INTERNATIONAL STANDARD

ISO 15830-4

Third edition
2022-10

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

Part 4: User's manual

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

Partie 4: Manuel de l'utilisateur

Reference number
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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 15830-4:2013), which has been technically revised.

The main changes are as follows:

— parts lists and disassembly and assembly procedures have been updated to the current production version of WorldSID;

— full arm parts list and the disassembly, assembly, and adjustment procedures have been removed;

— informative annex on general practices has been removed;

— informative annex on temperature sensitivity has been replaced by reference to ISO/TR 27957;

— informative annex on seating procedure has been replaced by reference to ISO 17949;

— all electrical components have been replaced by their respective mass or structural replacements;

— informative annex on cable routing has been removed;

— normative annex on electrical grounding scheme has been removed;

— informative annex on a permissible internal data acquisition system has been removed.

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 use.

In 1997, the WorldSID 50th percentile adult male dummy development was initiated, with the aim of defining a global-consensus side impact dummy with more human-like 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 4:
User's manual

1 Scope

This document specifies requirements for assembling and disassembling 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*

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 Requirements

4.1 Disassembly and assembly

The WorldSID shall be disassembled and assembled according to the procedures in Annex A.

Unless noted otherwise, all fasteners shall be installed using the torques in Annex B (Table B.1). Refer to Annex C (Table C.1) for fastener abbreviations, descriptions, and ISO references.

4.2 Support equipment

The usual laboratory equipment and, in particular, the specialized support equipment in Annex D (Table D.1) shall be used.

5 Procedures and information

5.1 Joint adjustment procedures

The WorldSID arms, knee pivots and ankle joints shall be adjusted according to the procedures in Annex E.

5.2 Seating procedure

Repeatable and reproducible crash test results are highly dependent upon systematic seating procedures. The recommended seating procedure is specified in ISO 17949. When implementing ISO 17949, the half arms should be positioned using the middle arm detent (the first detent downward from the uppermost detent). This detent creates a 32° differential between the rib angle sensor and the arm angle.

5.3 Temperature information

The WorldSID components with the most sensitivity to temperature change are the inner ribs, in particular, the energy absorbing material which covers the inner ribs. WorldSID temperature measurements should be made per procedures specified in ISO/TR 27957.

Annex A
(normative)

Procedures for disassembly and assembly of the WorldSID

A.1 Head

A.1.1 Parts list for head

NOTE Table A.1 lists the parts required for assembling the WorldSID head, which are shown in Figure A.1 and Figure A.2.

Table A.1 — Parts list for WorldSID head

Key number	Description	Quantity	Part number
1	Moulded head	1	W50–14014
2	Head core	1	W50–10007–1
3	Neck shroud assembly	1	W50–24017
4	Angular rate sensor mass replacement	3	477–3605
5	Neck load cell structural replacement	1	W50–71003
6	Tilt sensor mass replacement	1	476–3604
7	Triaxial accelerometer mass replacement and mount	1	7268C-SR
8	BHCS M4 × 0,7 × 10 LG	5	5001083
9	Flat washer M8 (8,9 mm ID × 18,8 mm OD × 2,3 mm thick) plain zinc	1	5000123
10	BHCS M8 × 1,25 × 30 LG	1	5001314
11	SHCS M6 × 1 × 14 LG	4	5000604
12	SHCS M3 × 0,5 × 8	6	5000388
13	SHCS M6 × 1 × 12	4	5000281
14	SHCS M4 × 0,7 × 10	1	5000151
15	SHCS M2 × 0,4 × 16	1	5000985
16	#2 flat washer	1	9003999
17	Cable retainer bracket	1	WS-1012
18	SHCS M1,6 × 0,35 × 3	1	5000063
19	SHCS M2 × 0,4 × 10	2	5000215
20	Mount, tilt sensor W50/W5 head	1	W50–00201
21	Mount, ARS, WSID	3	W50–00301
22	SHCS #0–80 × 3/8 "	6	9003146

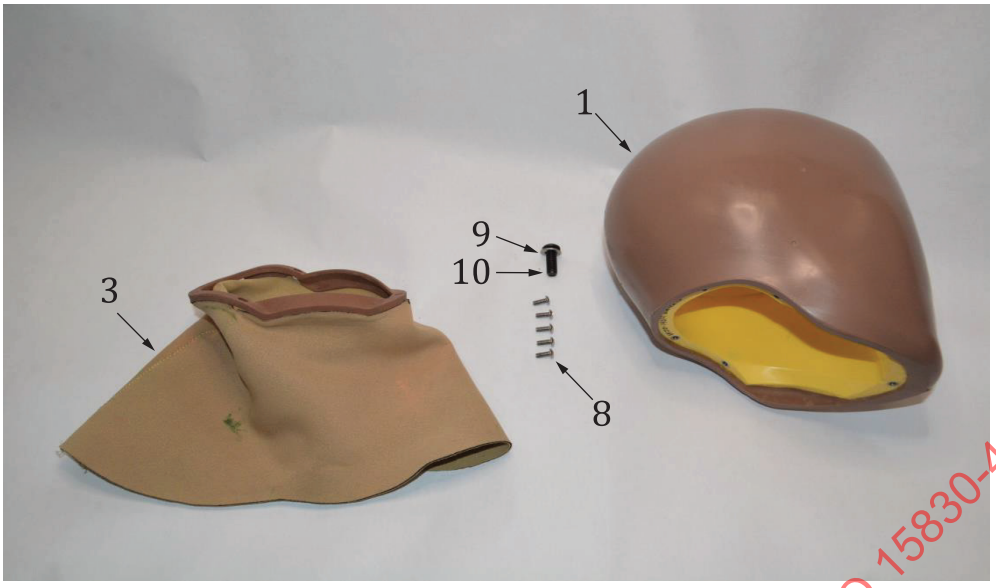


Figure A.1 — WorldSID moulded head and neck shroud components

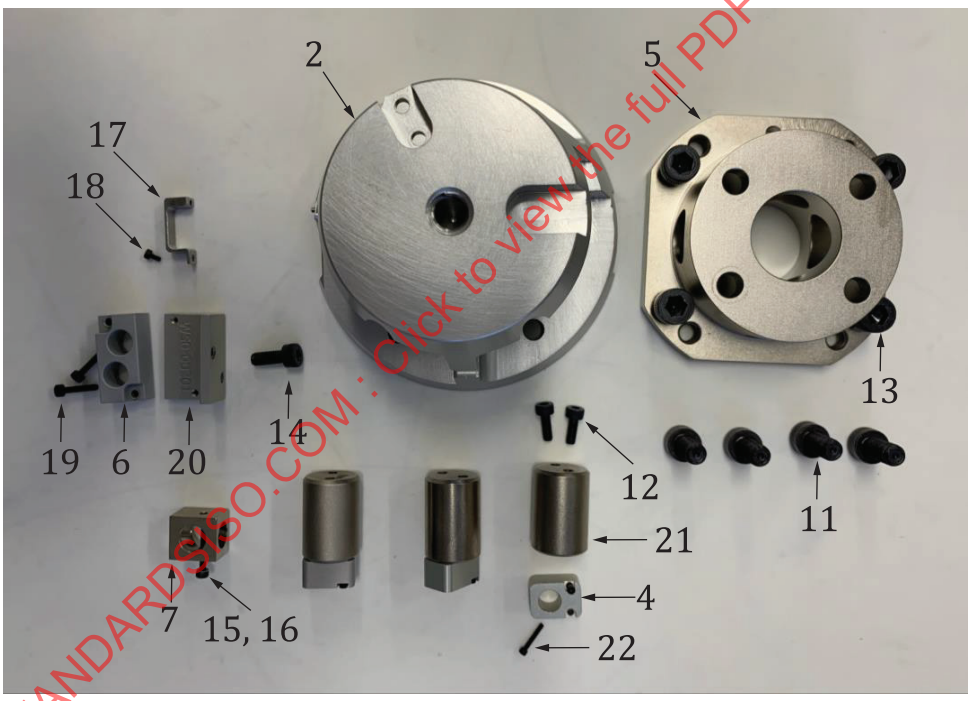


Figure A.2 — WorldSID head core components

A.1.2 Head disassembly

As shown in Figure A.3, remove the BHCS M8 × 1,25 × 30 LG fastener (Figure A.1, key10) and M8 flat washer (Figure A.1, key 9) from the top of the head. Lift the moulded head (Figure A.1, key 1) off the head core (Figure A.2, key 2). Detach the neck shroud assembly (Figure A.1, key 3) from the head by removing five screws, BHCS M4 × 0,7 × 10 LG (Figure A.1, key 8).

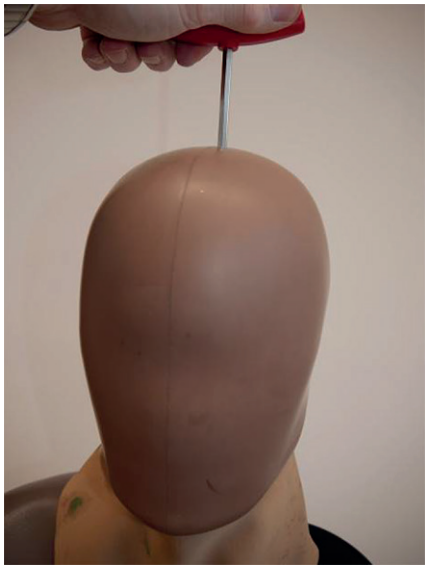


Figure A.3 — Removal of moulded head

Remove the four SHCS M6 × 12 (Figure A.2, key 13) to remove the upper neck load cell structural replacement from the neck assembly (see Figure A.4).

Figure A.4 — Separating the upper neck load cell structural replacement from the neck

Remove the four SHCS M6 × 1 × 14 LG (Figure A.2, key 11) from the bottom of the upper neck load cell structural replacement (Figure A.2, key 5) that attach it to the bottom of the head core (see Figure A.5).

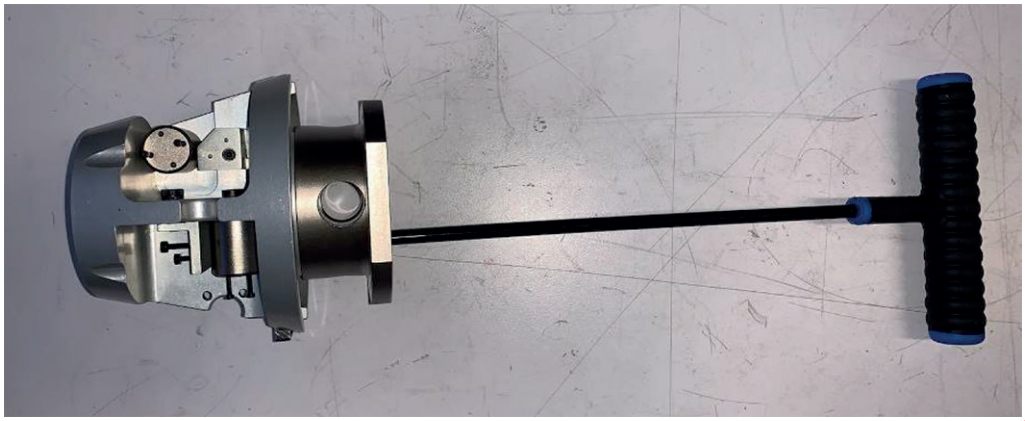


Figure A.5 — Removing upper neck load cell structural replacement from head core

Remove the tilt sensor mount (Figure A.2, key 20) from the head core (Figure A.2, key 2) by removing the SHCS M4 × 0,7 × 10 (Figure A.2, key 14). Remove the tilt sensor mass replacement (Figure A.2, key 6) from the tilt sensor mount (Figure A.2, key 20) by removing two SHCS M2 × 0,4 × 10 (Figure A.2, key 19). Remove each ARS mount (Figure A.2, key 21) from the head core (Figure A.2, key 2) by removing two SHCS M3 × 0,5 × 8 (Figure A.2, key 12). Remove each ARS mass replacement (Figure A.2, key 4) from its ARS mount (Figure A.2, key 21) by removing two SHCS #0-80 × 3/8 " (Figure A.2, key 22).

Remove the triaxial accelerometer mass replacement and mount (Figure A.2, key 7) from the head core by removing the SHCS M2 × 0,4 × 16 (Figure A.2, key 15) and flat washer (Figure A.2, key 16).

Remove the cable retainer bracket (Figure A.2, key 17) from the head core (Figure A.2, key 2) by removing the SHCS M1,6 × 0,35 × 3 (Figure A.2, key 18).

A.1.3 Head assembly

Inspect inside the head/skull and the head skin for damage before reassembling the head.

Attach the cable retainer bracket (Figure A.2, key 17) to the head core (Figure A.2, key 2) with the SHCS M1,6 × 0,35 × 3 (Figure A.2, key 18). Attach the triaxial accelerometer mass replacement (Figure A.2, key 7) to the head core with the SHCS M2 × 0,4 × 16 (Figure A.2, key 15) and flat washer (Figure A.2, key 16).

Attach the ARS mass replacements (Figure A.2, key 4) to their ARS mounts (Figure A.2, key 21) with SHCS #0-80 × 3/8 " (Figure A.2, key 22). Attach each ARS mount (Figure A.2, key 21) to the head core (Figure A.2, key 2) with two SHCS M3 × 0,5 × 8 (Figure A.2, key 12).

NOTE ARS mounting screws are English fasteners.

Attach the tilt sensor mass replacement (Figure A.2, key 6) to the tilt sensor mount (Figure A.2, key 20) with two SHCS M2 × 0,4 × 10 (Figure A.2, key 19). Attach the tilt sensor mount (Figure A.2, key 20) to the head core (Figure A.2, key 2) with the SHCS M4 × 0,7 × 10 (Figure A.2, key 14). Figure A.6 shows the proper orientation of the head instrumentation mass replacements in the head core.

a) Right side

b) Back

Figure A.6 — Orientation of WorldSID head instrumentation mass replacements

Attach the upper neck load cell structural replacement (Figure A.2, key 5) to the head core (Figure A.2, key 2). Attach the neck shroud assembly (Figure A.1, key 3) to the moulded head (Figure A.1, key 1) using five BHCS M4 × 0,7 × 10 LG (Figure A.1, key 8). Place the head and neck shroud assembly over the head core. Place the M8 flat washer (Figure A.1, key 9) into the recess at the top of the head and attach the head and neck shroud assembly to the head core using the BHCS M8 × 1,25 × 30 LG (Figure A.1, key 10).

A.2 Neck

A.2.1 Parts list for neck

NOTE Table A.2 lists the parts required for assembling the WorldSID neck, which are shown in Figure A.7.

Table A.2 — Parts list for WorldSID neck

Key number	Description	Quantity	Part number
1	Lower neck bracket	1	W50–20101–1
2	Upper neck bracket	1	W50–20102
3	Moulded neck	1	W50–22003
4	Neck interface plate	2	W50–20002
5	Half-spherical screw	1	175–2004
6	Neck compression tool	1	175–9500
7	Neck load cell structural replacement	1	W50–71003
8	SHCS M6 × 1 × 12 LG	8	5000281
9	Lateral neck buffer	1	W50–20006 (A, B or C)[a]
10	Flexion extension neck buffer	4	W50–20016
11	SHCS M6 × 1 × 30	2	5000008
12	Neck spacer	2	W50–20103

[a] The letters and colour bands designate different stiffnesses. A, red is softest, B, yellow is middle, and C, blue is stiffest.

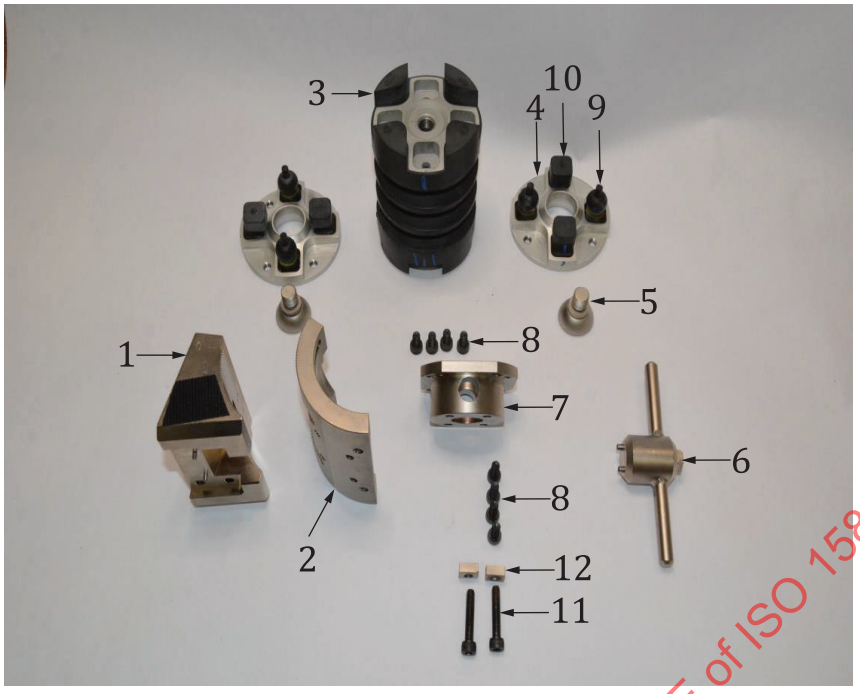


Figure A.7 — WorldSID neck components

A.2.2 Neck disassembly

To separate the neck assembly from the torso, detach the lower neck bracket (Figure A.7, key 1) from the spine box upper weldment by removing four SHCS M6 × 1 × 16 LG. Refer to Figure A.8.

NOTE The four SHCS M6 × 1 × 16 LG are part of the thorax/abdomen/shoulder assembly. Refer to Table A.3, key 30.

Figure A.8 — Removal of upper and lower neck bracket from torso

Remove the moulded neck (Figure A.7, key 3) from the lower neck load cell structural replacement (Figure A.7, key 7) by removing four SHCS M6 × 1 × 12 LG (Figure A.7, key 8). Refer to Figure A.9.

Figure A.9 — Removal of moulded neck from lower neck load cell structural replacement

Remove the lower neck load cell structural replacement (Figure A.7, key 7) from the upper and lower neck brackets (Figure A.7, keys 1 and 2) by removing four SHCS M6 × 1 × 12 LG (Figure A.7, key 8). Refer to Figure A.10.

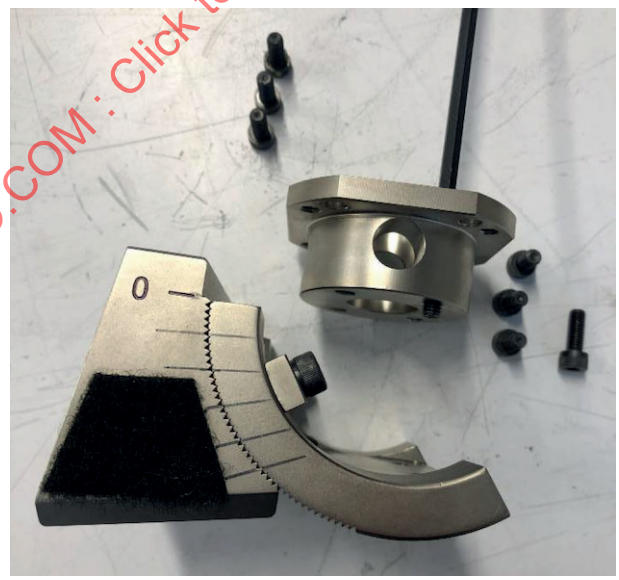


Figure A.10 — Removal of the lower neck load cell structural replacement from the upper and lower neck brackets

Use the neck compression tool (Figure A.7, key 6) to loosen the half-spherical screw (Figure A.7, key 5). Remove the half-spherical screw to remove the neck interface plates (Figure A.7, key 4) from the top and bottom of the moulded neck. Refer to Figure A.11.

Figure A.11 — Removal of neck interface plates using neck compression tool

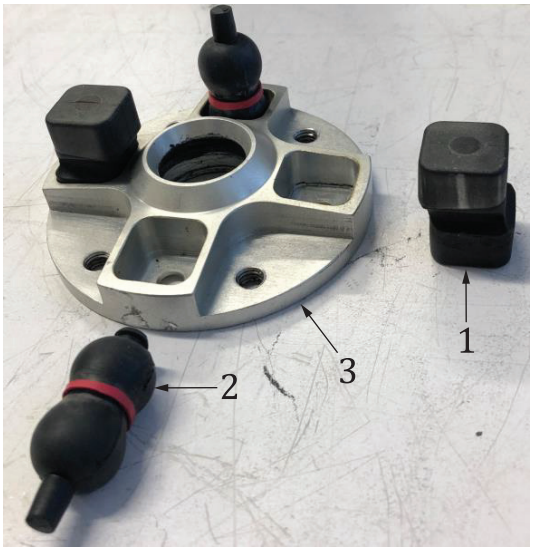
Disassemble the upper and lower neck bracket components (Figure A.7, keys 1 and 2) by removing the two SHCS M6 × 1 × 30 (Figure A.7, key 11) and two neck spacers (Figure A.7, key 12). Refer to Figure A.12.

Figure A.12 — Separation of neck bracket assembly

A.2.3 Neck assembly

Before reassembling the neck, inspect the moulded neck and buffers by flexing them to check for cracks of the rubber material.

Press the shorter ends of the lateral neck buffers (Figure A.7, key 9) into the lateral positions of the neck interface plates (Figure A.7, key 4). The buffers might need a twist to fully seat in the neck interface plate. The colour of the buffers depends on the required stiffness. Red is softest, yellow is middle, and blue is stiffest. Press the flexion extension neck buffers with the square cross-sections (Figure A.7, key 10) into the fore and aft positions of the neck interface plate with the bias towards the centre. Refer to Figure A.13.



Key

1 flexion extension neck buffer
2 lateral neck buffer
3 neck interface plate

Figure A.13 — Position of neck buffers in neck interface plate

Attach the neck interface plates to the moulded neck using the neck compression tool (Figure A.7, key 6) with a socket and torque wrench (not shown). Lubricate the half-spherical screws well with high pressure grease. Tighten the half-spherical screws to 10 N·m. Refer to Figure A.14.

Figure A.14 — Assembly of neck interface plates to moulded neck

Place the upper neck bracket (Figure A.7, key 2) over the lower neck bracket (Figure A.7, key 1) and engage the teeth in the desired orientation. Insert the neck spacer (Figure A.7, key 12) into the slot on one side and orient it so the hole in the nut lines up with the hole accessed from the back of the lower neck bracket. Insert the SHCS M6 × 1 × 30 (Figure A.7, key 11) to secure the brackets together. Repeat with the second neck bracket nut and SHCS on the other side. Refer to Figure A.10.

Attach the lower neck load cell structural replacement (Figure A.7, key 7) to the upper neck bracket (Figure A.7, key 2) with four SHCS M6 × 1 × 12 (Figure A.7, key 8). Refer to Figure A.9.

Attach the moulded neck (Figure A.7, key 3) to the lower neck load cell structural replacement (Figure A.7, key 17) with four SHCS M6 × 1 × 12 (Figure A.7, key 8) accessed from the bottom. Refer to Figure A.8.

A.3 Thorax, abdomen, and shoulder

A.3.1 Parts lists

A.3.1.1 Parts list for thorax, abdomen, and shoulder assembly

NOTE Table A.3 lists the parts required for assembling the WorldSID thorax, abdomen, and shoulder, which are shown in Figure A.15 and Figure A.16.

Table A.3 — Parts list for the WorldSID thorax, abdomen, and shoulder

Key number	Description	Quantity	Part number
1	Spine box assembly	1	W50–31000
2	Thorax rib assembly 1, WorldSID	2	W50–32111
3	Thorax rib assembly 2 and 3 and abdomen rib assembly 1 and 2, WorldSID	8	W50–32131
4	Sternum, thorax bib	1	W50–35022
5	Rib coupler, abdominal, WorldSID	1	W50–35021
6	Shoulder rib sternum mounting strip	2	W50–32177
7	Thorax and abdominal rib sternum mounting strip	10	W50–32178
8	Thorax and abdominal rib mounting strip, threaded	10	W50–32176
9	Screw, BHCS M5 × 0,8 × 10 LG	24	5000003
10	Shoulder rib assembly, inner band, WorldSID	2	W50–32160–2
11	Thorax rib assembly, inner band, WorldSID	6	W50–32150–2
12	Abdomen rib assembly, inner band, WorldSID	4	W50–32155–2
13	Shoulder rib mounting bracket, WorldSID	2	W50–32171
14	Thorax and abdominal rib accelerometer mounting bracket, WorldSID	10	W50–32172
15	Rib assembly, shoulder	2	W50–32001
16	Shoulder rib sternum mounting strip, threaded	2	W50–32175
17	Thorax and abdominal rib clamping bracket, WorldSID	10	W50–32173
18	Screw, FHCS M5 × 0,8 × 20 LG	8	5000386
19	Screw, rib displacement measurement device mount	6	W50–32179
20	Rib doubler, shoulder	2	W50–32010
21	Shoulder assembly, left	1	W50–61053–1
22	Clamp, damping	24	W50–32180
23	Screw, FHCS M5 × 0,8 × 10 LG	48	5000084
24	Screw, BHCS M5 × 0,8 × 6 LG	24	5000214
25	Shoulder pad, left, WorldSID	1	W50–35023–1
26	Shoulder pad, right, WorldSID	1	W50–35023–2
27	Screw, SHCS M2,5 × 0,45 × 10	10	5000456
28	Nut, locknut M12 × 1,75	2	5000462
29	Thorax pad	2	W50–35124
30	Screw, SHCS M6 × 1 × 16 LG	4	5000081
31	Screw, SHCS M2 × 0,4 × 16 LG SS	6	5000509
32	Cable tie mount, 13 mm × 13 mm, nylon, adhesive backed	10	6002035
33	Cable tie mount, #4 screw, nylon	1	6002036
34	Screw, BHCS M3 × 0,5 × 6 LG	1	5000399

Table A.3 *(continued)*

Key number	Description	Quantity	Part number
35	Cable tie, hook and loop, 280 mm (not shown)	8	6002055
36	Battery mounting bracket	1	W50–37013
37	Spine ballast stand offs	2	W50–37014
38	DAS mounting bracket, WorldSID thorax	1	W50–37015
39	DAS structural replacement	1	W50–74307
40	Screw, SHCS M5 × 0,8 × 25 LG	2	5000721
41	Screw, BHCS M5 × 0,8 × 12 LG	40	5000654
42	Screw, BHCS #6–32 × 1–1/4 ” LG	4	9003044
43	Screw, SHCS M3 × 0,5 × 12	6	5000568
44	DAS interposer structural replacement	1	W50–51052–4
45	Screw, SHCS M6 × 1 × 12 LG	1	5000281
46	Screw, LHCS M5 × 0,8 × 10 LG	24	5000774
47	Shoulder assembly, right	1	W50–61053–2
48	Temperature logger structural replacement	1	476–3605
49	Screw, SHCS M2,5 × 0,45 × 16 LG	2	5000069
50	Triaxial accelerometer structural replacement	6	7268C-SR
51	Washer #2 flat plain L SS	6	9003999

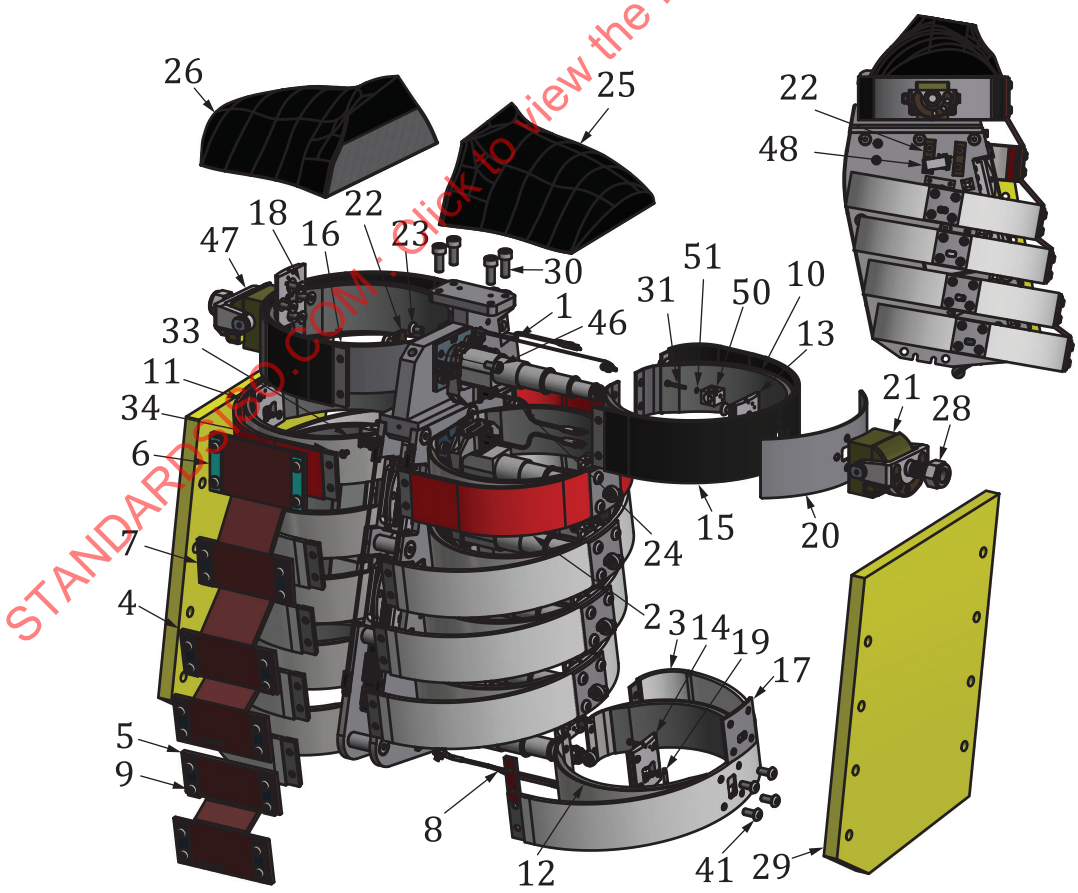


Figure A.15 — WorldSID thorax and abdomen components

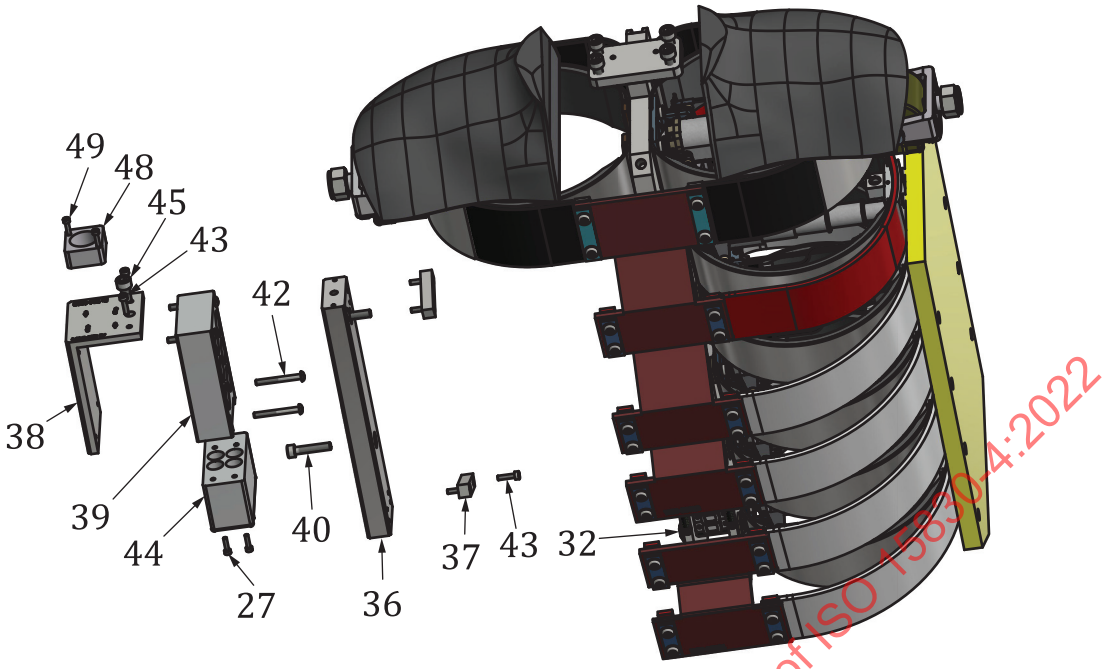


Figure A.16 — WorldSID thorax and abdomen non-impacted side components

A.3.1.2 Parts list for shoulder

NOTE Table A.4 lists the parts required for assembling the WorldSID shoulder, which is shown in Figure A.17.

Table A.4 — Parts list for WorldSID shoulder assembly

Key number	Description	Quantity			Part number
		Left	Right	Total	
1	Shoulder load cell structural replacement	1	1	2	W50–71092
2	Shoulder pivot shaft	1	1	2	W50–61049
3	Shoulder pivot washer	2	2	4	W50–61050
4	Shoulder clevis assembly, right	-	1	1	W50–63111
Not shown	Shoulder clevis assembly, left	1	-	1	W50–63112
5	M6 × 1 hex locknut zinc	1	1	2	5000143
6	SSNT M4 × 0,7 × 4, nylon tip	2	2	4	5000201
7	SSFP M6 × 1 × 12 LG	1	1	2	5001340

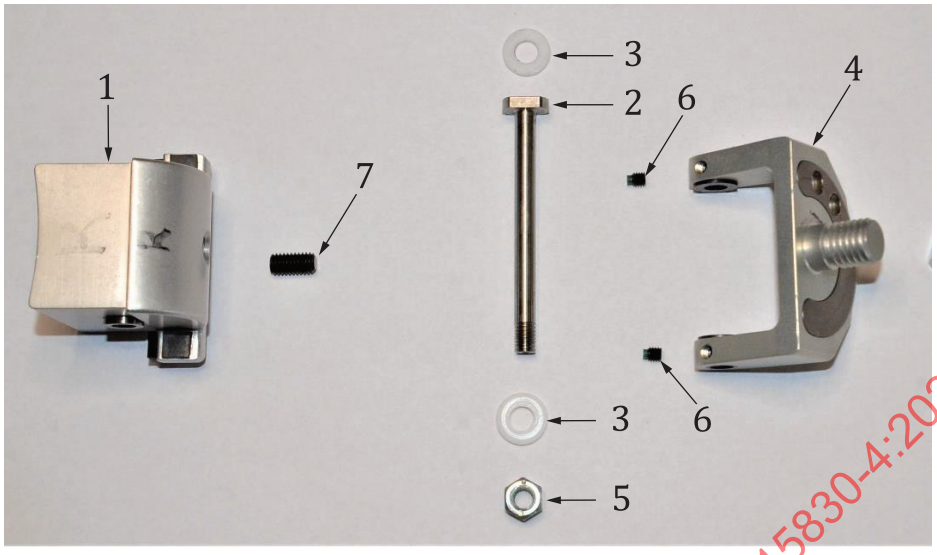


Figure A.17 — WorldSID shoulder components

A.3.1.3 Parts list for spine box assembly

NOTE Table A.5 list the parts required for assembling the WorldSID spine box, which are shown in Figure A.18.

Table A.5 — Parts list for WorldSID spine box assembly

Key number	Description	Quantity	Part number
1	Mounting bracket #1	2	W50–31042
2	Upper bracket weldment, spine box, WorldSID	1	W50–31010
3	Interposer mass replacement	2	W50–75001
4	Side plate, left WorldSID	1	W50–31020
5	SHCS M3 × 0,5 × 10 LG	13	5000119
6	Spacer, WorldSID	6	W50–31041
7	T12 accelerometer mount, WorldSID	1	W50–37024
8	Side plate, right WorldSID	1	W50–31030
9	Connector housing mass replacement	2	W50–75002
10	Backup plate mounting bracket	2	W50–37022
11	Cable assembly, W50 spine box	2	W50–75810
12	BHCS M3 × 0,5 × 5 LG	4	5000674
13	SHCS M4 × 0,7 × 10	4	5000151
14	FHCS M6 × 1 × 12 LG	18	5000139
15	SHCS M2 × 0,4 × 12 LG	8	5000382
16	BHCS M6 × 1 × 18	4	5000465
17	Angular accelerometer/tilt sensor mount bracket	1	W50–37023
18	Mounting bracket #2	2	W50–31043
19	DAS mass replacement	3	W50–74307
20	Cover plate spine box	2	W50–31045
21	Bracket, rotational accelerometer mount	1	W50–37029
22	SHCS M4 × 0,7 × 25 LG	8	5000461
23	FHCS M3 × 0,5 × 10	2	5000203

Table A.5 *(continued)*

Key number	Description	Quantity	Part number
24	SHCS M4 × 0,7 × 30 LG	2	5000463
25	SHCS M2 × 0,4 × 16 LG SS	2	5000509
26	Mount kit, tilt sensor	1	W50–00204
27	Triaxial accelerometer mass replacement	2	7268C-SR
28	Mount kit, ARS	1	W50–00311
29	Mount kit, dual-axis ARS, WS thorax	1	W50–00312
30	Washer, #2 flat plain SS	2	9003999

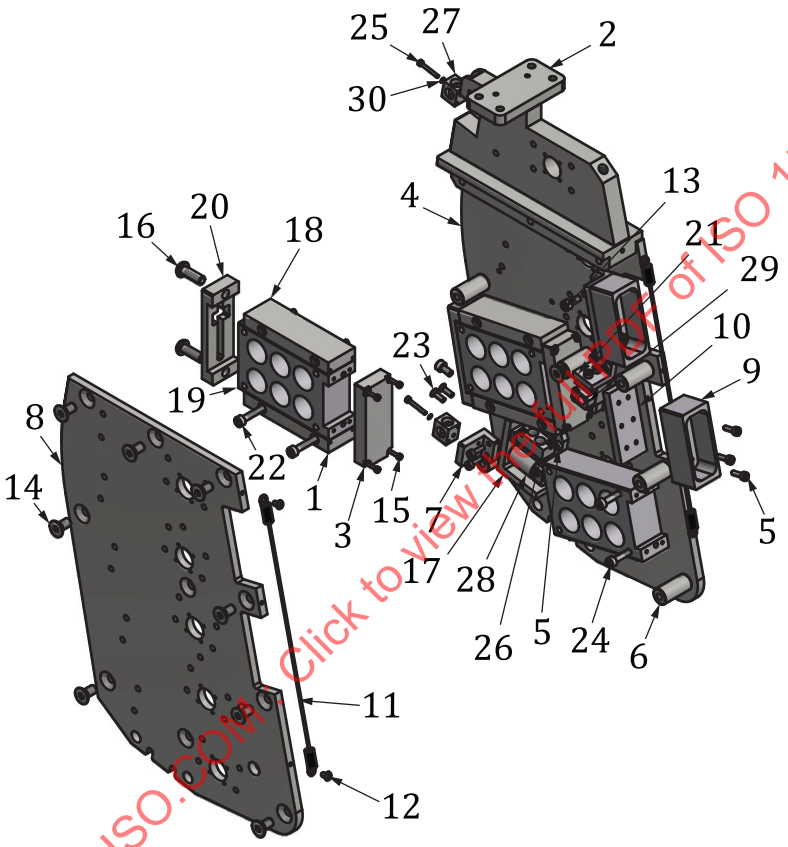


Figure A.18 — WorldSID spine box assembly

A.3.2 Thorax, abdomen and shoulder disassembly

A.3.2.1 Separation of upper and lower torso

Remove the four SHCS M8 × 1,25 × 18, two on each side of the bottom of the spine box, to separate the upper torso from the lower torso.

NOTE The four SHCS M8 × 1,25 × 18 are part of the pelvis assembly. Refer to Table A.7, key 20.

A.3.2.2 Shoulder disassembly

As shown in Figure A.19, remove the shoulder assemblies (Figure A.15, keys 21 and 47) by removing the four FHCS M5 × 0,8 × 20 LG (Figure A.15, key 18) that hold each in place.

To remove the clevis assembly (Figure A.17, key 4), take off the M6 × 1 hex nut (Figure A.17, key 5) with the nylon washer (Figure A.17, key 3) at the threaded end. Next, loosen the two SSNT M4 × 0,7 × 4

(Figure A.17, key 6) in the clevis assembly that hold the pivot shaft (Figure A.17, key 2) and the SSFP M6 × 1 × 12 mm (Figure A.17, key 7) from the load cell structural replacement. Refer to Figure A.20 and Figure A.21. Pull the pivot shaft out of the assembly.

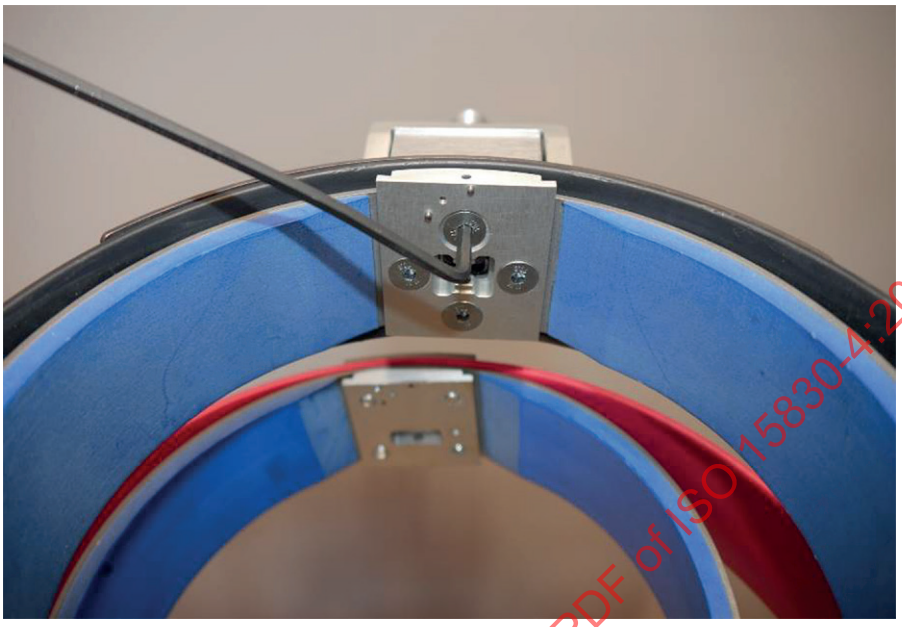


Figure A.19 — Removal of shoulder load cell assembly

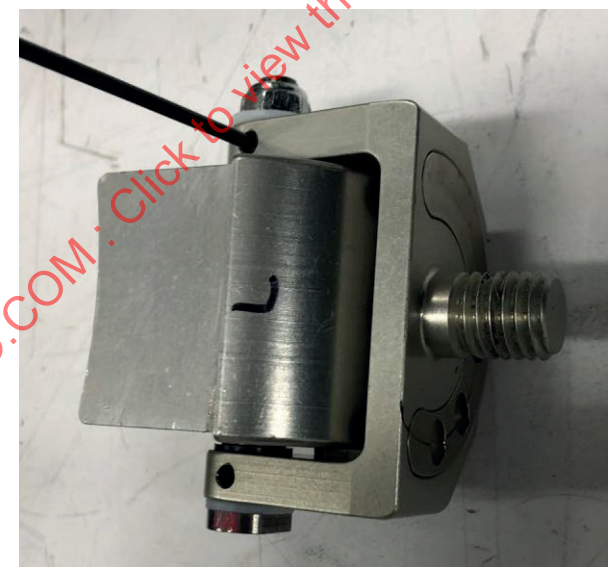


Figure A.20 — Removal of set screws from shoulder clevis

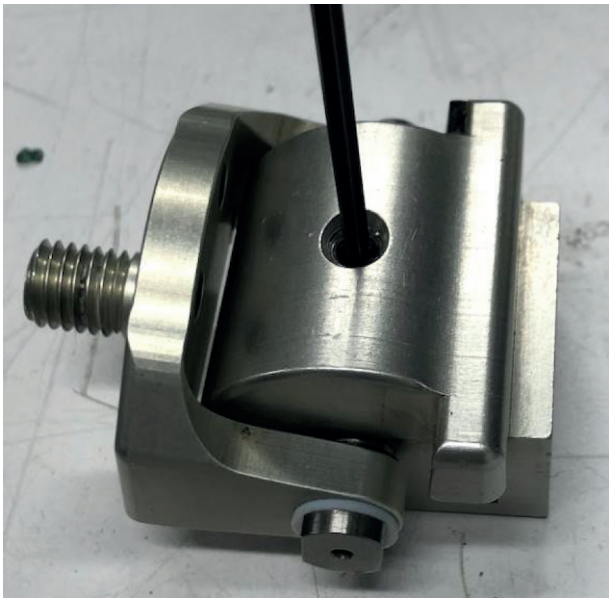


Figure A.21 — Removal of set screw from shoulder load cell structural replacement

A.3.2.3 Thorax and abdomen disassembly

Remove the thorax pad (Figure A.15, key 29) by removing the hook and loop cable ties (Table A.3, key 35) that hold it in place. Remove the shoulder pads (Figure A.15, keys 25 and 26) by lifting them off the dummy. Remove the lower neck bracket from the spine box by removing four SHCS M6 × 1 × 16 (Figure A.15, key 30).

Remove the shoulder rib mounting brackets (Figure A.15, key 13).

Remove the linear triaxial accelerometer mass replacement (Figure A.15, key 50) from the shoulder rib mounting bracket by removing the cheese screw M2 × 0,4 × 16 (Figure A.15, key 31).

Disconnect the shoulder rib (Figure A.15, key 15) at the front by removing the two BHCS M5 × 0,8 × 10 (Figure A.15, key 9) that attach the left and right shoulder ribs to the sternum thorax bib (Figure A.15, key 4). Remove a shoulder rib sternum mounting strip (Figure A.15, key 6) and a threaded shoulder rib sternum mounting strip (Figure A.15, key 16) from each side.

Detach the left and right shoulder ribs from the spine box at the rear by removing two BHCS M5 × 0,8 × 6 (Figure A.15, key 24) that hold each in place. On the non-struck side, remove the two damping clamps (Figure A.15, key 22).

The procedures for disassembling the remaining ribs are similar to those for the shoulder rib, but details for the first thoracic rib are included here in order to include references to the correct key numbers. Detach the rib clamping bracket (Figure A.15, key 17) and the rib accelerometer mounting bracket (Figure A.15, key 14) by removing the four BHCS M5 × 0,8 × 10 (Figure A.15, key 9). Remove the triaxial accelerometer mass replacement (Figure A.15, key 50) from the rib accelerometer mounting bracket (Figure A.15, key 14) by removing the cheese screw M2 × 0,4 × 16 (Figure A.15, key 31).

Detach the thorax rib at the front by removing the four BHCS M5 × 0,8 × 10 (Figure A.15, key 9) that connect it to the sternum (Figure A.15, key 4). Remove the two sternum rib mounting strips (Figure A.15, key 7) and the two threaded rib mounting strips (Figure A.15, key 8). Detach the inner band of the thorax rib (Figure A.15, key 11) by removing the four BHCS M5 × 0,8 × 10 (Figure A.15, key 9) that hold them in place. Remove the two damping clamps (Figure A.15, key 22). Detach the rib from the spine box at the rear by removing two BHCS M5 × 6 (Figure A.15, key 24) that hold them in place.

Repeat this procedure for the second and third thorax ribs and the two abdominal ribs with the few differences in parts described here. The two abdominal ribs are attached at the front to the abdominal

rib coupler (Figure A.15, key 5), and that the inner rib bands of the two abdomen ribs (Figure A.15, key 12) are different than the inner bands of the three thorax ribs.

NOTE 1 The damping material on the abdominal ribs is thicker than that on the thoracic ribs.

NOTE 2 The first thorax outer rib is different from the thorax ribs 2 and 3 and the abdominal ribs (Figure A.15, key 3), which are the same.

After the ribs are removed, detach the DAS mounting bracket (Figure A.16, key 38) from the non-struck side by removing two SHCS M3 × 0,5 × 12 (Figure A.16, key 43). Then, detach the DAS structural replacement (Figure A.16, key 39) by removing the four #6-32 × 1-1/4 ” BHCS (Figure A.16, key 42). Detach the DAS interposer structural replacement (Figure A.16, key 44) by removing the four SHCS M2,5 × 0,45 × 10 (Figure A.16, key 27). Next, remove the battery mounting bracket (Figure A.16, key 36) by detaching the two SHCS M5 × 0,8 × 25 (Figure A.16, key 40) that secure it to the spine box. Detach the spine ballast stand offs (Figure A.16, key 37) from the battery mounting bracket (Figure A.16, key 36) by removing the SHCS M3 × 0,5 × 12 (Figure A.16, key 43).

A.3.2.4 Spine box disassembly

Detach the upper bracket weldment (Figure A.18, key 2) from the spine box by removing three FHCS M6 × 1 × 10 (Figure A.18, key 14) from each side of the spine box. Separate the right-side spine plate (Figure A.18, key 8) from the spine box by removing six FHCS M6 × 1 × 12 (Figure A.18, key 14). Note that the internal components of the spine box will now be visible (see Figure A.22).

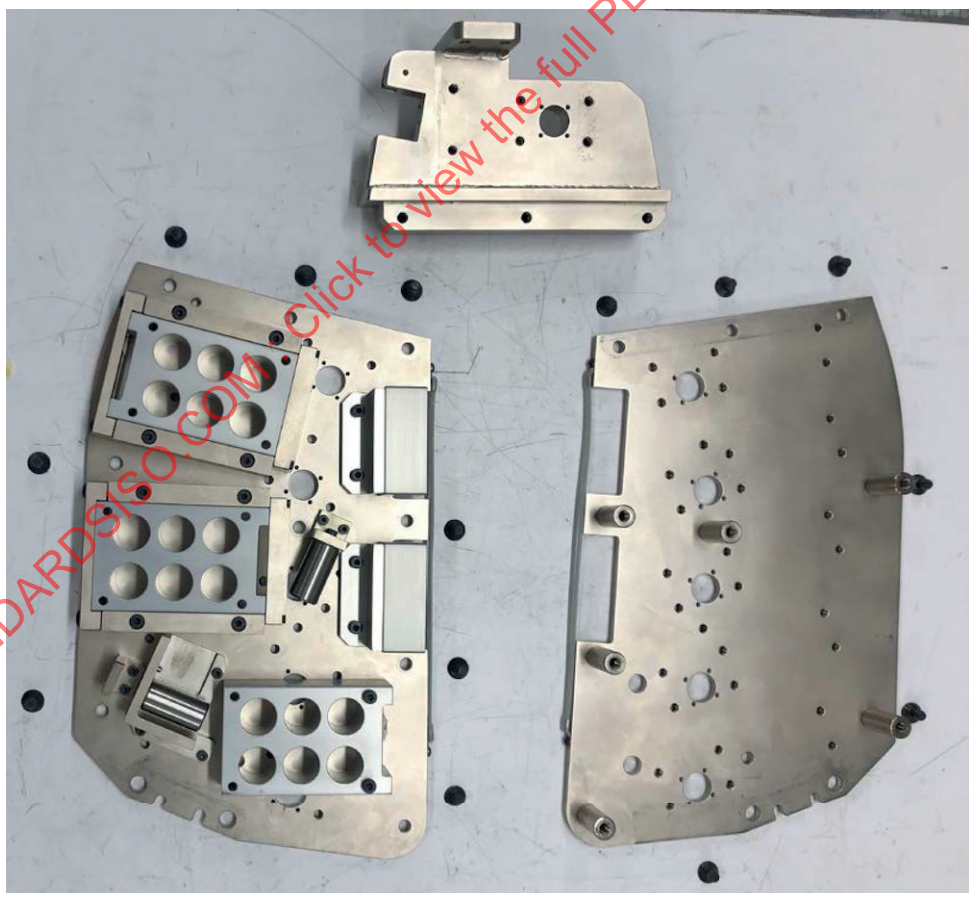


Figure A.22 — Internal spine box assembly

To begin disassembly of the left-side spine plate assembly, detach the cable assembly (Figure A.18, key 11) by removing the two BHCS M3 × 0,5 × 5 LG (Figure A.18, key 12).

Begin removal of the upper or middle DAS module mass replacement (Figure A.18, key 19) by removing two SHCS M4 × 0,7 × 25 (Figure A.18, key 22) that secure the #2 mounting brackets (Figure A.18, key 18) to the left-side spine plate (Figure A.18, key 4). Remove two more SHCS M4 × 0,7 × 25 (Figure A.18, key 22) that secure the #1 mounting brackets (Figure A.18, key 1) to the left-side spine plate. Remove the middle or upper DAS module mass replacement assembly (Figure A.18, key 19). Detach the spine box cover plate (Figure A.18, key 20) from the back of each DAS module mass replacement (Figure A.18, key 19) by removing two BHCS M6 × 1 × 18 (Figure A.18, key 16). Slide the DAS module mass replacement (Figure A.18, key 19) from between the two mounting brackets (Figure A.18, keys 1 and 18). Detach each interposer mass replacement (Figure A.18, key 3) from the mounting brackets by removing the four SHCS M2 × 0,4 × 12 (Figure A.18, key 15). Remove the two backup plate mounting brackets (Figure A.18, key 10) from the left-side spine plate by removing the two SHCS M4 × 0,7 × 10 (Figure A.18, key 13) that hold each in place. Remove each connector housing mass replacement (Figure A.18, key 9) from its backup plate mounting bracket (Figure A.18, key 10) by removing three SHCS M3 × 0,5 × 10 (Figure A.18, key 5). Remove the lower DAS module mass replacement (Figure A.18, key 19) from the spine box by detaching two SHCS M4 × 0,7 × 30 (Figure A.18, key 24).

To begin disassembly of the right-side spine plate assembly, detach the cable assembly (Figure A.18, key 11) by removing the two BHCS M3 × 0,5 × 5 LG (Figure A.18, key 12). Turn the right-side spine plate assembly over and remove six FHCS M6 × 1 × 12 (Figure A.18, key 14) to remove the six spacers (Figure A.18, key 6).

A.3.3 Thorax, abdomen and shoulder assembly

A.3.3.1 Thorax and abdomen assembly

Inspect the ribs for damage before reassembling the thorax, abdomen, and shoulder. Inspect the inner and outer bands for obvious deformation. Flex the inner band to check for delamination of the damping material. Flex the outer band and feel for cracks in the metal inside the shrink wrap. Inspect the shrink wrap for cuts or tears that expose the metal rib. Check the rib stiffeners for deformation as indicated by a gap between the rib and rib stiffener.

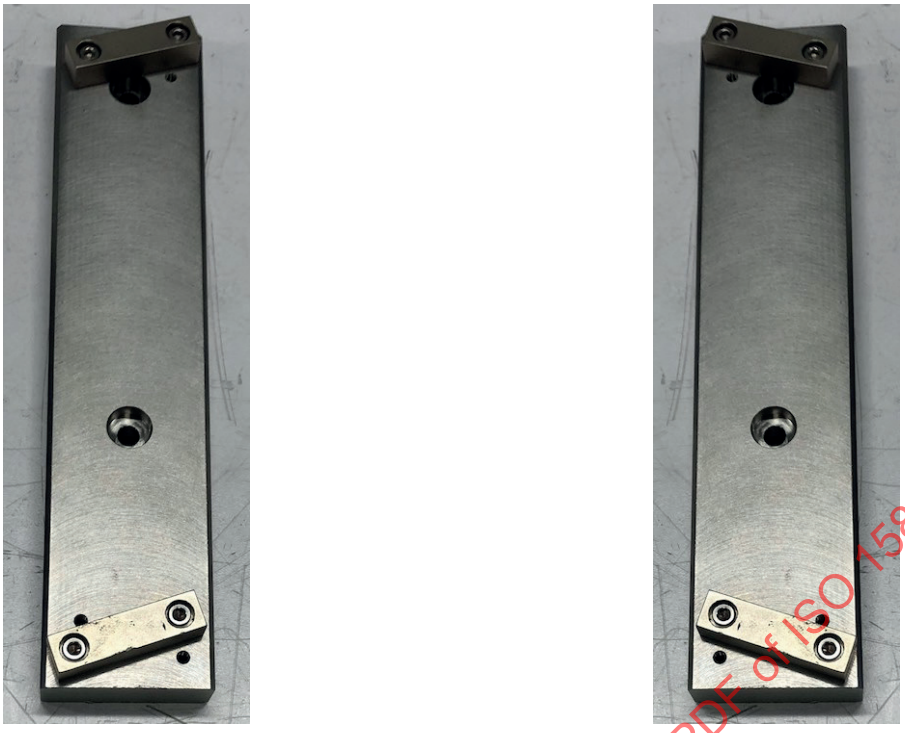
NOTE 1 Figure A.23 shows the colour coding scheme for the WorldSID ribs; the shoulder rib is grey, the first thoracic rib is red, and the remaining ribs (thorax number two and three, both abdominal) are white.

NOTE 2 The inner bands of the two abdominal ribs (Figure A.15, key 12) have a thicker layer of damping material than the inner bands of the thoracic ribs (Figure A.15, key 11), and the inner band of the shoulder rib (Figure A.15, key 10) is different from the other inner bands.

Figure A.23 — Rib colour scheme

Begin assembly of the thorax by attaching the two spine ballast stand offs (Figure A.16, key 37) to the battery mounting bracket (Figure A.16, key 36) with SHCS M3 × 0,5 × 12 (Figure A.16, key 43). The orientation of the standoffs depends on which side of the dummy the ballast will be mounted to. Refer to Figure A.24. Attach the battery mounting bracket (Figure A.16, key 36) with two SHCS M5 × 0,8 × 25 (Figure A.16, key 40) that secure it to the spine box on the non-struck side. Attach the DAS structural replacement (Figure A.16, key 39) with four BHCS #6-32 × 1-1/4 ” (Figure A.16, key 42) to the DAS mounting bracket (Figure A.16, key 38). Attach the DAS interposer structural replacement (Figure A.16, key 44) to the DAS structural replacement with SHCS M2,5 × 0,45 × 10 (Figure A.16, key 27). Then attach the DAS mounting bracket (Figure A.16, key 38) to the battery mounting bracket (Figure A.16, key 36).

NOTE 3 DAS structural replacement mounting screws are English fasteners.



a) Left side b) Right side

Figure A.24 — Orientation of spine ballast standoffs

Begin assembly of the ribs from the bottom. Attach the lower abdominal rib (Figure A.15, key 12) to the spine box at the rear using two BHCS M5 × 0,8 × 6 (Figure A.15, key 24). Secure the inner band of the abdomen rib (Figure A.15, key 12) with two damping clamps (Figure A.15, key 22) and four BHCS M5 × 0,8 × 10 (Figure A.15, key 9). To permit easier access to the connector boxes in the spine box, install the instrumentation before attaching the ribs to the rib and abdominal couplers.

Connect the rib clamping bracket (Figure A.15, key 17) and the rib accelerometer mounting bracket (Figure A.15, key 14) to the inner band and rib with four BHCS M5 × 0,8 × 10 (Figure A.15, key 9). Secure the triaxial accelerometer mass replacement (Figure A.15, key 50) to the rib accelerometer mounting bracket (Figure A.15, key 14) with a cheese screw M2 × 0,4 × 16 (Figure A.15, key 31).

Continue installing the ribs with the preceding procedure. Attach the shoulder rib mounting bracket (Figure A.15, key 13) to the shoulder rib and shoulder load cell structural replacement (Figure A.17, key 1) with four FHCS M5 × 0,8 × 20 (Figure A.15, key 18).

Position a threaded rib mounting strip (Figure A.15, key 8) behind the front holes on each abdominal rib assembly (Figure A.15, key 3), and place the abdominal rib coupler (Figure A.15, key 5) over it. Put the rib mounting strip (Figure A.15, key 7) over the rib coupler and secure the rib at the front with two BHCS M5 × 0,8 × 10 (Figure A.15, key 9).

When attaching the abdomen rib coupler and the thorax bib tighten the BHCS M5 × 0,8 × 10 gradually in an X-pattern (upper left, lower right, upper right and lower left) on each section. Tighten enough to remove gaps. Following the same X-pattern, tighten each to 0,7 N·m to 0,8 N·m, then 1,1 N·m to 1,2 N·m, then 1,4 N·m to 1,5 N·m. Repeat 1,4 N·m to 1,5 N·m a second time following the same X-pattern.

Attach the thorax pad (Figure A.15, key 29) with hook and loop cable ties (Table A.3, key 35). Attach the lower neck bracket to the spine box with four SHCS M6 × 1 × 16 (Figure A.15, key 30). Place the shoulder pads (Figure A.15, keys 25 and 26) in position, engaging the hook and loop fastener with light pressure.

A.3.3.2 Spine box assembly

Attach the six spacers (Figure A.18, key 6) to the right-side spine plate (Figure A.18, key 8) using six FHCS M6 × 1 × 12 (Figure A.18, key 14). Attach the upper spine box bracket weldment (Figure A.18, key 2) to the right-side spine plate with three more FHCS M6 × 1 × 12 (Figure A.18, key 14). Attach the cable assembly (Figure A.18, key 11) to the right-side spine plate with two BHCS M3 × 0,5 × 5 LG (Figure A.18, key 12). Refer to Figure A.25.

Figure A.25 — Spacers and cable assembly attached to right-side spine plate

As shown in Figure A.26, attach the lower DAS mass replacement (Figure A.18, key 19) to the left-side spine plate (Figure A.18, key 4) with two SHCS M4 × 0,7 × 30 (Figure A.18, key 24). Attach each backup plate mounting bracket (Figure A.18, key 10) to the spine box with two SHCS M4 × 0,7 × 10 (Figure A.18, key 13). Connect each interposer mass replacement (Figure A.18, key 3) to the mounting brackets #1 (Figure A.18, key 1) and #2 (Figure A.18, key 18) with four SHCS M2 × 0,4 × 12 (Figure A.18, key 15). Secure the mounting brackets/interposer mass replacements to the spine box with four SHCS M4 × 0,7 × 25 (Figure A.18, key 22). Slide the DAS mass replacements (Figure A.18, key 19) into the mounting brackets. Attach the spine box cover plate (Figure A.18, key 20) to the back of each DAS mass replacement with two BHCS M6 × 1 × 18 (Figure A.18, key 16). Attach each connector housing mass replacement (Figure A.18, key 9) to its backup plate mounting bracket (Figure A.18, key 10) with three SHCS M3 × 0,5 × 10 (Figure A.18, key 5).

Figure A.26 — DAS and interposer mass replacements attached to left-side spine plate

Next, assemble the angular accelerometer/tilt sensor bracket assembly. Attach the dual-axis tilt sensor mount kit (Figure A.18, key 26) to the back of the angular accelerometer/tilt sensor mount bracket

(Figure A.18, key 17) with a SHCS M3 × 0,7 × 8 LG zinc and M4 flat washer plain zinc. Position the angular accelerometer/tilt sensor bracket assembly on the spine box and secure it with three SHCS M3 × 0,5 × 10 (Figure A.18, key 5).

Attach the T12 accelerometer mount (Figure A.18, key 7) to the spine box with two SHCS M3 × 0,5 × 10 (Figure A.18, key 5). Attach a triaxial accelerometer mass replacement (Figure A.18, key 27) to the mount with a SHCS M2 × 0,4 × 16 (Figure A.18, key 25) and #2 washer (Figure A.18, key 30). Attach a linear triaxial accelerometer mass replacement (Figure A.18, key 27) to the top of the spine box weldment with a SHCS M2 × 0,4 × 16 (Figure A.18, key 25) and #2 washer (Figure A.18, key 30).

Attach the left-side and right-side plates (Figure A.18, key 4 and 8) with nine FHCS M6 × 1 × 12 (Figure A.18, key 14).

A.3.3.3 Shoulder assembly

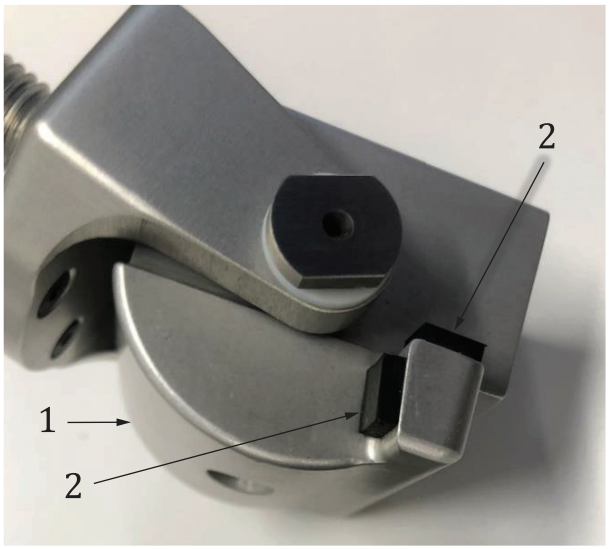
Inspect the plastic bushings in the shoulder clevis assembly and replace if damaged or missing. Check the tightness of the four FHCS M3 × 0,5 × 5 LG holding the detent insert. Refer to Figure A.27.

Key

1 FHCS M3 × 0,5 × 5 LG
2 plastic bushing

Figure A.27 — Inspection of shoulder clevis

Inspect the four rubber stops on the shoulder load cell structural replacement. Replace with W50-61059 if missing. Reattach with cyanoacrylate adhesive if loose. Refer to Figure A.28.



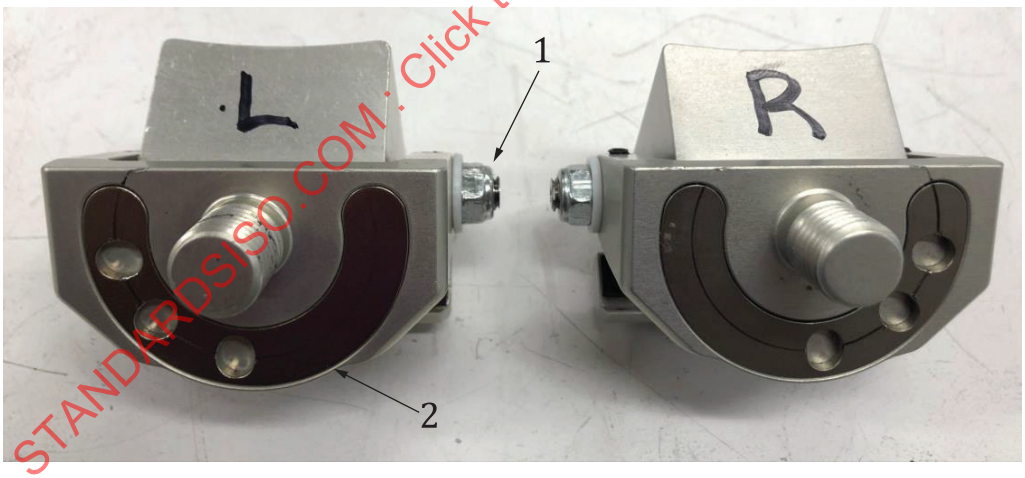
Key

1 shoulder load cell structural replacement

2 rubber stops

Figure A.28 — Rubber stops on shoulder load cell structural replacement

Assemble each shoulder with the detents towards the front. Insert the shoulder pivot shaft (Figure A.17, key 2) from the front. Refer to Figure A.29. Tighten the lock nut (Figure A.17, key 5) using an open end or adjustable wrench to hold the pivot shaft and a 10-mm socket or box end wrench to turn the nut. Note that the lock nut shall be used only once and replaced each time the shoulder is reassembled. Note that the left and right shoulder assemblies are mirror images of one another.



Key

1 pivot shaft lock nut

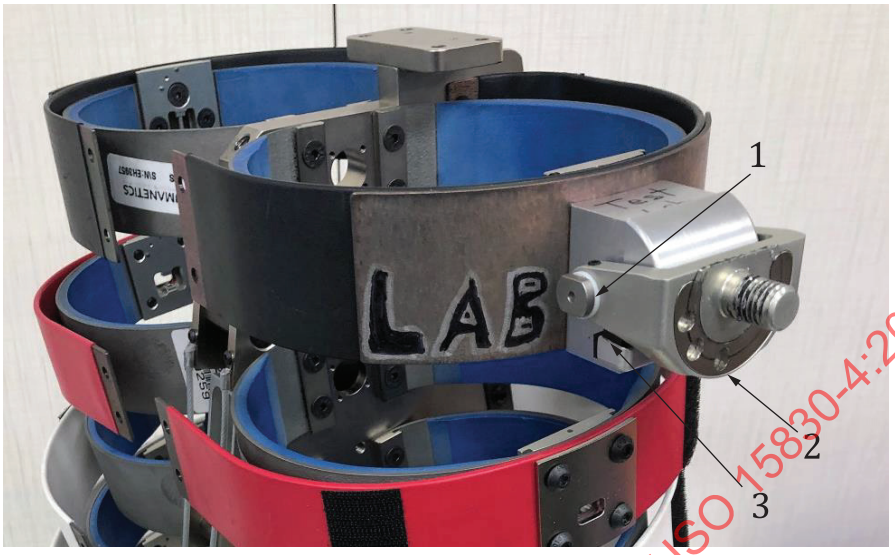
2 detent insert

Figure A.29 — Left and right shoulder clevis assemblies

Inspect the nylon tips of the two SSNT M4 × 0,7 × 4 (Figure A.17, key 6) friction adjustment screws and replace if they are missing or damaged. Orient the shoulder pivot shaft so that the SSFP M6 × 1 × 12 LG (Figure A.17, key 7) clamps on the flat of the shoulder pivot shaft.

Attach the shoulder assemblies (Figure A.15, keys 21 and 47) to the shoulder rib with four FHCS M5 × 0,8 × 20 LG (Figure A.15, key 18). Ensure that the pivot shaft head is towards the front and

the nut towards the back of the dummy. Ensure that the arm clevis detents are towards the front. The clevis rests on the rubber stops that prevent the clevis from rotating further down. Refer to Figure A.30.



Key

1 pivot shaft head
2 arm clevis detents
3 rubber stop

Figure A.30 — Orientation of shoulder clevis assemblies

A.4 Arm

A.4.1 Parts list for arm

The half arm is moulded as one piece which consists of a plastic bone, vinyl skin, and urethane foam. The bone has a spring plunger for locating the arm position. The locknut is used to adjust the 1-to-2-*g*-setting.

NOTE Table A.6 lists the parts required for attaching the WorldSID arm, which are shown in Figure A.31.

Table A.6 — Parts list for WorldSID arm

Key number	Description	Quantity	Part number
1	Half arm assembly	2	W50–63100
2	Hex lock nut, M12 × 1,75	2	5000462

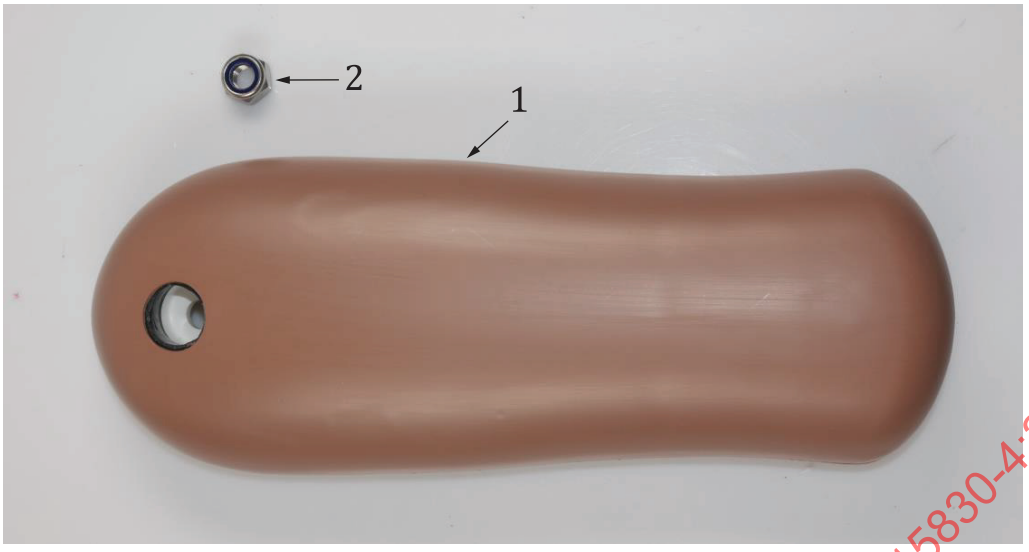


Figure A.31 — Arm assembly

A.4.2 Arm disassembly

Remove the arm (Figure A.31, key 1) from the shoulder by removing the locknut (Figure A.31, key 2).

A.4.3 Arm assembly

Before reattaching the arm, inspect it for damage. Attach the arm (Figure A.31, key 1) to the shoulder using the locknut (Figure A.31, key 2).

A.4.4 Arm adjustment

Adjust the arm according to the procedure in E.1.

A.5 Pelvis

A.5.1 Parts list for pelvis

NOTE Table A.7 lists the parts required for assembling the WorldSID pelvis which are shown in Figures A.32 and A.33. Figure A.34 and Figure A.35 show different views of the pelvis.

Table A.7 — Parts list for WorldSID pelvis

Key number	Description	Quantity	Part number
1	Structural replacement, sacroiliac load cell	1	W50–71975
2	Structural replacement, lumbar spine load cell	1	W50–71122
3	Sacroiliac load cell interface, left	1	W50–42016
4	Sacroiliac load cell interface, right	1	W50–42017
5	Pelvis bone, left	1	W50–42010
6	Pelvis bone, right	1	W50–42011
7	Sacroiliac load cell backing plate	2	W50–42002
8	Pubic buffer, moulded	2	W50–42510
9	Structural replacement, pubic load cell	1	W50–71059
10	Instrumentation bracket pelvis	1	W50–42040
11	Pelvis flesh	1	W50–42019–1

Table A.7 *(continued)*

Key number	Description	Quantity	Part number
12	Weldment, lower lumbar mounting bracket, WorldSID	1	W50–41030
13	Screw, FHCS M6 × 1 × 16	4	5000090
14	Lumbar spine rubber, WorldSID	1	W50–41018
15	Bushing, lumbar	6	W50–41019
16	Lumbar lower clamping plate, WorldSID	2	W50–41021
17	Lumbar upper clamping plate, WorldSID	1	W50–41022
18	Lumbar mounting wedge, WorldSID	1	W50–41026
19	Screw, BHCS M5 × 0,8 × 25 LG	4	5000466
20	Screw, SHCS M8 × 1,25 × 18 LG	4	5000209
21	Instrumentation cover plate, pelvis	1	W50–42031
22	Hip joint socket	2	W50–42005
23	Inner ring hip joint	2	W50–42007
24	Hip socket retainer	2	W50–42008
25	Screw, FHCS M6 × 1 × 20 LG stainless	6	5000036
26	Screw, FHCS M6 × 1 × 30 LG	8	5000265
27	Screw, FHCS M4 × 0,7 × 10 LG	3	5000023
28	Screw, BHCS M3 × 0,5 × 6 LG	4	5001020
29	Washer, flat M8 (8,9 mm ID × 18,8 mm OD × 2,3 mm thick) zinc	2	5000123
30	Screw, SHCS M4 × 0,7 × 8 LG zinc	8	5000024
31	Washer, flat M4 (4,3 mm ID × 9,0 mm OD × 0,7 mm thick) zinc	6	5000155
32	Screw, BHCS M4 × 0,7 × 16 LG	6	5000153
33	Screw, SHCS M6 × 1 × 10	16	5000457
34	Screw, HHCS bolt M8 × 1,25 × 10 LG zinc	2	5000569
35	Screw, BHCS M6 × 1 × 20 LG	6	5000438
36	Screw, SHCS M2 × 0,4 × 16 LG SS	1	5000509
37	Screw, SSFP M4 × 0,7 × 6 LG	6	5000464
38	Screw, SHCS M6 × 1 × 20 LG	4	5000001
39	Bushing, lumbar spine, top	4	W50–41020
40	Cable tie mount, #4 screw, nylon	2	6002036
41	Screw, BHCS M3 × 0,5 × 6 LG stainless	2	5000399
42	Battery container, WorldSID	1	W50–43001
43	Screw, FHCS M3 × 0,5 × 10 LG	4	5000203
44	Battery replacement	1	W5–3325
45	Thermal pad (not shown)	1	W5–3326
46	Battery cover, WorldSID	1	W50–43002
47	Screw, BHCS M4 × 0,7 × 8 LG	3	5000103
48	Screw, FHCS M3 × 0,5 × 16 LG	2	5000455
49	Mount kit, tilt sensor	1	W50–00206
50	Mount kit, triaxial ARS, WorldSID pelvis	1	W50–00313
51	Mass replacement, triaxial accelerometer	1	7268C-SR
52	Washer, flat #2 plain L SS	1	9003999

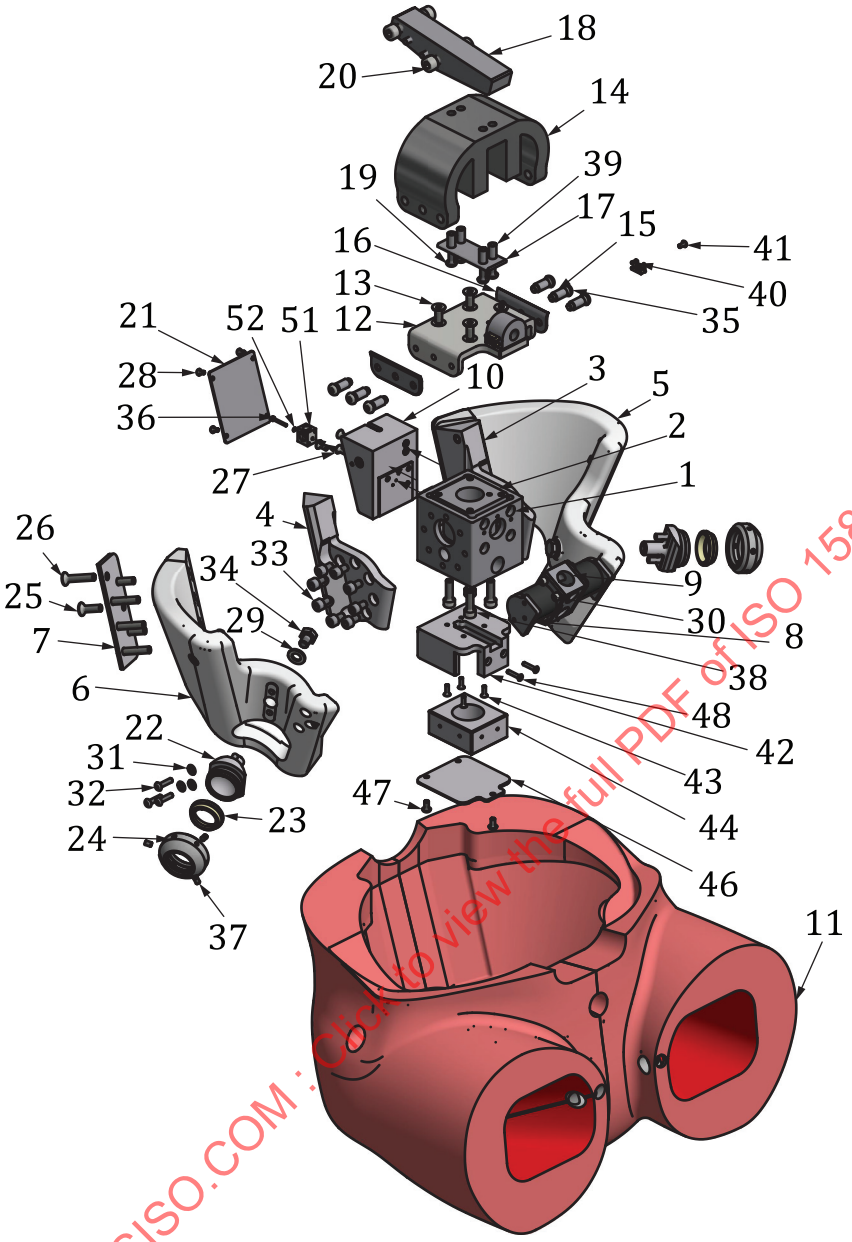


Figure A.32 — WorldSID pelvis components

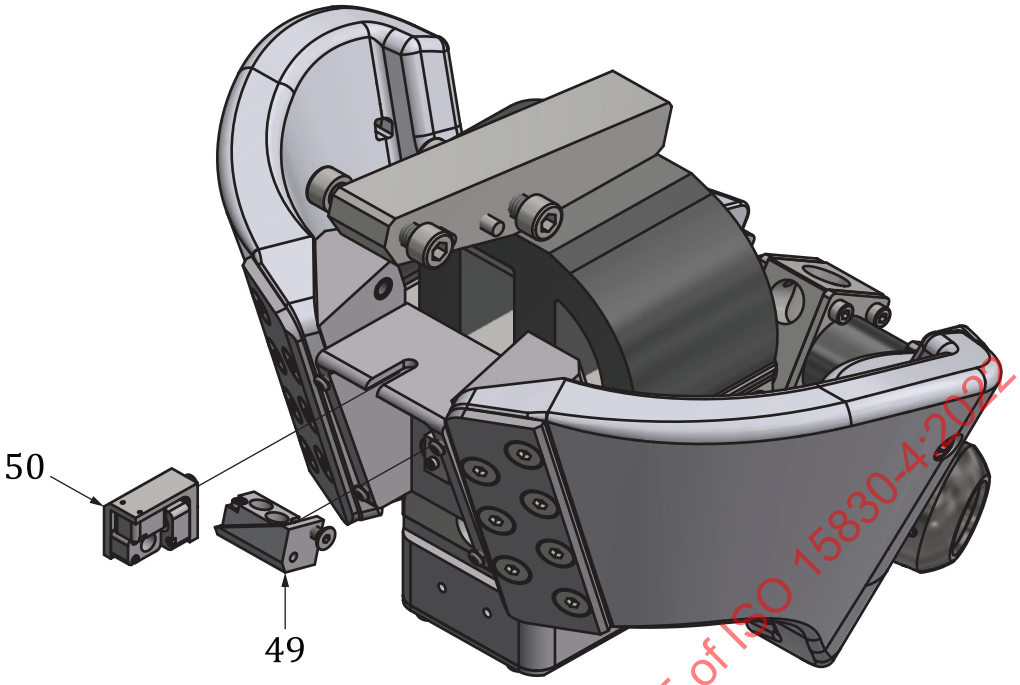


Figure A.33 — WorldSID pelvis components rear view

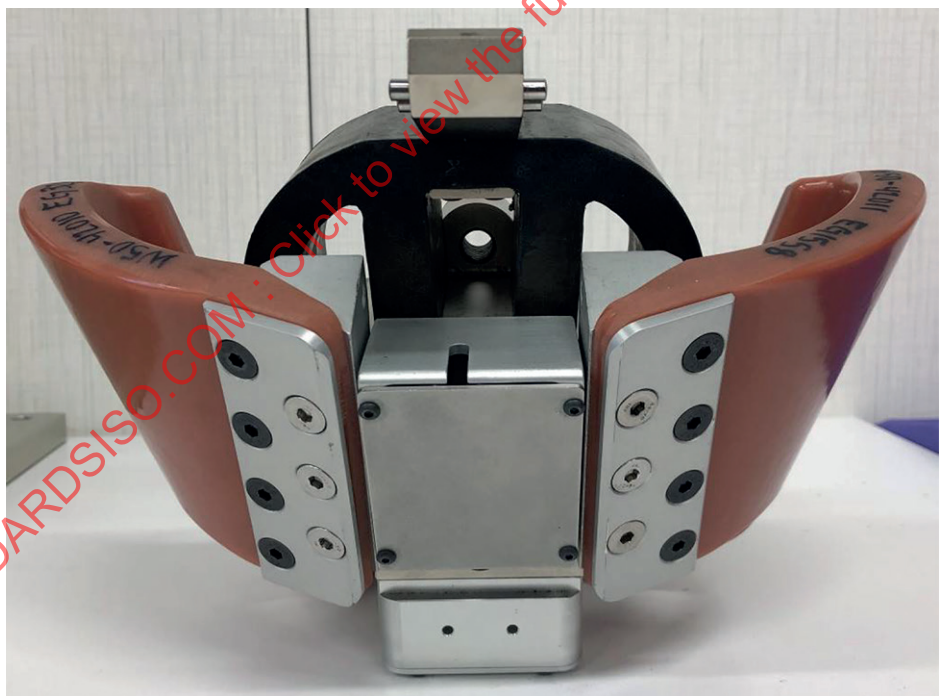


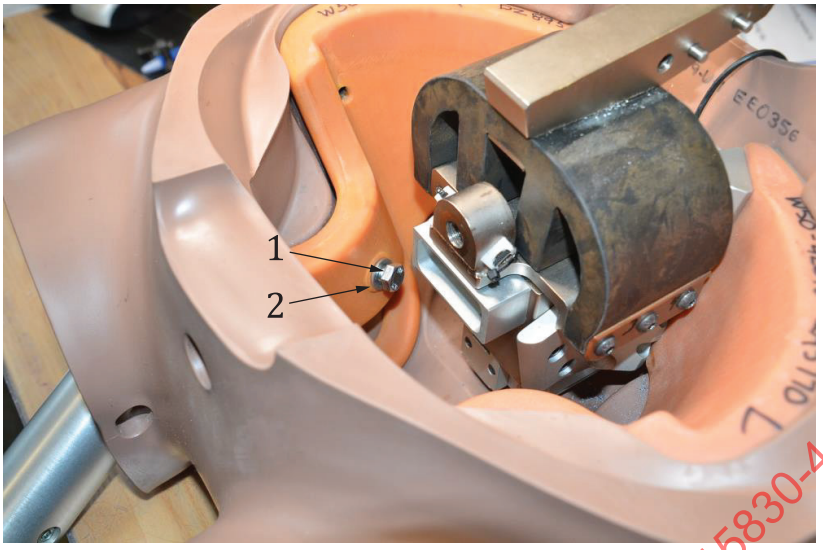
Figure A.34 — Rear view of pelvis assembly

Figure A.35 — Front view of pelvis assembly

A.5.2 Pelvis disassembly

Remove the torso from the pelvis assembly by removing four SHCS M8 × 1,25 × 18 (Figure A.32, key 20) that connect it to the lumbar mounting wedge (Figure A.32, key 18). Access the SHCS from the bottom of the torso below the ribs. To avoid dropping the screw into the pelvis, place a lab rag on top of the pelvis. Use a non-ball end T-handle that has been magnetized to also prevent dropping the screw.

Detach the upper leg assemblies from the iliac wing by removing the hex head screws M8 × 1,25 × 10 LG (Figure A.32, key 34) and M8 flat washer plain zinc (Figure A.32, key 29) that attach each to the pelvis assembly. Refer to Figure A.36. Note that they are accessible from the interior of the pelvis bone and can be removed with a box end wrench.



Key

1 HHCS M8 × 1,25 × 10 LG

2 flat washer

Figure A.36 — Detaching the femur assemblies

Remove the pelvis flesh (Figure A.32, key 11) by peeling it away from the pelvis. Refer to Figure A.37.

Figure A.37 — Removal of pelvis bone assembly from pelvis flesh

Remove the sacroiliac load cell backing plates (Figure A.32, key 7) by removing the four FHCS M6 × 1 × 30 (Figure A.32, key 26) and three FHCS M6 × 1 × 20 (Figure A.32, key 25) that secure them. Detach the moulded pubic buffers (Figure A.32, key 8) from the moulded pelvis by removing the three BHCS M4 × 0,7 × 16 (Figure A.32, key 32) and M4 flat washers (Figure A32, key 31) that hold each in place. Separate the left and right pelvis bones (Figure A.32, keys 5 and 6) from the pubic assembly and from the sacroiliac assembly. Refer to Figure A.38.

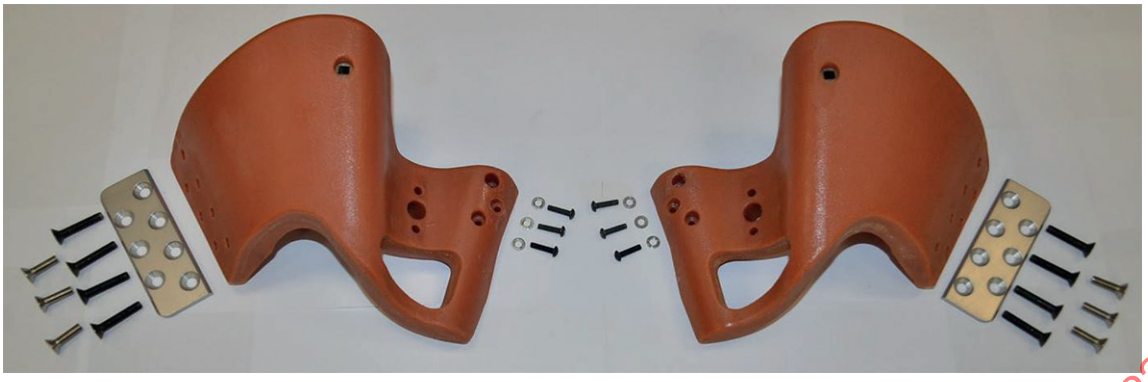


Figure A.38 — Pelvis bones, sacroiliac backing plates and fasteners

Detach the pubic buffers (Figure A.32, key 8) from the pubic load cell structural replacement (Figure A.32, key 9) by removing four SHCS M4 × 0,7 × 8 (Figure A.32, key 30) from each side. Refer to Figure A.39.

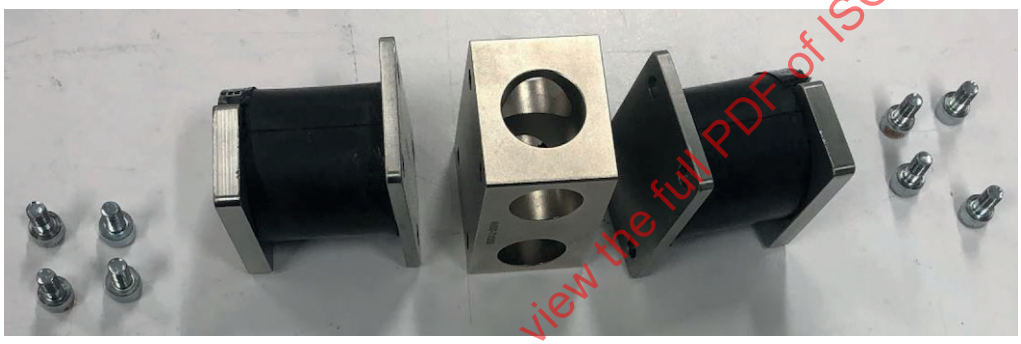


Figure A.39 — Pubic buffers separated from pubic load cell structural replacement

Detach the lumbar spine (Figure A.32, key 14), remove the six BHCS M6 × 1 × 20 (Figure A.32, key 35) and six lumbar bushings (Figure A.32, key 15) that attach it to the lower lumbar mounting bracket weldment (Figure A.32, key 12). Remove the two lower lumbar clamping plates (Figure A.32, key 16) to separate the lumbar spine assembly from the sacroiliac assembly. Refer to Figure A.40.

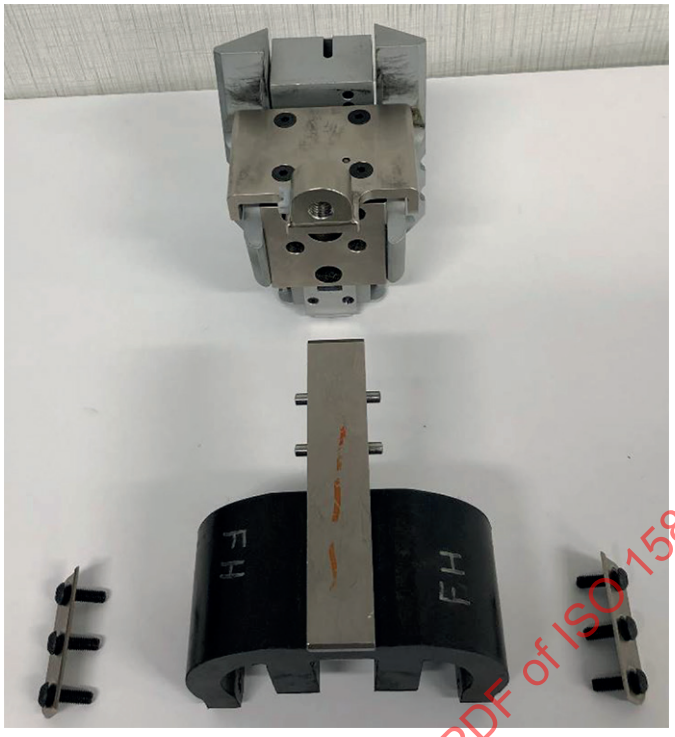
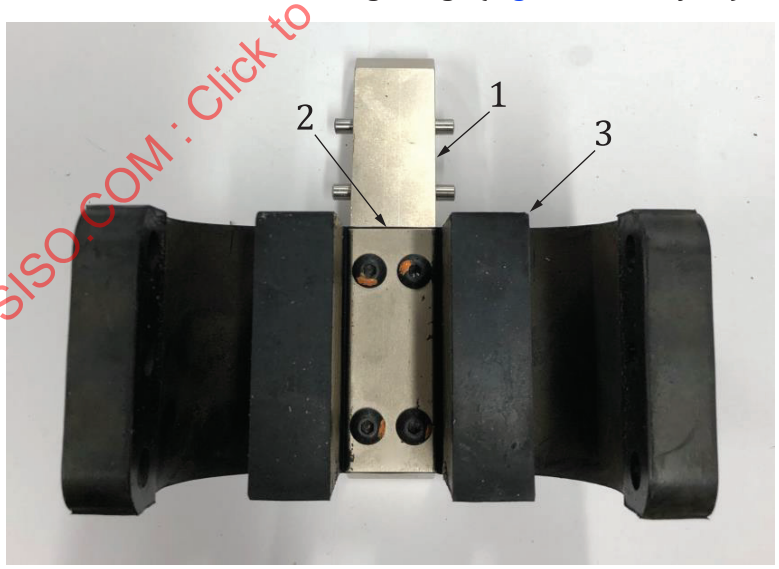


Figure A.40 — Lumbar spine assembly removed from sacroiliac assembly

Remove the lumbar upper clamping plate (Figure A.32, key 17) from the lumbar spine by removing the four BHCS M5 × 0,8 × 25 (Figure A.32, key 19) and four lumbar spine top bushings (Figure A.32, key 39). Refer to Figure A.41. Remove the lumbar mounting wedge (Figure A.32, key 18).



Key

1 lumbar mounting wedge
2 lumbar upper clamping plate
3 lumbar spine rubber

Figure A.41 — Separate the upper lumbar clamping plate and lumbar mounting wedge from the lumbar spine

Figure A.42 shows the lumbar components disassembled.

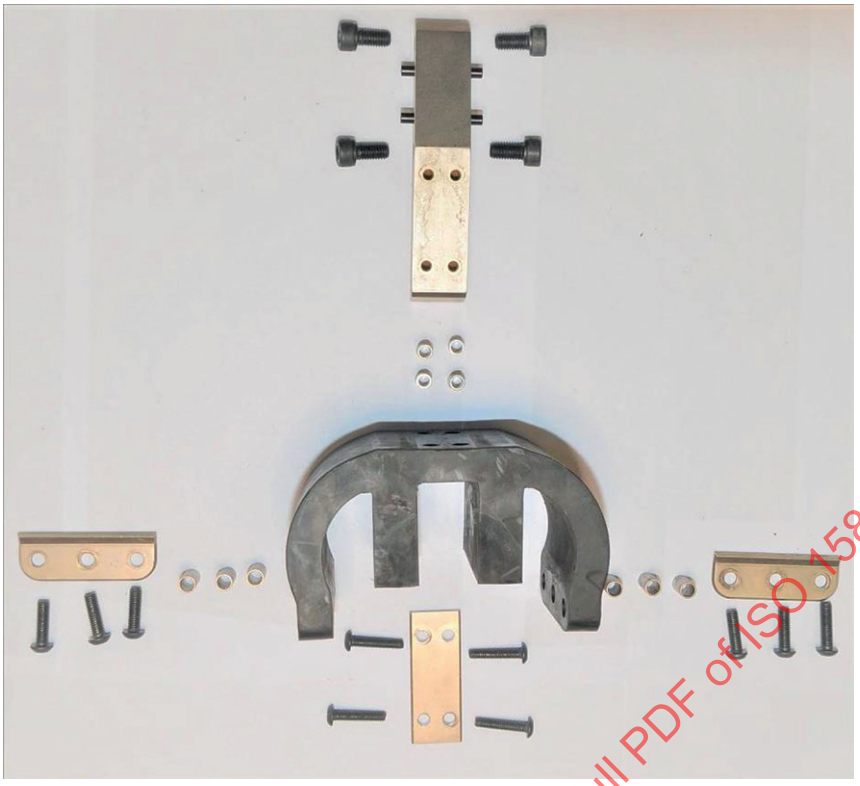


Figure A.42 — Lumbar components disassembled

Detach the lumbar lower mounting bracket weldment (Figure A.32, key 12) from the sacroiliac assembly by removing four FHCS M6 × 1 × 16 (Figure A.32, key 13). Refer to Figure A.43.

Figure A.43 — Lumbar lower mounting bracket weldment removed from sacroiliac assembly

Detach the left and right sacroiliac load cell interfaces (Figure A.32, keys 3 and key 4) by removing the eight SHCS M6 × 1 × 10 (Figure A.32, key 33) that hold each in place.

Remove the pelvis instrumentation cover plate (Figure A.32, key 21) by removing four BHCS M3 × 0,5 × 6 (Figure A.32, key 28). Detach the pelvis instrumentation bracket (Figure A.32, key 10) from the sacroiliac load cell structural replacement (Figure A.32, key 1) by removing three FHCS M4 × 0,7 × 10 (Figure A.32, key 27) accessed from the back. Remove the SHCS M4 × 0,7 × 8 (Figure A.32, key 30)

to detach the tilt sensor mount kit (Figure A.32, key 49) from the pelvis instrumentation bracket. Detach the linear triaxial accelerometer mass replacement (Figure A.32, key 51) from the pelvis instrumentation bracket by removing the SHCS M2 × 0,4 × 16 (Figure A.32, key 36).

Detach the battery cover (Figure A.32, key 46) by removing three BHCS M4 × 0,7 × 8 (Figure A.32, key 47). Remove the battery replacement (Figure A.32, key 44) by removing two FHCS M3 × 0,5 × 16 (Figure A.32, key 48). Next, remove the four FHCS M3 × 0,5 × 10 (Figure A.32, key 43) and detach the battery container (Figure A.32, key 42) from the sacroiliac load cell structural replacement.

Separate the lumbar spine load cell structural replacement (Figure A.32, key 2) from the sacroiliac load cell structural replacement (Figure A.32, key 1) by removing the four SHCS M6 × 1 × 20 (Figure A.32, key 38) accessed from the bottom. Refer to Figure A.44.

Figure A.44 — Separation of sacroiliac and lumbar spine load cell structural replacements

A.5.3 Pelvis assembly

Before reassembling the pelvis, inspect all parts for damage. Flex the lumbar spine and the pubic buffers to check for cracks in the rubber material.

NOTE In general, the procedure for assembling the pelvis is substantially the opposite of the procedure for disassembling it, and the following descriptions are provided to assist the user to more efficiently assemble the WorldSID pelvis.

Install the lumbar spine load cell structural replacement (Figure A.32, key 2) into the sacroiliac load cell structural replacement (Figure A.32, key 1). Note that the locating pin defines the orientation. Refer to Figure A.45. Flip over and install four SHCS M6 × 1 × 20 (Figure A.32, key 38). Attach the battery container (Figure A.32, key 42) to the sacroiliac load cell with four FHCS M3 × 0,5 × 10 (Figure A.32, key 43). Next, place the battery replacement (Figure A.32, key 44) into the container. Attach the battery cover (Figure A.32, key 46) with three BHCS M4 × 0,7 × 8 (Figure A.32, key 47).

Figure A.45 — Lumbar spine load cell structural replacement placed into sacroiliac structural replacement

Mount the linear triaxial accelerometer mass replacement (Figure A.32, key 51) to the pelvis instrumentation bracket (Figure A.32, key 10) using a SHCS M2 × 0,4 × 16 (Figure A.32, key 36) accessed from the back. Attach the tilt sensor mount kit (Figure A.33, key 49) to the pelvis instrumentation bracket with a SHCS M4 × 0,7 × 8 (Figure A.32, key 30) accessed from the side. Secure the pelvis instrumentation bracket (Figure A.32, key 10) to the sacroiliac load cell structural replacement (Figure A.32, key 1) with three FHCS M4 × 0,7 × 10 (Figure A.32, key 27). Mount the pelvis instrumentation cover plate (Figure A.32, key 21) with four BHCS M3 × 0,5 × 6 (Figure A.32, key 28). Attach the left and right sacroiliac load cell interfaces (Figure A.32, key 3 and key 4) with eight SHCS M6 × 1 × 10 (Figure A.32, key 33) that hold each in place. Connect the lower lumbar mounting bracket weldment (Figure A.32, key 12) to the lumbar load cell structural replacement (Figure A.32, key 2) with four FHCS M6 × 1 × 16 (Figure A.32, key 13). Install cable tie mounts (Figure A.32, key 40) onto lumbar mounting bracket weldment using two BHCS M3 × 0,5 × 6 (Figure A.32, key 41). Refer to Figure A.46.

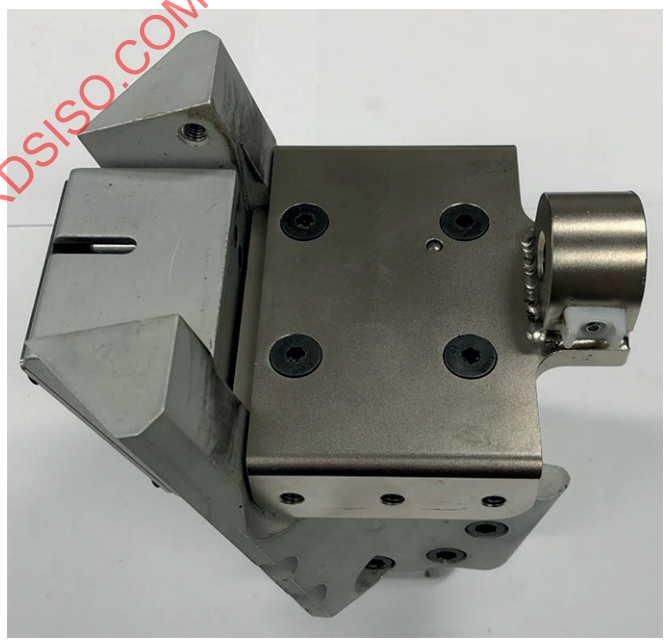


Figure A.46 — Lower lumbar mounting bracket weldment installed on sacroiliac assembly

Place the lumbar mounting wedge (Figure A.32, key 18) on top of the lumbar spine, lining up the threaded holes on the bottom with those in the lumbar spine. Insert four lumbar spine top bushings (Figure A.32, key 39) into the holes in the top of the lumbar spine. Place the lumbar upper clamping plate (Figure A.32, key 17) over the holes in the lumbar spine and secure it with four BHCS M5 × 0,8 × 25 (Figure A.32, key 19). Refer to Figure A.47.

Figure A.47 — Mounting wedge and upper clamping plate installed on lumbar spine rubber

Install the lumbar assembly onto the sacroiliac assembly with dowel pins located toward the rear of the assembly. Place the assembled lumbar spine over the lower lumbar mounting bracket (Figure A.32, key 12). Position a lumbar lower clamping plate (Figure A.32, key 16) over the holes in the side of the lumbar spine so the curve of the plate matches the curve in the rubber, with the radius edge facing down. Install three lumbar bushings (Figure A.32, key 15) in the left side of the lumbar. Secure the lumbar spine and clamping plate to the mounting bracket with three BHCS M6 × 1 × 20 (Figure A.32, key 35). Repeat the procedure for the other side of the lumbar spine. Refer to Figure A.48.

Figure A.48 — Attach lumbar lower clamping plates

Connect the moulded pubic buffers (Figure A.32, key 8) to the pubic load cell structural replacement (Figure A.32, key 9) with four SHCS M4 × 0,7 × 8 (Figure A.32, key 30) on each side. Refer to Figure A.49.

Figure A.49 — Pubic buffers attached to pubic load cell structural replacement

Attach the moulded pubic buffers (Figure A.32, key 8) to the left and right pelvis bones (Figure A.32, key 5 and key 6) with three BHCS M4 × 0,7 × 16 (Figure A.32, key 32) and three M4 flat washers (Figure A.32, key 31) on each side. Torque bolts to 1,0 N·m ± 0,25 N·m. Position the central assembled portion of the pelvis within the moulded pelvis/pubic assembly. Attach each sacroiliac load cell backing plate (Figure A.32, key 7) with four FHCS M6 × 1 × 30 (Figure A.32, key 26) and three FHCS M6 × 1 × 20

(Figure A.32, key 25). The three shorter screws on each side are used on the inboard holes. Torque bolts to 2,5 N·m ± 0,5 N·m. Refer to Figure A.34.

Place the pelvis assembly into the pelvis flesh (Figure A.32, key 11), placing the pubic assembly in first and ensuring the pubic bone area is under the front ridge of the pelvis flesh. Refer to Figure A.50.

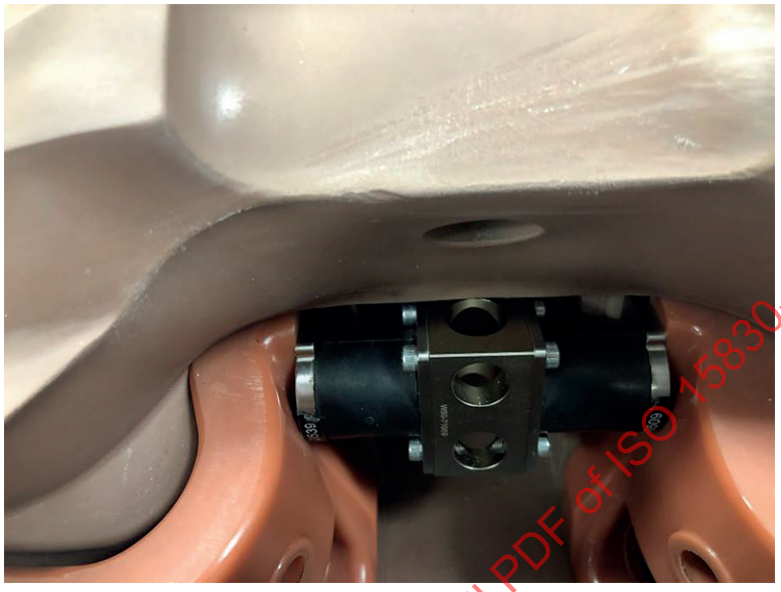


Figure A.50 — Pubic assembly inserted under the front ridge of pelvis flesh

Push on the lumbar wedge and work the pelvis flesh so that the iliac wings are below the ridge in the pelvis flesh. Refer to Figure A.51.

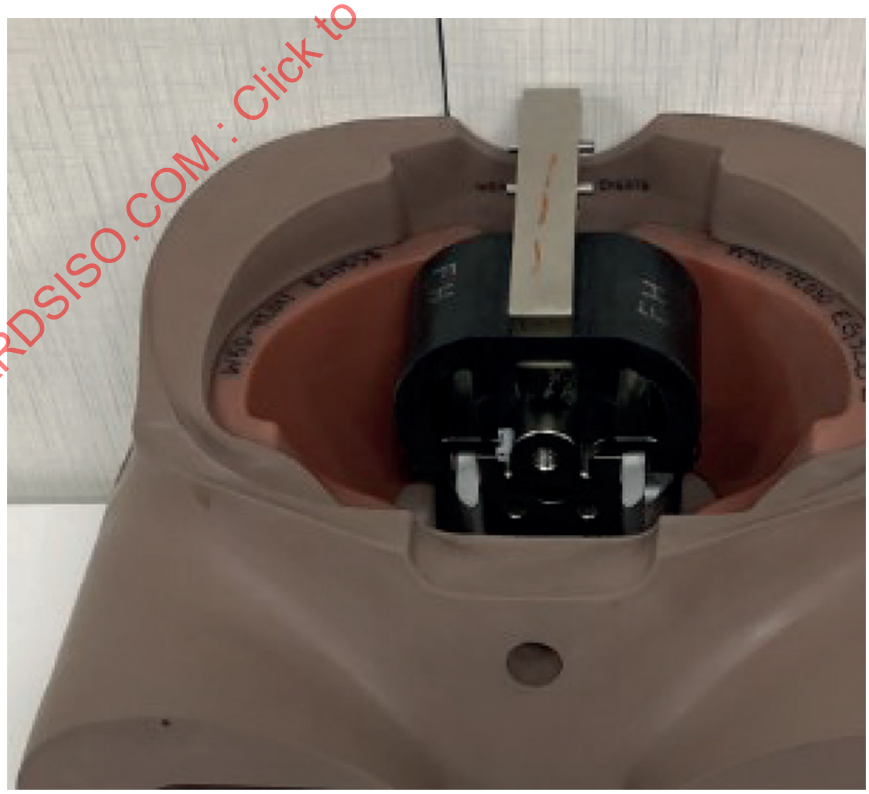


Figure A.51 — Iliac wings inserted under the ridge of pelvis flesh

Make sure the flesh is correctly positioned over the pelvis by inserting the H-point tool through the access holes in the pelvis flesh. Refer to Figure A.52.

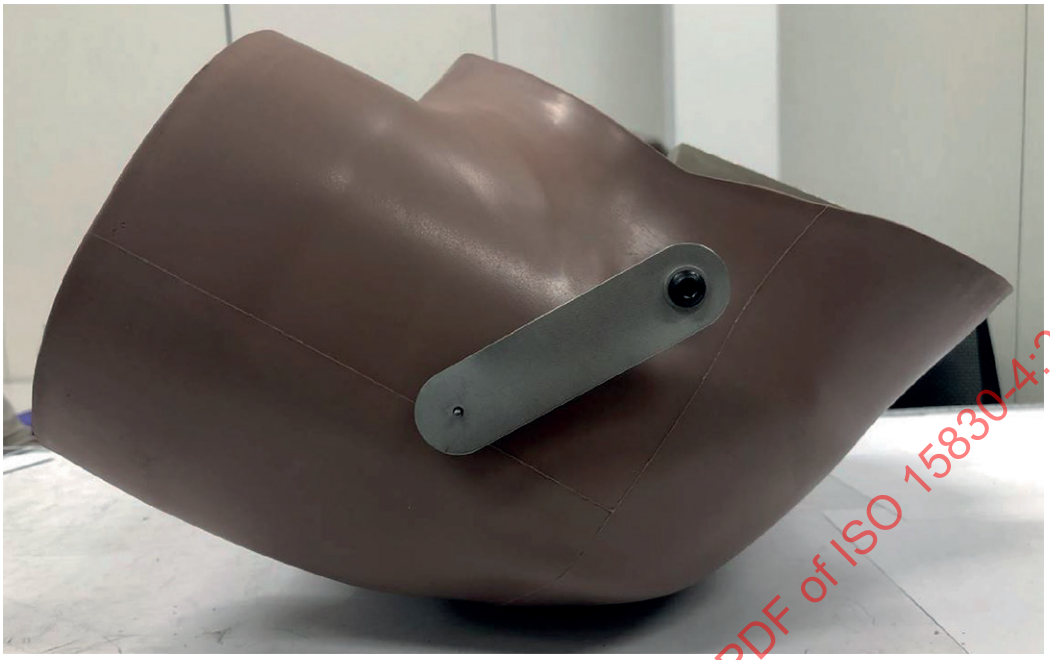


Figure A.52 — H-point tool inserted through access hole in pelvis flesh

When assembling the hip joint, apply grease to the hip joint inner ring (Figure A.32, key 23) and the hip joint socket (Figure A.32, key 22) before tightening the hip socket retainer (Figure A.32, item 24). Insert the hip joint assembly through the front access hole in the pelvis flesh. Secure from the inside of the pelvis with an HHCS M8 × 1,25 × 10 (Figure A.32, key 34). Place the assembled torso over the lumbar mounting wedge (Figure A.32, key 18) and secure with four SHCS M8 × 1,25 × 18 (Figure A.32, key 20).

A.6 Femoral neck and upper leg

A.6.1 Parts list for femoral neck and upper leg

NOTE Table A.8 lists the parts required for assembling the WorldSID femoral neck and upper leg, which are shown in Figure A.53, Figure A.54 and Figure A.55.

Table A.8 — Parts list for WorldSID femoral neck and upper leg

Key number	Description	Quantity			Part number
		Left	Right	Total	
1	Hip socket	1	1	2	W50–42005
2	Femoral neck ball	1	1	2	W50–51038
3	SSCP M4 × 0,7 × 6	4	4	8	5000076
4	Hip socket retainer	1	1	2	W50–42008
5	Femoral neck base	1	1	2	W50–51035
6	LHSHCS M6 × 1,0 × 12	4	4	8	5000072
7	Femoral neck load cell structural replacement	1	1	2	W50–71965
8	Trochanter assembly, right	-	1	1	W50–51022
Not shown	Trochanter assembly, left	1	-	1	W50–51023
9	BHCS M6 × 1,0 × 16	4	4	8	5000072

Table A.8 *(continued)*

Key number	Description	Quantity			Part number
		Left	Right	Total	
10	Modified BHCS M6 thread	12	12	24	W50–61042
11	Universal leg load cell structural replacement	1	1	2	W50–51060
12	Leg tube assembly	1	1	2	W50–51068
13	Upper leg flesh	1	1	2	W50–51059–1
14	DAS mass replacement assembly	1	1	2	W50–51053

Figure A.53 — Femoral neck components

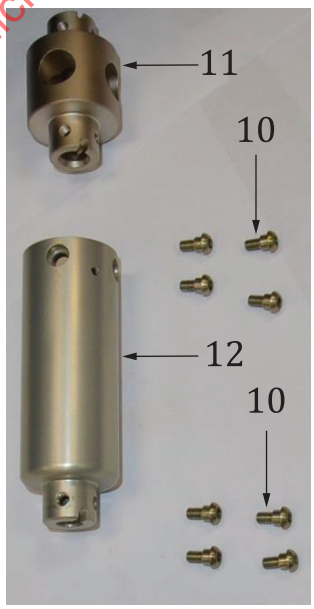


Figure A.54 — Upper leg components

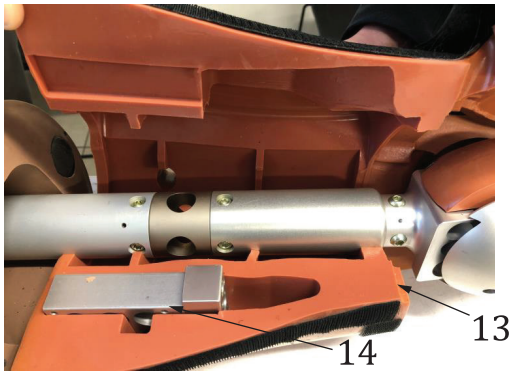


Figure A.55 — Upper leg assembly

A.6.2 Femoral neck and upper leg disassembly

Remove the upper leg flesh (Figure A.55, key 13). Note that the DAS mass replacement (Figure A.55, key 14) is in a pocket in the upper leg flesh.

Remove the four modified BHCS (Figure A.54, key 10) that attach the trochanter assembly (Figure A.53, key 8) to the universal leg load cell structural replacement (Figure A.54, key 11).

Remove the four BHCS M6 × 1,0 × 16 (Figure A.53, key 9) that attach the femoral neck load cell structural replacement (Figure A.53, key 7) to the trochanter assembly (Figure A.53, key 8). Refer to Figure A.56.

Figure A.56 — Femoral neck load cell structural replacement separated from the trochanter assembly

Loosen the hip socket retainer (Figure A.53, key 4). Loosen the three set screws SSCP M4 × 0,7 × 6 to remove the hip joint socket (Figure A.53, key 3). Refer to Figure A.57.

Figure A.57 — Remove hip joint socket

Disassemble the femoral neck by loosening the SSCP M4 × 0,7 × 6 (Figure A.53, key 3) that holds the femoral neck ball (Figure A.53, key 2) in place. Refer to Figure A.58.

Figure A.58 — Loosen set screw in femoral ball

Use a modified spanner wrench with a 25 mm to 28 mm diameter (Annex D, W50-51001) to turn the femoral ball and a 40 mm to 42 mm spanner wrench (Annex D, W50-51002) to hold the femoral neck base (Figure A.53, key 5). Be careful not to damage the surface of the ball during disassembly and re-assembly. Refer to Figure A.59.

Figure A.59 — Loosen femoral ball

Remove the four LHSHCS M6 × 1,0 × 12 (Figure A.53, key 6) that attach the femoral neck base (Figure A.53, key 5) to the femoral neck load cell structural replacement (Figure A.53, key 7). Note that these screws can be removed without removing the ball using a modified hex key wrench (Annex D, W50-51003). Remove the four modified BHCS (Figure A.54, key 10) that attach the leg tube assembly (Figure A.54, key 12) to the universal leg load cell structural replacement (Figure A.54, key 11). Remove the four modified BHCS (Figure A.54, key 10) that attach the leg tube assembly to the knee assembly. Separate these assemblies. Refer to Figure A.60.

Figure A.60 — Leg tube separated from universal leg load cell structural replacement and knee

A.6.3 Upper leg and femoral neck assembly

Before reassembling the upper leg and femoral neck, inspect all parts for damage.

Attach the hip socket retainer (Figure A.53, key 4) to the femoral neck load cell structural replacement (Figure A.53, key 7). Screw the femoral neck ball (Figure A.53, key 2) on to the femoral neck base (Figure A.53, key 5). Note that a drop of thread locker may be applied to the threads of the socket. Tighten the ball on to the base using a modified 25 mm to 28 mm spanner wrench (Annex D, W50-51001) to turn the ball and a 40 mm to 42 mm spanner wrench (Annex D, W50-51002) to hold the femoral neck. Be careful not to damage the surface of the ball during re-assembly. Secure the femoral ball by tightening the SSCP M4 × 0,7 × 6 (Figure A.53, key 3). Install the hip socket (Figure A.53, key 1) and hip socket retainer (Figure A.53, key 4).

Attach the femoral neck load cell structural replacement (Figure A.53, key 7) to the trochanter assembly (Figure A.53, key 8). Ensure that the locating pin on the trochanter is oriented towards the bottom of the leg before tightening the four BHCS M6 × 1 × 16 (Figure A.53, key 9). Refer to Figure A.61.

Key

1 locating pin

Figure A.61 — Locating pin on trochanter assembly

Attach the trochanter assembly and the leg tube assembly (Figure A.54, key 12) to the upper leg load cell (Figure A.54, key 11) using eight modified BHCS M6 (Figure A.54, key 10).

A.7 Knee

A.7.1 Parts list for knee assembly

NOTE Table A.9 lists the parts required for assembling the WorldSID knee, which are shown in Figure A.62.

Table A.9 — Parts list for WorldSID knee

Key number	Description	Quantity			Part number
		Left	Right	Total	
1	SHCS M4 × 0,7 × 10	8	8	16	5000151
2	Knee cover	2	2	4	W50–52004
3	Knee contact load cell structural replacement	2	2	4	W50–52015
4	Rotary potentiometer mass replacement	1	1	2	W50–61123
5	BHCS M3 × 0,5 × 6	2	2	4	5001020
6	Cable guide	1	1	2	W50–61030
7	Knee pivot shaft assembly	1	1	2	W50–52008
8	Knee clevis assembly, left	1	-	1	W50–52021

Table A.9 *(continued)*

Key number	Description	Quantity			Part number
		Left	Right	Total	
Not shown	Knee clevis assembly, right	-	1	1	W50–52009
9	Friction washer	1	1	2	W50–52064
10	Compression washer (rubber)	1	1	2	W50–61016
11	Clamping washer (steel)	1	1	2	W50–61014
12	BHCS M10 × 1,5 × 20	1	1	2	5000176
13	Knee pad mould assembly	1	1	2	W50–52010
14	BHCS M4 × 0,7 × 12	6	6	12	5000005
15	Knee bone assembly	1	1	2	W50–52002
16	SSHDP M6 × 1,0 × 12	1	1	2	5000185
17	BHCS M4 × 0,7 × 14	8	8	16	5000975

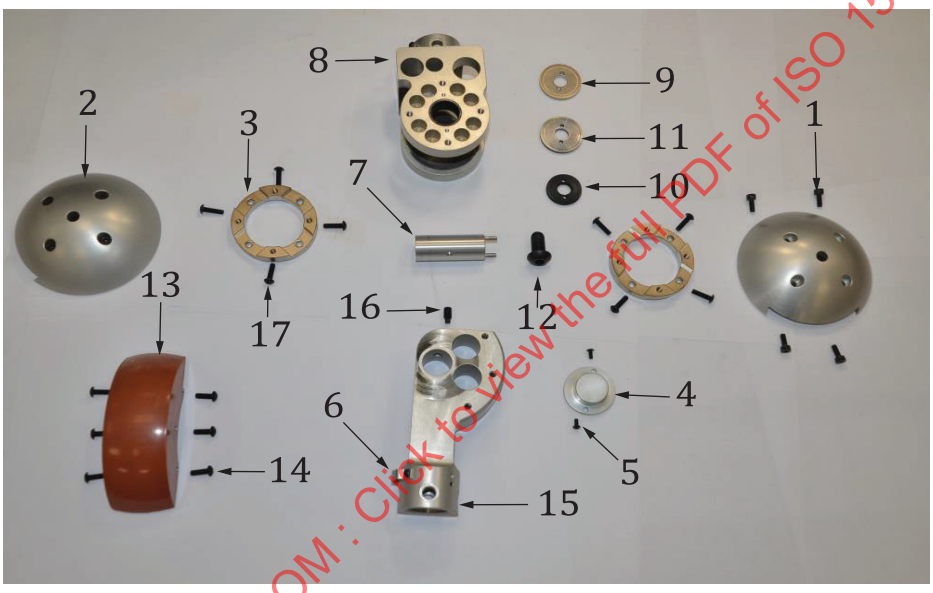


Figure A.62 — Knee components

A.7.2 Knee disassembly

Detach the lower leg assembly by removing the four modified BHCS (Figure A.64, key 2) that attach the knee assembly to the universal leg load cell structural replacement at the upper tibia position (Figure A.64, key 1).

Remove the knee covers (Figure A.62, key 2) by removing the four SHCS M4 × 0,7 × 10 (Figure A.62, key 1) holding each cover in place. Remove the rotary potentiometer mass replacement (Figure A.62, key 4) by taking out the BHCS M3 × 0,5 × 6 (Figure A.62, key 5) at each side of the potentiometer. Note that the knee contact load cell structural replacement (Figure A.62, key 3) is positioned directly beneath the knee cover and is removed by taking out four BHCS M4 × 0,7 × 14 (Figure A.62, key 17) for each load cell structural replacement.

Remove the knee bone assembly (Figure A.62, key 15) by taking out the SSHDP M6 × 1,0 × 12 (Figure A.73, key 16). Remove the BHCS M10 × 1,5 × 20 (Figure A.62, key 12) along with the associated washers (Figure A.62, keys 11, 10 and 9).

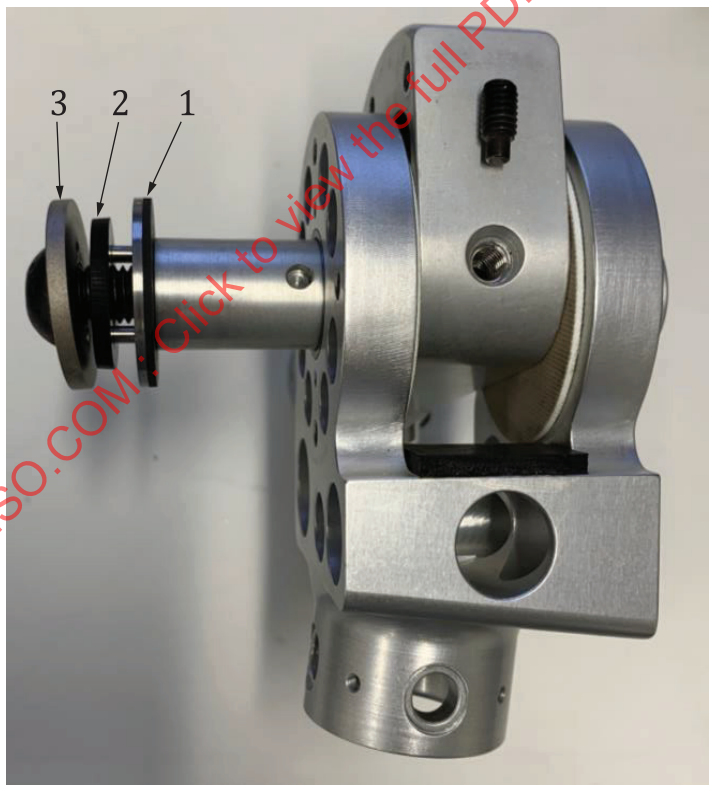
Remove the knee pivot shaft assembly (Figure A.62, key 7) by sliding it out of the assembly. Slide the knee bone assembly (Figure A.62, key 15) out of the knee clevis assembly. Remove the knee pad mould

assembly (Figure A.62, key 13) from the knee bone by taking out the six BHCS M4 × 0,7 × 12 (Figure A.62, key 14) (three on each side) that hold it in position.

A.7.3 Knee assembly

Before reassembling the knee, inspect all parts for damage. The friction pads inside the knee clevis should be attached to the knee clevis. If they are loose, reattach with glue before reassembly. Inspect the washers for damage and wear. The middle washer is the compression washer made from a soft polychloroprene rubber. Because it is a soft material, permanent compression and/or tearing could occur. If the part is permanently compressed or damaged in any way, it should be replaced. Inspect the knee pad for tears or cuts in the material.

To assemble the knee, install the knee bone (Figure A.62, key 15) in the knee clevis and push the knee pivot shaft (Figure A.62, key 7) into the pivot hole. Locate the detent on the knee pivot shaft. Align the shaft-locking hole with the SSHDP M6 × 1 × 12 (Figure A.62, key 16). Tighten the SSHDP M6 so that the knee pivot shaft is locked in place. Note that if the pivot shaft is not locked into the knee bone, the shaft will not rotate with the knee bone during tests. Install the friction, compression, and clamping washers (Figure A.62, keys 9, 10 and 11, respectively). Note that the friction washer (Figure A.62, key 9) is made up of two disks; one disk is steel and the other is a commercial brake material. Push the friction washer on to the pivot shaft pins so that the brake material side of the washer is against the knee clevis. Install the compression and clamping washers and secure them with a BHCS M10 × 1,5 × 20 (Figure A.62, key 12), which is the adjustment for the 1-to-2-*g*-setting adjustment of the knee. Refer to Figure A.63.



Key

1 friction washer
2 compression washer
3 clamping washer

Figure A.63 — Assembly of knee washers

Install the rotary potentiometer mass replacement (Figure A.62, key 4) with two BHCS M3 × 0,5 × 6 (Figure A.62, key 5). Attach the knee contact load cell structural replacements

(Figure A.62, key 3) onto the knee clevis, using four BHCS M4 × 0,7 × 14 (Figure A.62, key 17) for each side. Attach the knee covers (Figure A.62, key 2) directly to the knee contact load cell structural replacements with four SHCS M4 × 0,7 × 10 (Figure A.62, key 1). Attach the moulded knee pad assembly (Figure A.62, key 13) using six BHCS M4 × 0,7 × 12 (Figure A.62, key 14).

The knee assembly is attached to the leg tube assembly using four modified BHCS M6.

NOTE The left and right knee assemblies are different.

A.8 Lower leg, ankle and shoe

A.8.1 Parts list for lower leg, ankle and shoe

NOTE Table A.10 lists the parts required for assembling the WorldSID lower leg and ankle, which are shown in Figure A.64 and Figure A.65.

Table A.10 — Parts list for WorldSID lower leg, ankle and shoe

Key number	Description	Quantity			Part number
		Left	Right	Total	
1	Universal leg load cell structural replacement	2	2	4	W50–51060
2	Modified button head cap screw	8	8	16	W50–61042
3	Lower leg tube	1	1	2	W50–53001
4	Cable guide	2	2	4	W50–61030
5	BHCS M3 × 0,5 × 6	4	4	8	5000171
6	Leg flesh orienting block	1	1	2	W50–54038
7	SHCS M6 × 1,0 × 13	1	1	2	5000281
8	Moulded leg flesh	1	1	2	W50–53002
9	SSCP M6 × 1,0 × 8	3	3	6	5000622
10	Z-axis radial limit screw	1	1	2	W50–54041
11	“Z”-pivot pin	1	1	2	W50–54009
12	Z-axis anti-rattle washer	1	1	2	W50–54024
13	Z-axis rotational washer	1	1	2	W50–54010
14	Z-axis nut	1	1	2	W50–54023
15	Ankle clevis assembly, harmonized	1	1	2	W50–57002
16	Ankle friction shoulder bolt	1	1	2	WS-5724
17	Spring, Belleville disc. 11,2 mm ID × 22,5 mm OD × 2 mm thick × 2,5 mm cone height	1	1	2	5000889
18	Nylon flat washer 13 mm ID × 24 mm OD × 2,5 mm thick	2	2	4	5000888
19	Stop ring	1	1	2	WS-5723
20	Base plate assembly, harmonized	1	1	2	W50–57005
21	SHCS M5 × 0,8 × 16	8	8	16	5000002
22	Moulded shoe, left	1	-	1	W50–55004
Not shown	Moulded shoe, right	-	1	1	W50–55005
23	Rear bearing cover	2	2	4	WS-5443
24	SHCS M5 × 0,8 × 12	6	6	12	5000002
25	Retainer bracket	2	2	4	WS-5701
26	X-version resistive element	8	8	16	WS-54041
27	Ankle joint assembly	1	1	2	WS-5704

Table A.10 *(continued)*

Key number	Description	Quantity			Part number
		Left	Right	Total	
28	SSHDP M5 × 0,8 × 6	1	1	2	5000165
Not shown	SSSDP M6 × 6	1	1	2	6000165

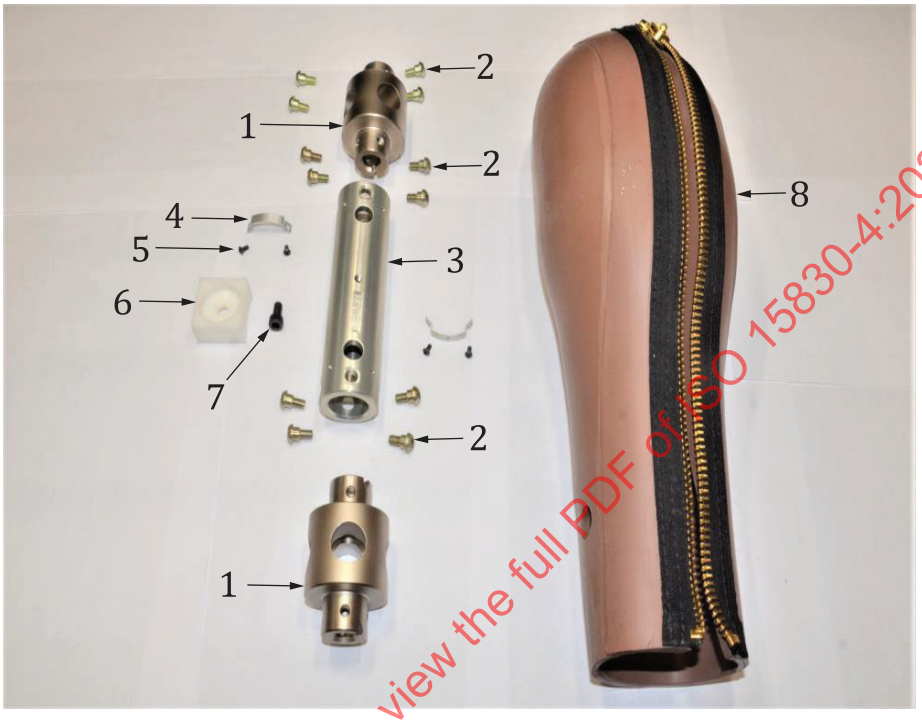


Figure A.64 — Lower leg components

Figure A.65 — Ankle components and moulded shoe

A.8.2 Lower leg and ankle disassembly

Remove the lower leg flesh (Figure A.64, key 8). Remove four modified BHCS (Figure A.64, key 2) to disconnect the tibia from the knee assembly.

Remove the BHCS M3 × 0,5 × 6 (Figure A.64, key 5) to remove the cable guides (Figure A.64, key 4). Remove the four modified BHCS (Figure A.64, key 2) to separate the universal leg load cell structural replacement (Figure A.64, key 1) from the lower leg tube (Figure A.64, key 3).

Remove the z-axis radial limit screw (Figure A.65, key 10) to remove the universal leg load cell structural replacement (Figure A.65, key 1). Refer to Figure A.66.

Figure A.66 — Removal of z-axis radial limit screw

Using a modified 22 mm open-end wrench (Annex D, W50-51004), hold the z-axis nut (Figure A.65, key 14) in place while rotating the lower leg tube (Figure A.64, key 3) and load cell structural replacement until the lower tibia leg load cell structural replacement can be pulled from the ankle assembly. The z-axis rotational washer (Figure A.65, key 13) and anti-rattle washer (Figure A.65, key 12) will fall out as the lower leg tube is removed. Refer to Figure A.67.

Figure A.67 — Separate ankle clevis from universal leg load cell structural replacement

Remove the four SHCS M5 × 0,8 × 16 (Figure A.65, key 21) to remove the moulded shoe (Figure A.65, key key 22) from the ankle assembly. Refer to Figure A.68.

Figure A.68 — Moulded shoe removed from ankle assembly