Sensor sign convention shall comply with SAE J1733 and any deviations shall be noted.

4.1.3.2 Tri-axial linear accelerometers

- If measured, tri-axial linear accelerations shall be measured using Endevco accelerometer, model 7268C-2000M1¹⁾.
- Tri-axial linear accelerometer assemblies shall have a mass of $8 \text{ g} \pm 1 \text{ g}$ (not including cable).

4.1.3.3 Rotational accelerometers

- If measured, rotational accelerations shall be measured using Endevco accelerometer, model 7302BM4²⁾.
- Rotational accelerometers shall have a mass of $35 \text{ g} \pm 4 \text{ g}$ (not including cable).

4.1.3.4 Tilt-angle sensors

4.1.3.4.1 Head tilt sensor

1) Accelerometer model 7268C-2000M1 is a product supplied by Endevco Corp., San Juan Capistrano, California, USA. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

2) Accelerometer model 7302BM4 is a product supplied by Endevco Corp., San Juan Capistrano, California, USA. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

ISO 15830-3:2013(E)

- If measured, head tilt angles shall be measured using either IES tilt sensor, model/1401 AT³⁾, or MSC Automotive GmbH tilt sensor, model 260D/GP-X⁴⁾.
- Head tilt sensors shall have a mass of less than 25 g (not including cable).

4.1.3.4.2 Thorax and pelvis tilt sensor

- If measured, thorax and pelvis tilt angles shall be measured using either IES tilt sensor, model IES/1401 T⁵⁾, or MSC Automotive GmbH tilt sensor, model 260D/GP-X⁶⁾.
- Thorax and pelvis tilt sensors shall have a mass of less than 25 g (not including cable).

4.1.3.5 Universal neck load cell

- If measured, upper and lower neck forces and moments shall be measured using Humanetics (formerly Denton) load cell, model W50-71000⁷⁾.
- Upper and lower neck load cells shall have a mass of 346 g ± 20 g (not including attachment bolts or plug) or 361 g ± 25 g (including mating plug and 450 mm of cable).

4.1.3.6 IR-TRACC for shoulder, chest and abdomen rib deflection

- If measured, rib deflections shall be measured using Humanetics (formerly FTSS) Infra-red Telescoping Rod for the Assessment of Chest Deflection (IR-TRACC), model IF-363⁸⁾.
- IR-TRACCs shall have a mass of 117 g ± 15 g (including the connector and 300 mm of cable).

Calculation of IR-TRACC displacements shall be performed as described in 5.1.

4.1.3.7 Shoulder load cell

- If measured, shoulder forces shall be measured using Humanetics (formerly Denton) load cell, model W50-71090⁹⁾.

3) Head tilt sensor model IES/1401 AT is a product supplied by Humanetics (formerly Robert A. Denton, Inc.), Plymouth, Michigan, USA. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

4) Tilt sensor model 260D/GP-X is a product supplied by MSC Automotive GmbH. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

5) Thorax and pelvis tilt sensor model IES/1401 T is a product supplied by Humanetics (formerly Robert A. Denton, Inc.), Plymouth, Michigan, USA. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

6) Tilt sensor model 260D/GP-X is a product supplied by MSC Automotive GmbH. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

7) Load cell model W50-71000 (see ISO 15830-2:2013, Annex C) is a product supplied by Humanetics (formerly Robert A. Denton, Inc.), Plymouth, Michigan, USA. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

8) IR-TRACC model IF-363 (see ISO 15830-2:2013, Annex C) is a product supplied by Humanetics (formerly First Technology Safety Systems, Inc.), Plymouth, Michigan, USA. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

9) Load cell model W50-71090 (see ISO 15830-2:2013, Annex C) is a product supplied by Humanetics (formerly Robert A. Denton, Inc.), Plymouth, USA. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be

- Shoulder load cell shall have a mass of $176 \text{ g} \pm 13 \text{ g}$ (not including cable and mating connector).

4.1.3.8 Arm load cell

- If measured, upper and lower arm forces and moments shall be measured using Humanetics (formerly Denton) load cell, model W50-71070¹⁰.
- Upper and lower arm load cells shall have a mass of $385 \text{ g} \pm 30 \text{ g}$ (not including cable and mating connector).

4.1.3.9 Elbow load cell

- If measured, elbow moments shall be measured using Humanetics (formerly Denton) load cell, model W50-71060¹¹.
- Elbow load cell shall have a mass of $300 \text{ g} \pm 22 \text{ g}$ (not including cable and mating connector).

4.1.3.10 Elbow rotational potentiometer

- If measured, elbow angular displacement shall be measured using Humanetics (formerly Denton) potentiometer, model W50-61027¹².
- Elbow potentiometer shall have a mass of $15 \text{ g} \pm 2 \text{ g}$ (not including cable and mating connector).

4.1.3.11 Lumbar load cell

- If measured, lumbar forces and moments shall be measured using Humanetics (formerly Denton) load cell, model W50-71120¹³.
- Lumbar load cell shall have a mass of $473 \text{ g} \pm 35 \text{ g}$ (not including cable and mating connector).

4.1.3.12 Pubic load cell

- If measured, pubic forces and moments shall be measured using Humanetics (formerly Denton) load cell, model W50-71051¹⁴.
- Pubic load cell shall have a mass of $145 \text{ g} \pm 10 \text{ g}$ (not including cable and mating connector).

used if they can be shown to lead to the same results.

10) Load cell model W50-71070 (see ISO 15830-2:2013, Annex C) is a product supplied by Humanetics (formerly Robert A. Denton, Inc.), Plymouth, Michigan, USA. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

11) Load cell model W50-71060 (see ISO 15830-2:2013, Annex C) is a product supplied by Humanetics (formerly Robert A. Denton, Inc.), Plymouth, Michigan, USA. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

12) Potentiometer model W50-61027 (see ISO 15830-2:2013, Annex C) is a product supplied by Humanetics (formerly Robert A. Denton, Inc.), Plymouth, Michigan, USA. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

13) Load cell model W50-71120 (see ISO 15830-2:2013, Annex C) is a product supplied by Humanetics (formerly Robert A. Denton, Inc.), Plymouth, Michigan, USA. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

14) Load cell model W50-71051 (see ISO 15830-2:2013, Annex C) is a product supplied by Humanetics (formerly Robert A. Denton, Inc.), Plymouth, Michigan, USA. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

4.1.3.13 Sacro-iliac load cell

- If measured, sacro-iliac forces and moments shall be measured using Humanetics (formerly Denton) load cell, model W50-71130¹⁵).
- Sacro-iliac load cell shall have a mass of 1 062 g ± 75 g (not including cable and mating connector).

4.1.3.14 Femoral neck load cell

- If measured, femoral neck forces shall be measured using Humanetics (formerly Denton) load cell, model W50-71080¹⁶).
- Femoral neck load cell shall have a mass of 240 g ± 18 g (not including cable and mating connector).

4.1.3.15 Mid-femur and leg load cell

- If measured, upper and lower leg forces and moments shall be measured using Humanetics (formerly Denton) load cell, model W50-71010¹⁷).
- Upper and lower leg load cell shall have a mass of 470 g ± 36 g (not including cable and mating connector).

4.1.3.16 Knee contact load cell

- If measured, knee contact lateral force shall be measured using Humanetics (formerly Denton) load cell, model W50-71020¹⁸).
- Knee contact load cell shall have a mass of 77 g ± 6 g (not including cable and mating connector).

4.1.3.17 Knee rotational potentiometer

- If measured, knee angular displacement shall be measured using Humanetics (formerly Denton) potentiometer, model W50-61027¹⁹).
- Knee potentiometer shall have a mass of 15 g ± 2 g (not including cable).

4.1.3.18 Ankle rotational potentiometer

15) Load cell model W50-71130 (see ISO 15830-2:2013, Annex C) is a product supplied by Humanetics (formerly Robert A. Denton, Inc.), Plymouth, Michigan, USA. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

16) Load cell model W50-71080 (see ISO 15830-2:2013, Annex C) is a product supplied by Humanetics (formerly Robert A. Denton, Inc.), Plymouth, Michigan, USA. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

17) Load cell model W50-71010 (see ISO 15830-2:2013, Annex C) is a product supplied by Humanetics (formerly Robert A. Denton, Inc.), Plymouth, Michigan, USA. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

18) Load cell model W50-71020 (see ISO 15830-2:2013, Annex C) is a product supplied by Humanetics (formerly Robert A. Denton, Inc.), Plymouth, Michigan, USA. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

19) Potentiometer model W50-61027 (see ISO 15830-2:2013, Annex C) is a product supplied by Humanetics (formerly Robert A. Denton, Inc.), Plymouth, Michigan, USA. This information is given for the convenience of users of this part of ISO 15830 and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

- If measured, ankle x , y , z angular displacements shall be measured using Humanetics (formerly Denton) potentiometer, models W50-54012, W50-54052, and W50-54051, respectively²⁰.
- Ankle potentiometers shall have a mass of $7 \text{ g} \pm 5 \text{ g}$ (not including cable).

4.1.3.19 Temperature sensor

- If measured, thoracic cavity temperature shall be measured using a Dallas Semiconductor temperature sensor, model DS192H/Z²¹.
- Temperature sensor assembly shall have a mass of $21 \text{ g} \pm 5 \text{ g}$ (not including cable).

4.2 Permissible internal data acquisition system (DAS)

4.2.1 General

The following DAS may be installed in the dummy. If installed, it shall comply with the following specifications. If the DAS is not installed, then the DAS mass replacements shall be installed in the dummy.

4.2.2 DAS characteristics

- If installed, the DTS WorldSID G5 DAS²²) shall be mounted in accordance with the drawings given in ISO 15830-2:2013.
- The size, location, and mounting of the DAS shall not interfere with dummy motions.
- DAS electronic specifications shall comply with SAE J211 or ISO 6487.

4.2.3 DAS mass and mass distribution

- The combined mass of in-dummy DAS components or DAS mass replacements, excluding sensors and sensor cables, shall be $2,20 \text{ kg} \pm 0,5 \text{ kg}$.
- DAS mass shall be distributed as given in [Table 2](#).

Table 2 — DAS mass distribution

Body segment	DAS mass (g) ^a
Attached to and inside spine box	$1\,560 \pm 350$
Left femur	287 ± 60
Right femur	287 ± 60
Thorax cabling	75 ± 30

20) Potentiometer, models W50-54012, W50-54052, and W50-54051 (see ISO 15830-2:2013, Annex C) are products supplied by Humanetics (formerly Robert A. Denton, Inc.), Plymouth, Michigan, USA. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

21) Temperature sensor, model DS192H/Z is a product supplied by Dallas Semiconductor. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.

22) The WorldSID G5 DAS is a product supplied by Diversified Technical Systems, Inc. (DTS), Seal Beach, California, USA. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of the product named. Alternative products may be used if they can be shown to lead to the same results.