BS ISO 15830-4:2013



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

Part 4: User's manual

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National foreword

This British Standard is the UK implementation of ISO 15830-4:2013. It supersedes BS ISO 15830-4:2005 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee AUE/7, Automobile occupant restraint systems.

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

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INTERNATIONAL STANDARD

ISO 15830-4

Second edition
2013-05-15

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
ISO 15830-4:2013(E)

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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

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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 15830-4:2005) which has been technically revised. Technical amendments have been incorporated throughout all four parts, resulting from extensive experience with the standard and design changes.

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

— *Part 1: Terminology and rationale*

— *Part 2: Mechanical subsystems*

— *Part 3: Electronic subsystems*

— *Part 4: User's manual*

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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 human-like anthropometry, biofidelity, and injury monitoring capabilities, suitable for regulatory use. Participating in the development were research institutes, dummy and instrumentation manufacturers, governments, and vehicle manufacturers from around the world.

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

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

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

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

Part 4: User's manual

1 Scope

This part of ISO 15830 specifies requirements for assembling and disassembling 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 categories M1 and goods vehicles of categories 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 15830-1, *Design and performance specifications for the WorldSID 50th percentile adult male side impact dummy — Part 1: Terminology and rationale*

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

3 Terms and definitions

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

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 C.

4.2 Full arm changeover

If a full arm is to be relocated from the left side of the dummy to the right side or from the right side of the dummy to the left side, then this shall be done using the procedures given in A.4.5.

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Annex A
(normative)

Procedures for disassembling and assembling the WorldSID

A.1 Head

A.1.1 Parts list for head

Note that Table A.1 lists the parts required for assembling the WorldSID head, which are illustrated in Figure A.1. Note that part numbers correspond to those on electronic drawing W50-10000.

Table A.1 — Parts list for WorldSID head

Item number	Description	Quantity	Part number
1	Head core	1	W50-10007
2	Moulded head	1	W50-14014
3	Rotational accelerometer, Endevco 7302BM4[a]	3	ISO 15830-3:2013, 4.1.3.3
4	Dual-axis tilt sensor	1	ISO 15830-3:2013, 4.1.3.4.1
5	Linear triaxial accelerometer	1	ISO 15830-3:2013, 4.1.3.2
6	Neck load cell structural replacement	1	W50-71003
7	SHCS M3 x 0,5 x 6	6	5000393
8	Cheese screw, M2 x 16	1	5000254
9	SHCS M4 x 0,7 x 10	1	5000151
10	SHCS M6 x 1 x 16	4	5000081
11	Flat washer M8 (8,9 ID x 18,8 OD x 2,3 thick)	1	5000123
12	BHCS M8 x 1,25 x 25	1	5000255
13	Neck shroud assembly	1	W50-24103
14	SHCS M6 x 12	4	5000281
15	BHCS M4 x 0,7 x 10	5	5000010
Not shown	Rotational accelerometer mass replacement	3	W50-10010
Not shown	Linear triaxial accelerometer mass replacement	1	W50-61063
Not shown	Dual-axis tilt sensor mass replacement	1	W50-10011
Not shown	Universal neck load cell	1	W50-71000

[a] 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 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.

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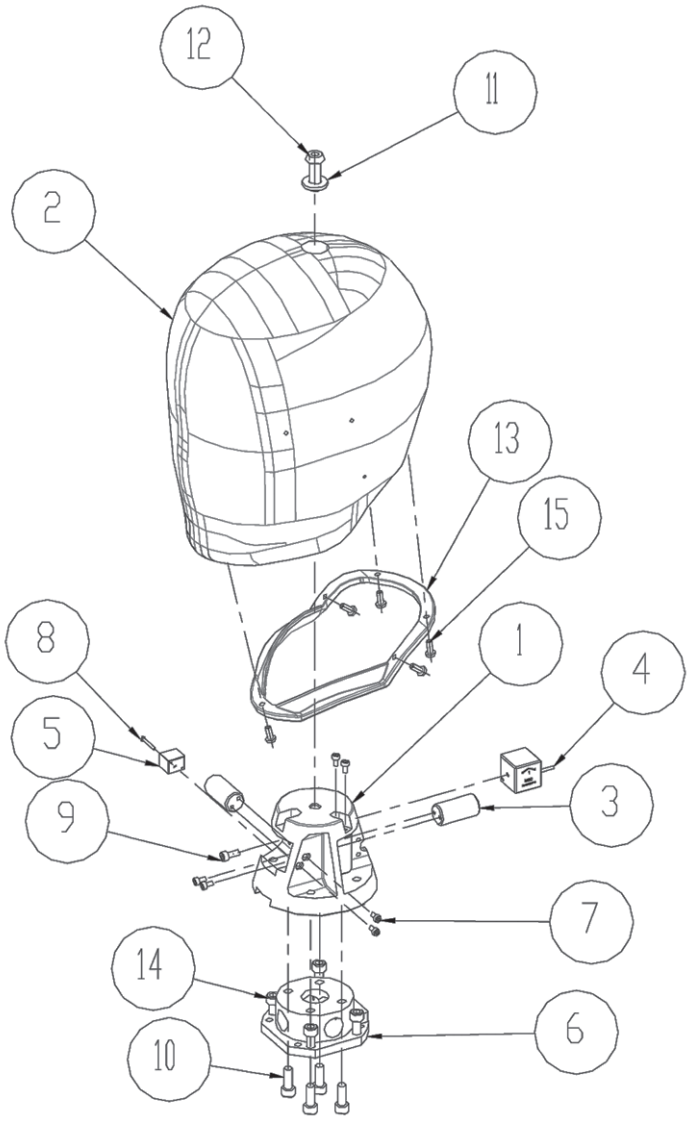


Figure A.1 — WorldSID head components

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A.1.2 Disassembling

As shown in Figure A.2, remove the BHCS M8 × 25 fastener (Figure A.1, Item 12) and M8 flat washer (Figure A.1, Item 11) from the top of the head. Lift the moulded head (Figure A.1, Item 2) off the head core assembly. If the head sticks to the core, tap the bottom edge of the head lightly with a plastic hammer. Detach the neck shroud assembly (Figure A.1, Item 13) from the head by removing five screws, BHCS M4 × 10.



Figure A.2 — Removal of moulded head

Remove the four SHCS M6 × 12 (Figure A.1, Item 14) that connect the head core assembly to the neck assembly (see Figure A.3).

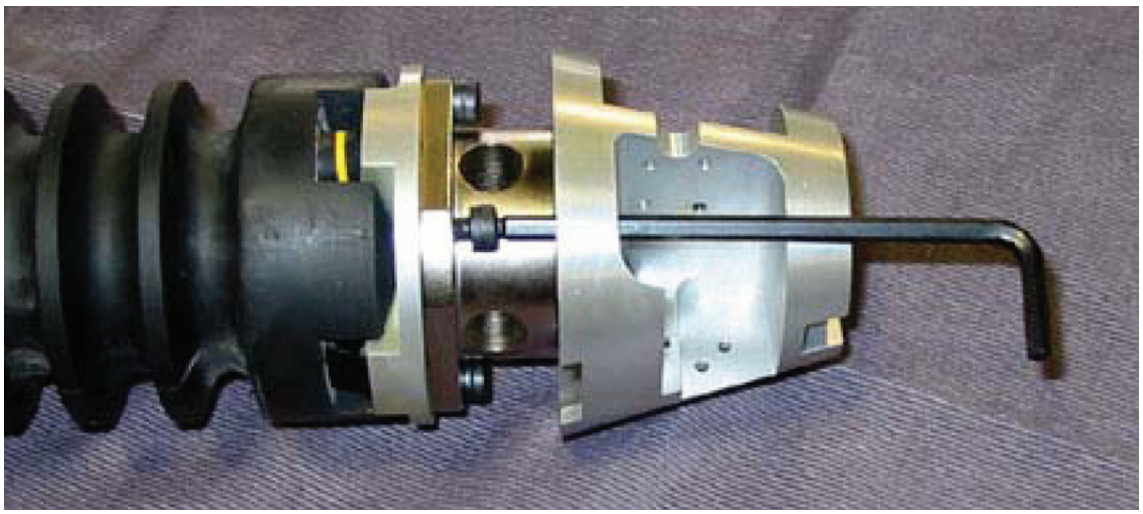


Figure A.3 — Separating the head core from the neck

Remove the four SHCS M6 × 16 (Figure A.1, Item 10) from the bottom of the upper neck load cell structural replacement (Figure A.1, Item 6) that attach it to the bottom of the head core (see Figure A.4).

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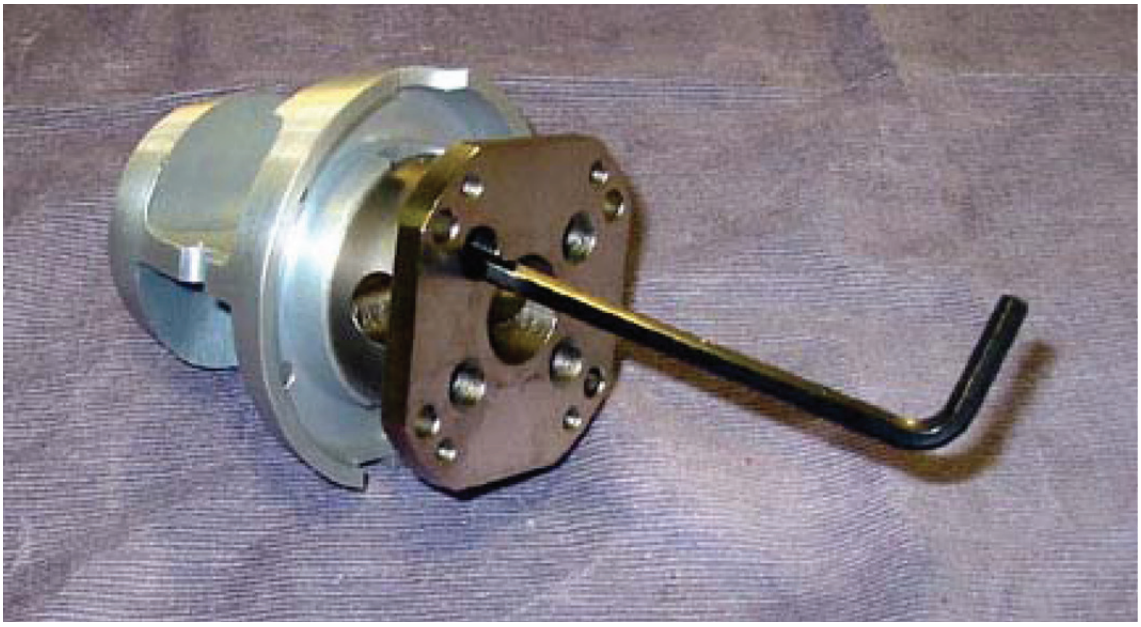


Figure A.4 — Removing upper neck load cell from instrumented head core

A.1.3 Assembling

Install the head instrumentation as described in A.1.4. Use four SHCS M6 × 16 (Figure A.1, Item 10) to attach the upper neck load cell to the bottom of the head core (Figure A.1, Item 1). Make sure the slot at the top front of the head core is lined up with the connector for the upper neck load cell. Torque the screws to 6 Nm. Attach the head core assembly to the neck assembly using four SHCS M6 × 12 (Figure A.1, Item 14). Torque the screws to 6 Nm.

Mount the neck shroud assembly (Table A.1, Item 13) to the moulded head (Figure A.1, Item 2) using five BHCS M4 × 10. Place the head/neck shroud assembly over the instrumented core, making sure that all wires are free. Place the M8 flat washer into the recess at the top of the head and connect the head to the instrumented core using the BHCS M8 × 25 (Figure A.1, Item 12). Tighten the screw 1/4 - 1/2 turn after engagement of the screw head and the skull.

As shown in Figure A.5, bundle the wires from the head instrumentation together at the rear with cable ties and route down the back of the neck over to the non-struck side of the dummy. Pass the cables between the shoulder rib and first thoracic rib. As shown in Figure A.5, make sure that the cable has some slack. See Annex G for more detailed wiring information.

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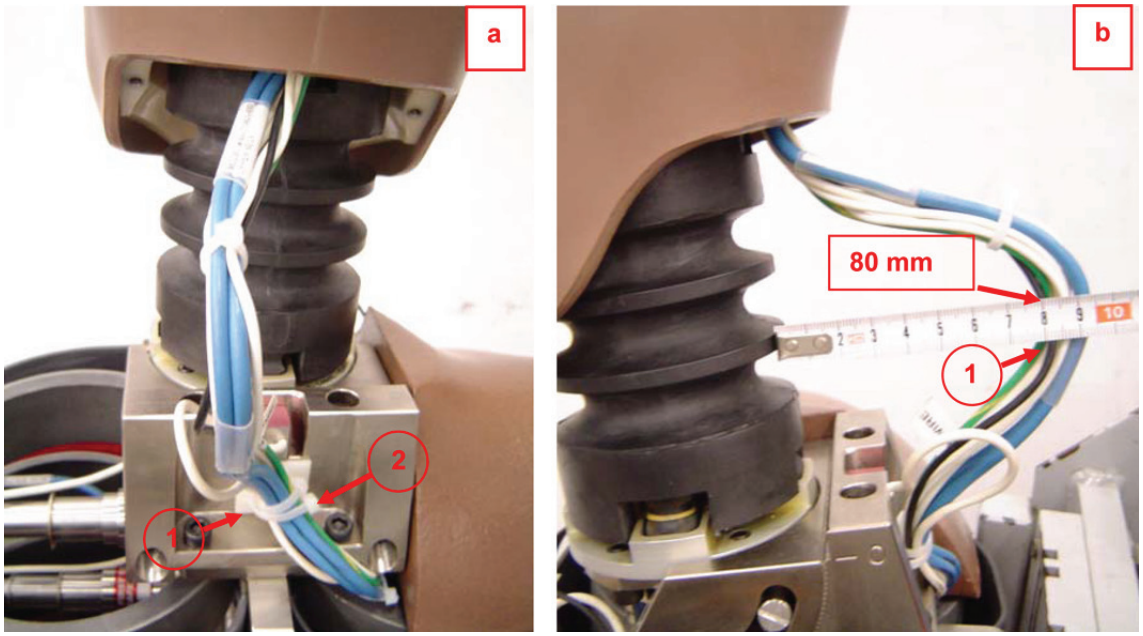


Figure A.5 — Wire routing for head instrumentation

A.1.4 Instrumentation mounting

Note that, as shown in Figure A.6, the head core can be instrumented with three rotational accelerometers (Figure A.6, Item 3), one linear triaxial accelerometer (Figure A.6, Item 5), and one dual-axis tilt sensor (Figure A.6, Item 4). Note that each rotational accelerometer is secured with two SHCS M3 × 6 (Figure A.6, Item 7) and that the y-axis rotational accelerometer is mounted in the right-front chamber with screws accessed from the left-front chamber. Mount the z-axis rotational accelerometer in the left-rear chamber with screws accessed from the top. Mount the x-axis rotational accelerometer in the right-rear chamber with screws accessed from the right-front chamber. Note that the linear triaxial accelerometer is mounted in the right-front chamber with one cheese screw M2 × 16 (Figure A.6, Item 8) that is accessed from the right. Mount the tilt sensor in the right-rear chamber with one SHCS M4 × 10 (Figure A.6, Item 9) accessed from the right-front chamber. Note that the instrumentation in the right-rear chamber shall be installed before the instrumentation in the right-front chamber. Note that the upper neck load cell is also considered part of the head assembly instrumentation.

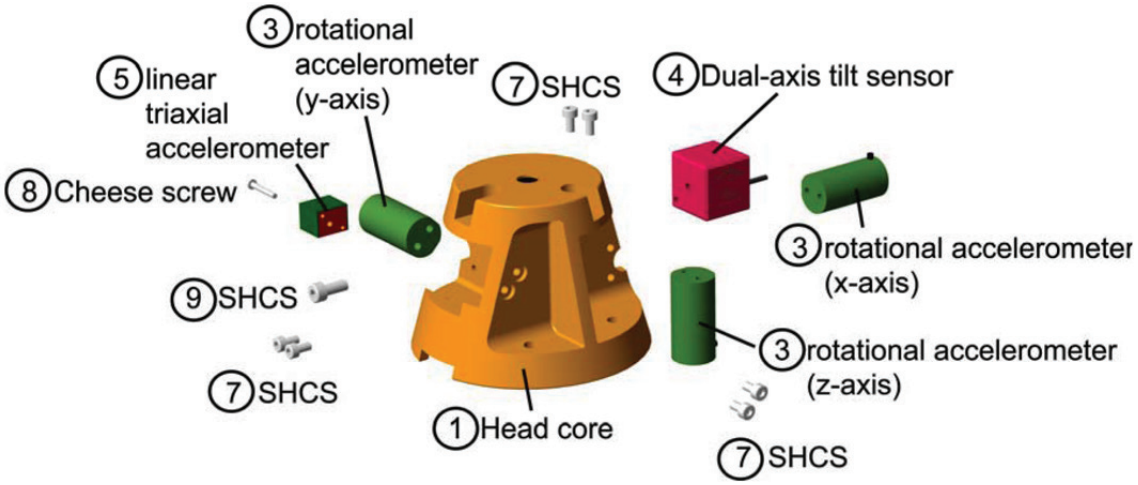


Figure A.6 — WorldSID head instrumentation

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A.2 Neck

A.2.1 Parts lists for neck

Note that Table A.2 lists the parts required for assembling the WorldSID neck, which are shown in Figure A.7. Note that part numbers correspond to those found on drawing W50-20000.

Table A.2 — Parts list for WorldSID neck

Item number	Description	Quantity	Part number
1	Lower neck bracket	1	W50-20101
2	Upper neck bracket	1	W50-20102
3	Neck assembly, tested and certified	1	W50-21001
4	SHCS M6 x 12	8	5000281
5	Neck spacer	2	W50-20103
6	Screw, SHCS M6 x 1 x 30	2	5000008
7	Cable tie mount, #4 screw	1	6002036
8	Screw, BHCS M3 x 0,5 x 6	1	5000399
9	Neck load cell replacement	1	W50-71003

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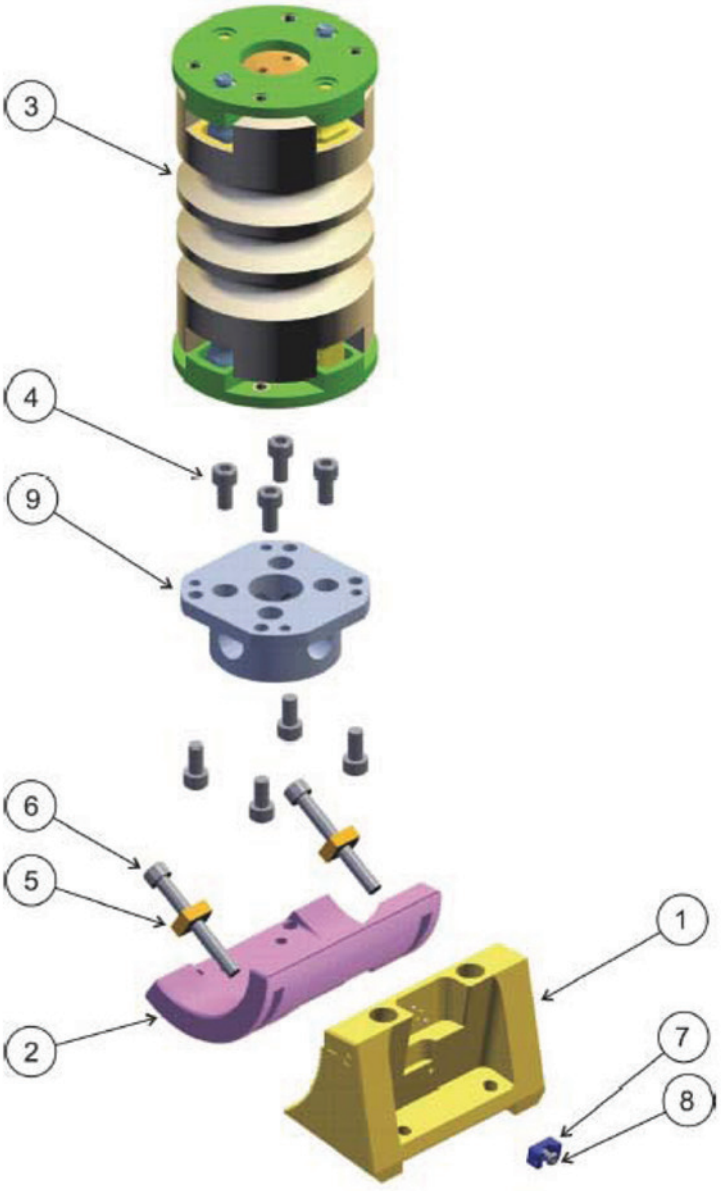


Figure A.7 — WorldSID neck components

A.2.2 Disassembling

Separate the upper (Figure A.7, Item 2) and lower (Figure A.7, Item 1) neck brackets by removing two SHCS M6 x 30 (Figure A.7, Item 6) accessed from the rear of the dummy (see Figure A.8). Two spacers (Figure A.7, Item 5), accessed from either side, will be free to be removed.

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Figure A.8 — Removing lower neck bracket

Remove the upper part of the neck bracket and lower neck load cell structural replacement from the neck assembly by removing four SHCS M6 x 12 (Figure A.7, Item 4) accessed from the bottom (Figure A.9). The lower neck load cell is removed from the upper neck bracket by removing four SHCS M6 x 12 (Figure A.7, Item 4).

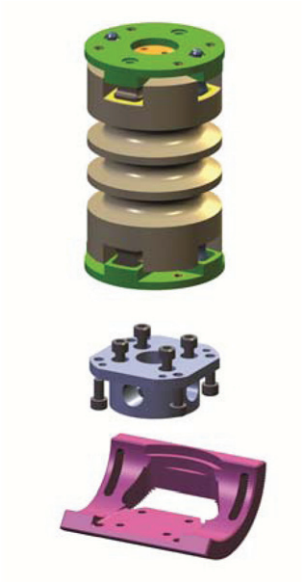


Figure A.9 — Removing upper neck bracket

To take apart the neck assembly, use the neck compression wrench to remove the half-spherical screw from the neck (Figure A.10). The interface plates will come off, and the four dampers can be removed by pulling them out (see Figure A.11).

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Figure A.10 — Using clamp to remove neck interface plate



Figure A.11 — Neck dampers are free to be removed when interface plates are removed

A.2.3 Assembling

When assembling the neck, mount the neck buffers with the circular cross-sections on the lateral sides of the neck, and mount the neck buffers with the square cross-sections on the front and rear of the neck. As shown in Figure A.12, note that the lateral locations for the buffers in the interface plates are farthest from the holes for mounting the neck to the head and torso.

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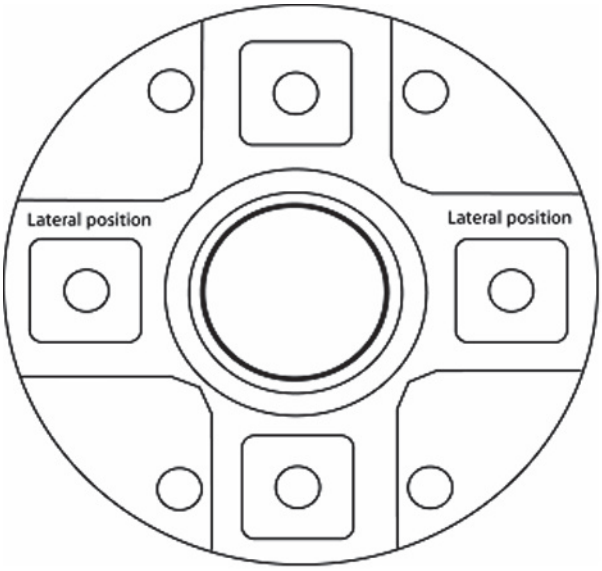


Figure A.12 — Lateral positions for neck buffers

Note that the circular cross-section buffers have a cylindrical end and a mushroom-shaped end. Press the mushroom ends firmly into the top and bottom interface plates so that the mushroom cap protrudes into the counterbore on the flat face of the interface plate. Note that a turning action during assembly helps to get the circular buffers positioned correctly. Tune the correct response of the neck in lateral bending by using three different hardnesses of lateral circular cross-section buffers. When installing the flexion/extension buffers in the interface plates, position them as shown in Figure A.13 so the end that sticks out farther is facing the moulded neck.

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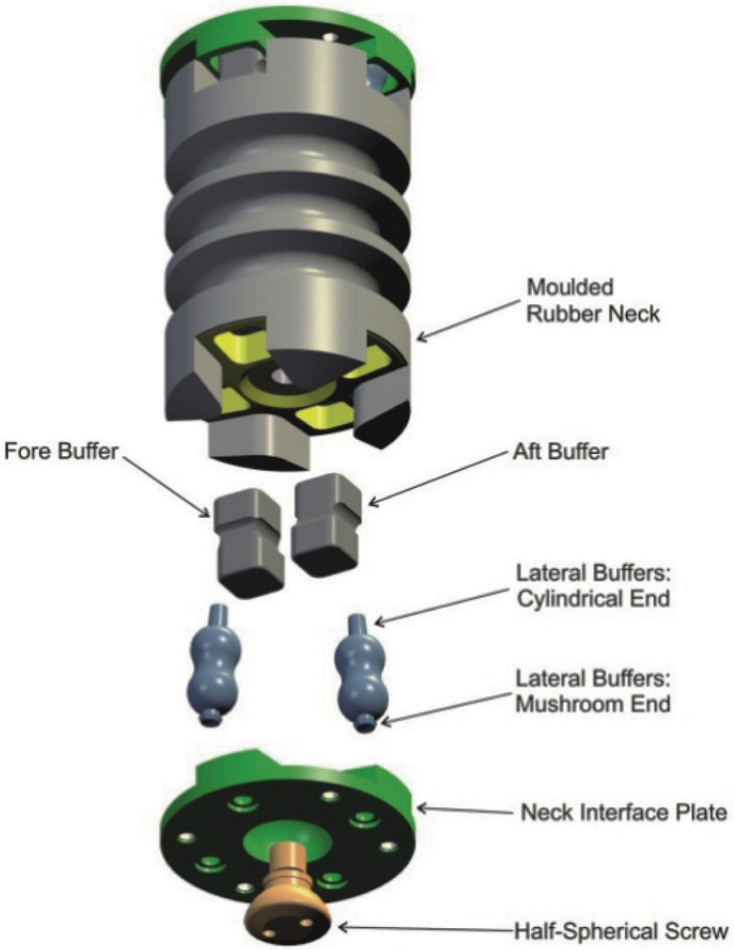


Figure A.13 — Assembling of neck buffers

Position the interface plate with the installed buffers over one end of the neck. Lubricate the surface of the half-spherical screw with "Never Seez"[1)] high-pressure grease. Attach the interface plate to the neck by tightening the half-spherical screws to 10 Nm using the neck compression tool. Repeat for the other end of the neck.

Place the upper neck bracket (Figure A.7, Item 2) over the lower neck bracket (Figure A.7, Item 1) and engage the teeth in the desired orientation. Insert the neck spacer (Figure A.7, Item 5) 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 x 30 (Figure A.7, Item 6) to secure the brackets together. Repeat with the second neck bracket nut and SHCS on the other side.

Mount the neck load cell or its structural replacement (Figure A.7, Item 9) to the neck bracket with four SHCS M6 x 12 (Figure A.7, Item 4). Tighten the screws to 6 Nm. Attach the neck assembly (Figure A.7, Item 3) to the neck bracket/load cell assembly with four SHCS M6 × 12 (Figure A.7, Item 4) accessed from the bottom. Tighten the screws to 6 Nm.

A.2.4 Instrumentation mounting

Note that the neck assembly includes a lower neck load cell (the upper neck load cell is considered part of the head assembly). Note that a triaxial accelerometer can be mounted in a recess in the back of the

1) "Never Seez" is a commercial product. 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.

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lower neck bracket. Attach the triaxial accelerometer or its mass replacement to the upper neck bracket using a cheese screw M2 × 16 (see Figure A.14).

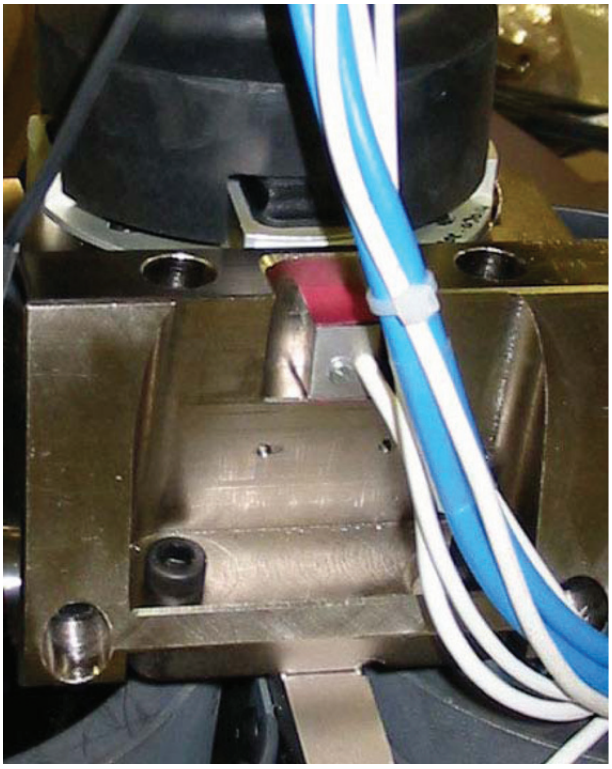


Figure A.14 — Neck triaxial accelerometer installation

A.3 Thorax, abdomen, and shoulder

A.3.1 Parts list

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

Note that Table A.3 lists the parts required for assembling the WorldSID thorax, abdomen, and shoulder, which are illustrated in Figure A.15. Note that part numbers correspond to those on drawing W50-30000.

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

Item number	Description	Quantity	Part number
1	Spine box assembly	1	W50-31000
2	IRTRACC displacement sensor assembly, ribs 1-6 (ref)	6	IF-363
3	Thorax rib assembly 1, WorldSID	2	W50-32111
4	Thorax rib assembly 2 & 3, WorldSID	8	W50-32131
5	Sternum, thorax rib	1	W50-35022
6	Rib coupler, abdominal, WorldSID	1	W50-35021
7	Shoulder rib sternum mounting strip	2	W50-32177
8	Thorax and abdominal rib sternum mounting strip	10	W50-32178
9	Thorax and abdominal rib mounting strip, threaded	10	W50-32176
10	Screw, BHCS M5 X 0,8 X 10	24	5000003

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Table A.3 *(continued)*

Item number	Description	Quantity	Part number
11	Shoulder rib assembly, inner band, WorldSID	2	W50-32160-2
12	Thorax rib assembly, inner band, WorldSID	6	W50-32150-2
13	Abdomen rib assembly, inner band, WorldSID	4	W50-32155-2
14	Shoulder rib mounting bracket, WorldSID	2	W50-32171
15	Thorax and abdominal rib accelerometer mounting bracket, WorldSID	10	W50-32172
16	Accelerometer, linear triaxial, Endevco 7268C-M1 (ref)	6	7268C-M1
17	Rib assembly, shoulder	2	W50-32001
not shown	Shoulder rib sternum mounting strip, threaded	2	W50-32175
19	Thorax and abdominal rib clamping bracket, WorldSID	10	W50-32173
20	Screw, FHCS M5 X 0,8 X 16	8	5000467
21	Screw, rib IRTRACC mount	6	W50-32179
22	Rib doubler, shoulder	2	W50-32010
23	Shoulder assembly, l.c. structural replacement	2	W50-61053
24	Clamp, damping	24	W50-32180
25	Screw, FHCS M5 X 0,8 X 10	48	5000084
26	Screw, BHCS M5 X 0,8 X 6	24	5000214
27	Shoulder pad, left, WorldSID	1	W50-35023-1
28	Shoulder pad, right, WorldSID	1	W50-35023-2
29	Screw, BHCS M2,5 X 0,45 X 10	10	5000208
30	Nut, locknut M12 X 1,75	2	5000462
31	Thorax pad	2	W50-35024
32	Screw, SHCS M6 X 1 X 16	4	5000081
33	Screw, cheese M2 X 16	6	5000254
34	Cable tie mount, ,50 x ,50, nylon, adhesive backed	10	6002035
35	Cable tie mount, #4 screw, nylon	1	6002036
36	Screw, BHCS M3 X 0,5 X 6	1	5000399
37	Cable tie, hook & loop, 11 inch (not shown)	8	6002055
38	Temperature logger assy (ref)	1	734-0808
39	Battery mounting bracket	1	W50-37013
40	Spine ballast stand offs	2	W50-37014
41	G5 mounting bracket, WorldSID thorax	1	W50-37015
42	G5 structural replacement	1	W50-74307
43	Screw, SHCS M5 X 0,8 X 30	2	5000471
44	Screw, BHCS M5 X 0,8 X 12	40	5000654
45	Screw, BHCS #6-32 X 1-1/4	4	9003044
46	Screw, SHCS M3 X 0,5 X 12	6	5000568
47	Structural replacement cover	1	556-5125-2

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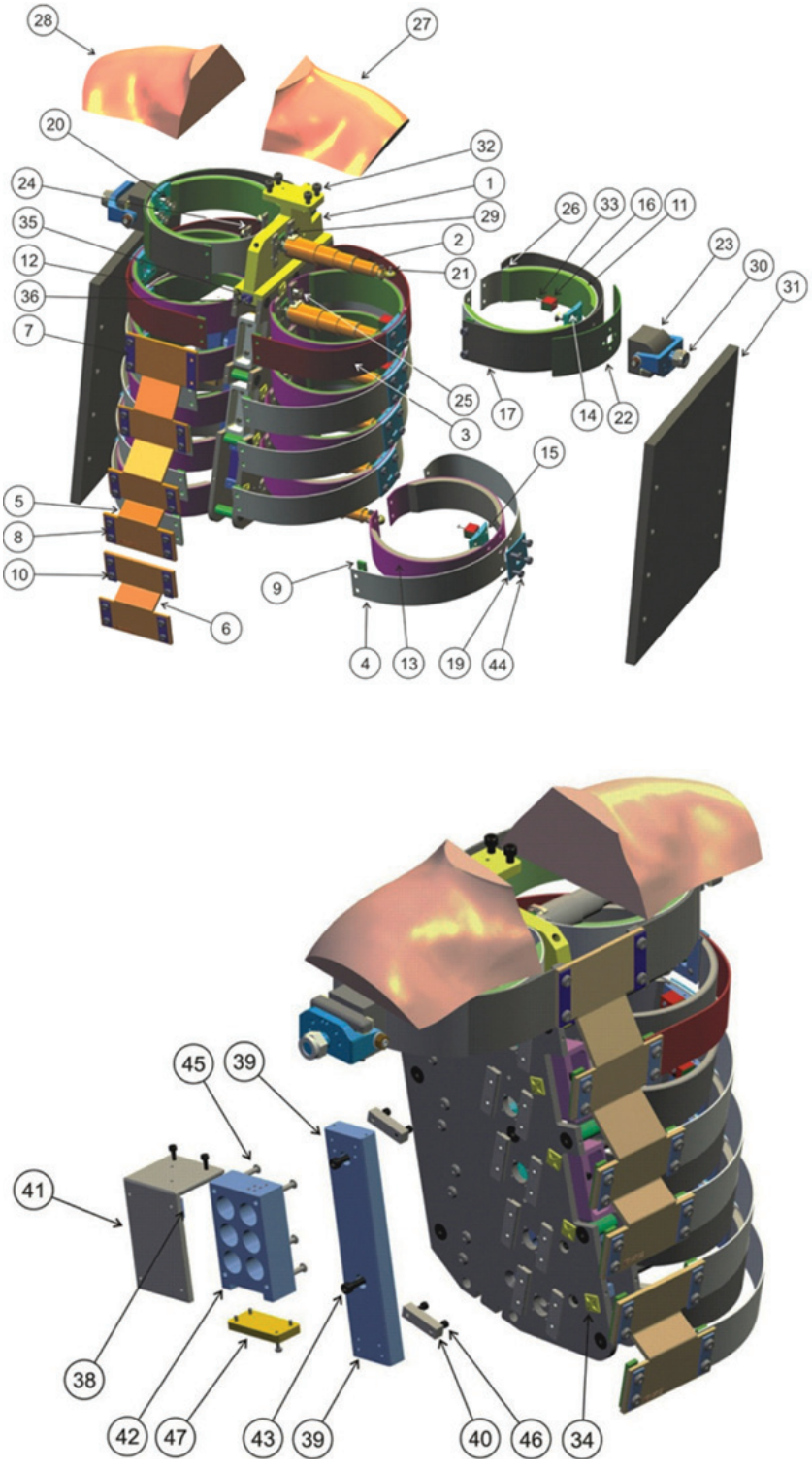


Figure A.15 — Components of WorldSID thorax and abdomen

A.3.1.2 Parts list for shoulder

Note that Table A.4 lists the parts required for assembling the WorldSID shoulder (electronic drawing W50-61053), which is illustrated in Figure A.16.

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Table A.4 — Parts list for shoulder assembly

Item number	Description	Quantity	Part number
1	Shoulder load cell structural replacement	1	W50-71092
2	Shoulder pivot shaft	1	W50-61049
3	Shoulder pivot washer	2	W50-61050
4	Shoulder clevis assembly	1	W50-61117
5	M6 hex locknut	1	5000143
6	SSNT M4 x 0,7 x 4 mm	2	5000201
Not shown	Shoulder load cell	1	W50-71090
Not shown	SSFP M4 x 0,7 x 4 mm	2	5000618
Not shown	SSFT M6 x 10	1	5000226

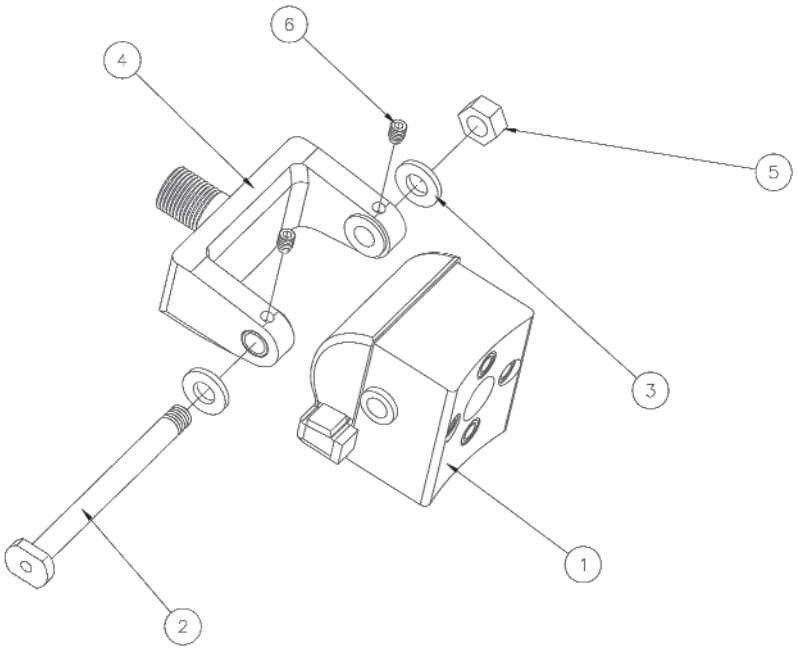


Figure A.16 — Shoulder

A.3.1.3 Parts list for spine box assembly

Note that Table A.5 list the parts required for assembling the WorldSID spine box. Note that part numbers correspond to those on drawing W50-31000 and shown in Figure A.17.

Table A.5 — Parts list for WorldSID spine box

Item number	Description	Quantity	Part number
1	Mounting bracket #1	2	W50-31042
2	Upper bracket weldment, spine box, WorldSID	1	W50-31010
3	Interposer replacement	2	W50-75001
4	Side plate, left WorldSID	1	W50-31020
5	SHCS M3 x 0,5 x 10	7	5000119
6	Spacer, WorldSID	6	W50-31041

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Table A.5 *(continued)*

Item number	Description	Quantity	Part number
7	T12 accelerometer mount, WorldSID	1	W60-37024
8	Side plate, right WorldSID	1	W50-31030
9	SHCS M3 x 0,5 x 8	8	5000388
10	Connector housing mass replacement	2	W50-75002
11	Backup plate mounting bracket	2	W50-37022
12	SHCS M4 x 0,7 x 10	4	5000151
13	FHCS M2,5 x 0,45 x 6	24	5000202
14	Ball joint assembly, IRTRACC	6	W50-31050
15	FHCS M6 x 1 x 10	18	5000204
16	Accelerometer, linear triaxial	2	ISO 15830-3:2013, 4.1.3.2
17	SHCS M2 x 0,4 x 12,0 12,9 alloy steel	8	5000382
18	Cheese screw M2 x 16	2	5000254
19	BHCS M6 x 1 x 18	4	5000465
20	Rotational accelerometer/tilt sensor mount bracket	1	W50-37023
21	Mounting bracket #2	2	W50-31043
22	G5 mass replacement	3	W50-74307
23	Cover plate spine box	2	W50-31045
24	Accelerometer, rotational	2	ISO 15830-3:2013, 4.1.3.3
25	SHCS M4 x 0,7 x 25	8	5000461
26	Bracket, rotational accelerometer mount	1	W50-37029
27	Tilt sensor, dual axis (ref)	1	ISO 15830-3:2013, 4.1.2.4.3
28	FHCS M3 x 0,5 x 10	2	5000203
29	SHCS M4 x 0,7 x 8	1	5000024
30	Pin, dowel M4 x 14	2	5000053
Not shown	Linear accelerometer mass replacement	2	W50-61063
Not shown	Rotational accelerometer mass replacement	2	W50-10010
Not shown	Dual axis tilt sensor mass replacement	1	W50-10011

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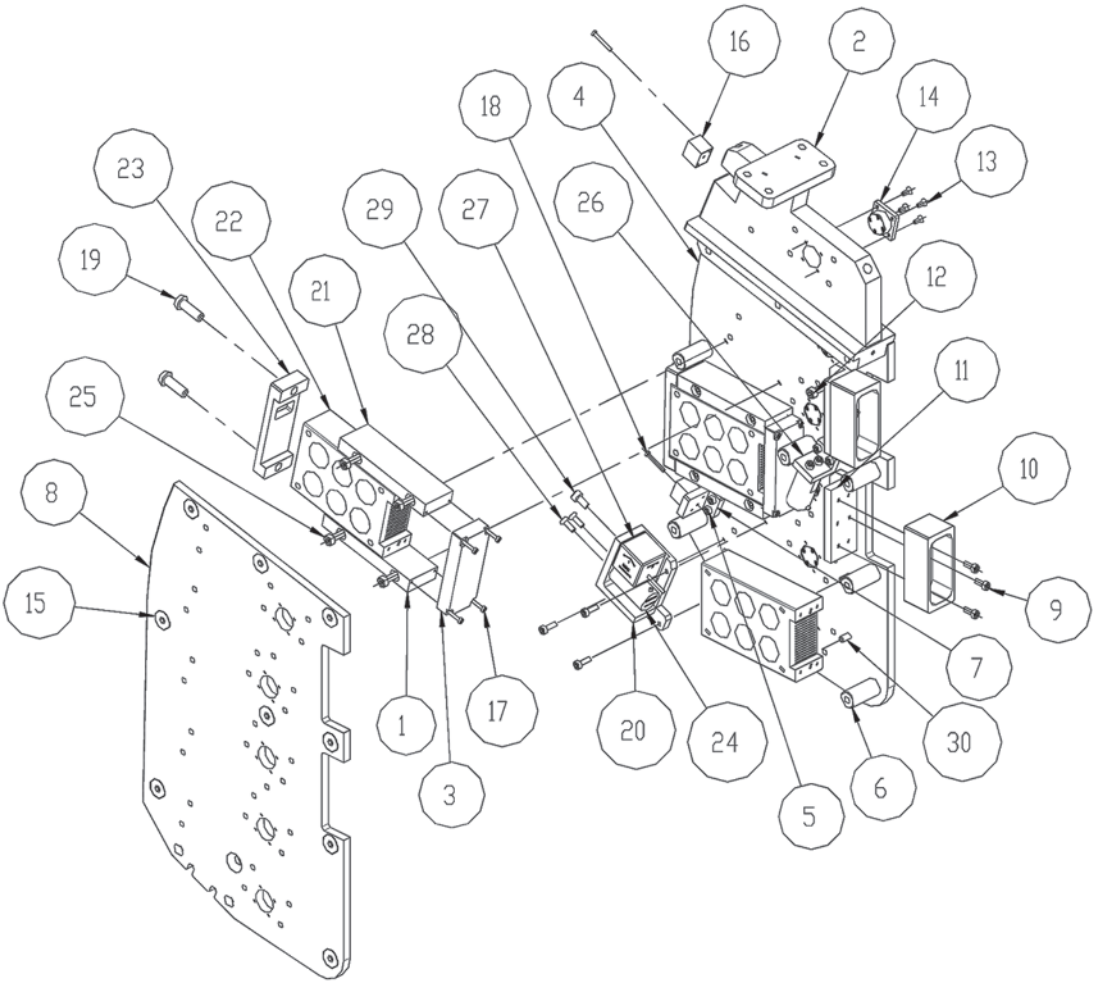


Figure A.17 — WorldSID spine box assembly

A.3.2 Disassembling

A.3.2.1 Separation of upper and lower torso

To separate the upper and lower torso, first make sure all cables running between the upper and lower torso are detached. These would normally include sensor cables that were routed to the DAS in the thorax, and a ground cable. This step may require disassembly of the sternum to access the sensor collector. Thereafter, remove the four SHCS M8, two on each side of the bottom of the spine box, to separate the upper and lower torsos.

A.3.2.2 Shoulder

As shown in Figure A.18, remove the shoulder assembly (Figure A.15, Item 23) by removing the four FHCS M5 x 16 (Figure A.15, Item 20) that hold each in place.

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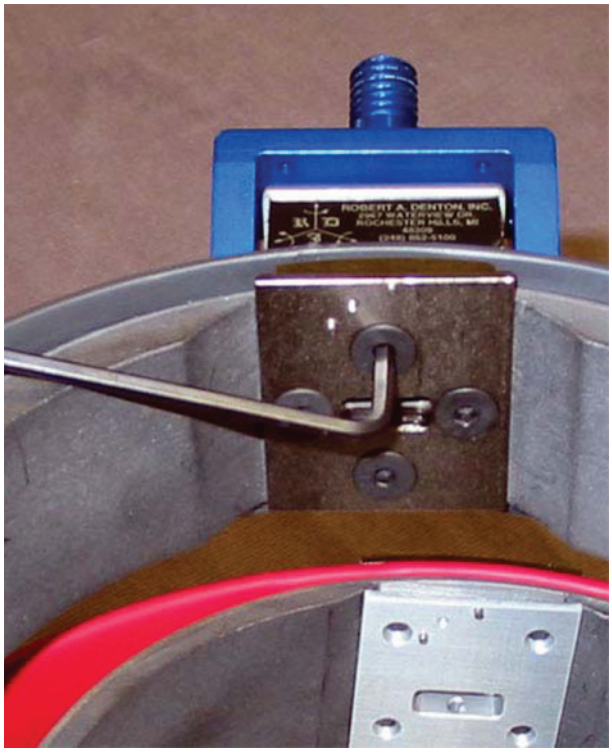


Figure A.18 — Removing shoulder load cell assembly

To remove the clevis assembly (Figure A.16, Item 4), take off the M6 hex nut (Figure A.16, Item 5) with the nylon washer (Figure A.16, Item 3) at the threaded end. Next, loosen the two SSNT M4 × 0,7 × 4 (Figure A.16, Item 6) in the clevis assembly that hold the pivot shaft (Figure A.16, Item 2) and the SSFT M6 × 10 mm (in the load cell behind the clevis securing the pivot shaft) from the load cell structural replacement then pull the shaft out of the assembly.

NOTE The shoulder load cell has two SSFP M4 × 4 mm securing the pivot shaft instead of the one SSFT M6 × 10 in the load cell structural replacement.

A.3.2.3 Thorax and abdomen

Remove the thorax pad (Figure A.15, Item 31) by removing it from the Velcro® that holds it in place. Remove the shoulder pads (Figure A.15, Items 27 and 28) by lifting them off of the dummy. Remove the lower neck bracket from the spine box by removing four SHCS M6 × 16 (Figure A.15, Item 32).

Remove the shoulder rib mounting brackets (Figure A.15, Item 14). Detach the shoulder rib IR-TRACC (Figure A.15, Item 2) from the shoulder rib mounting bracket by removing the IR-TRACC rib mount screw (Figure A.15, Item 21), accessed from the bottom of the shoulder rib mounting bracket.

Remove the linear triaxial accelerometer (Figure A.15, Item 16) from the shoulder rib mounting bracket by removing the cheese screw M2 × 16 (Figure A.15, Item 33). Detach the shoulder IR-TRACC assembly from the spine box by removing the BHCS M2,5 × 10 (Figure A.15, Item 29).

As shown in Figure A.19, disconnect the shoulder rib (Figure A.19, Item 17) at the front by removing the two BHCS M5 × 10 (Figure A.15, Item 10) that attach the left and right shoulder ribs to the sternum thorax rib (Figure A.15, Item 5). Remove a shoulder rib sternum mounting strip (Figure A.15, Item 7) and a threaded shoulder rib sternum mounting strip (Figure A.15, Item 18) which are removed from each side.

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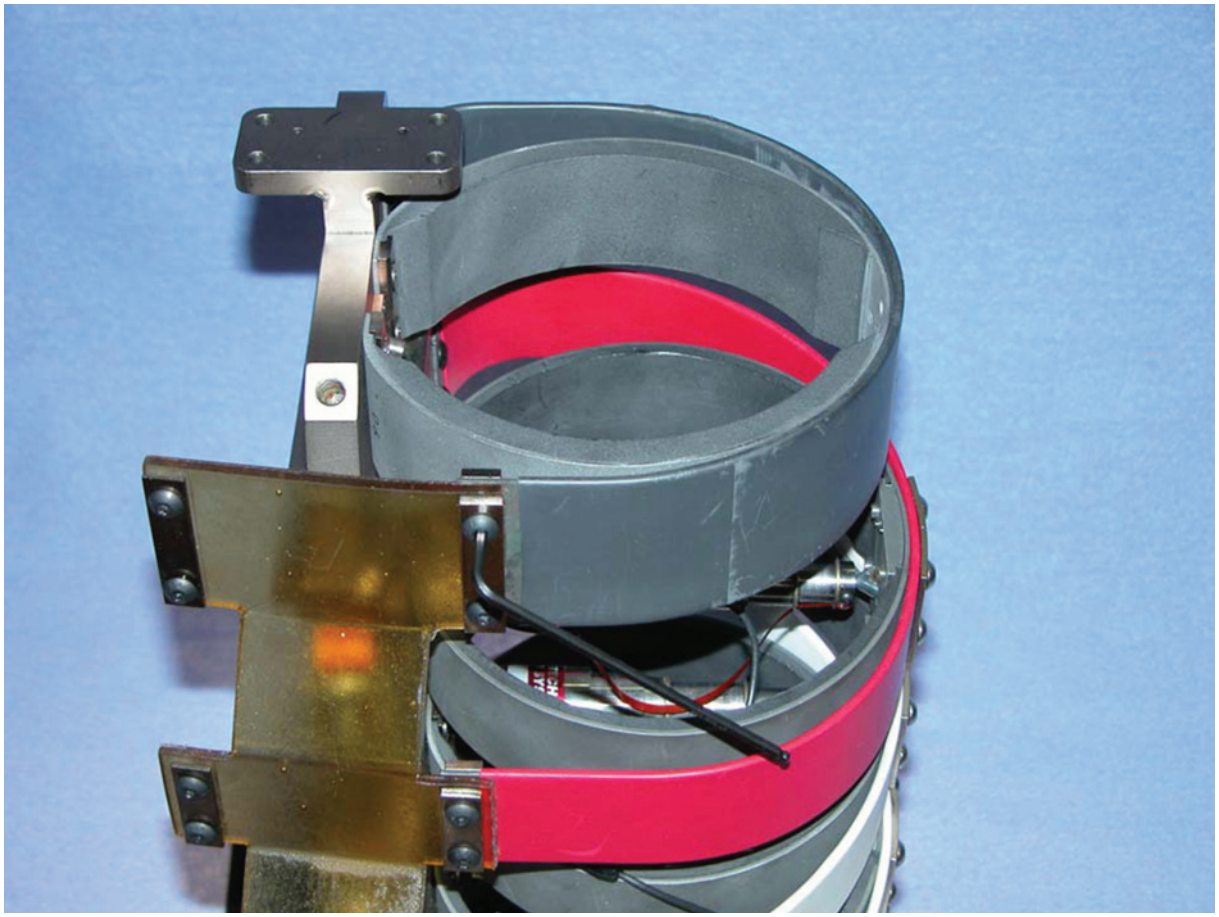


Figure A.19 — Detaching shoulder rib at front from sternum

Detach the left and right shoulder ribs from the spine box at the rear by removing two BHCS M5 × 6 (Figure A.15, Item 26) that hold each in place (see Figure A.20). On the non-struck side, remove the two damping clamps (Figure A.15, Item 24).

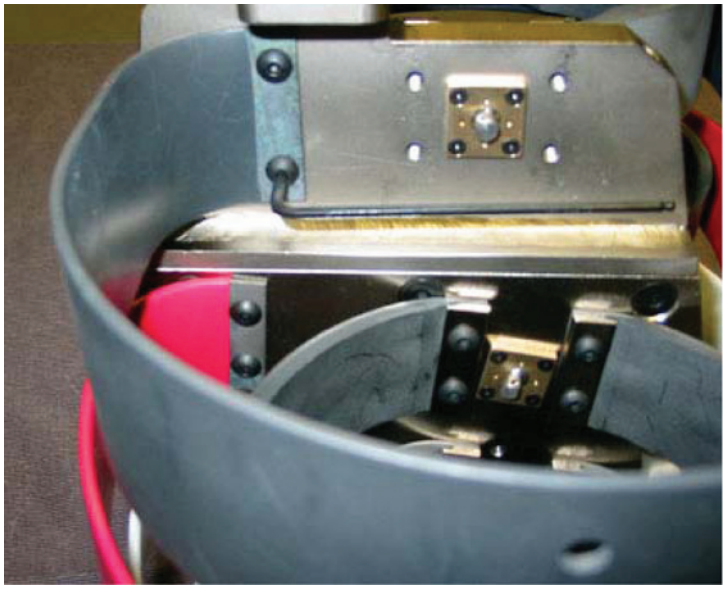


Figure A.20 — Detaching the rib from the spine box at the rear

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Note that 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 item numbers. Detach the rib clamping bracket (Figure A.15, Item 19) and the rib accelerometer mounting bracket (Figure A.15, Item 15) by removing the four BHCS M5 × 10 (Figure A.15, Item 10). Remove the triaxial accelerometer (Figure A.15, Item 16) from the rib accelerometer mounting bracket (Figure A.15, Item 15) by removing the cheese screw M2 × 16 (Figure A.15, Item 33).

Remove the IR-TRACC (Figure A.15, Item 2) by removing the BHCS M2,5 × 10 (Figure A.15, Item 29) that secures it to the spine box. Detach it from the rib accelerometer bracket by removing the IR-TRACC mount screw (Figure A.15, Item 21), which is accessed from the bottom of the rib accelerometer bracket.

Detach the thorax rib at the front by removing the four BHCS M5 × 10 (Figure A.15, Item 10) that connect it to the sternum (Figure A.15, Item 5). Remove the two sternum rib mounting strips (Figure A.15, Item 8) and the two threaded rib mounting strips (Figure A.15, Item 9). Detach the inner band of the thorax rib (Figure A.15, Item 12) by removing the four BHCS M5 × 10 (Figure A.15, Item 10) that hold them in place. Remove the two damping clamps (Figure A.15, Item 24). Detach the rib from the spine box at the rear by removing two BHCS M5 × 6 (Figure A.15, Item 26) 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. Note that the two abdominal ribs are attached at the front to the abdominal rib coupler (Figure A.15, Item 6), and that the inner rib bands of the two abdomen ribs (Figure A.15, Item 13) are different than the inner bands of the three thorax ribs (Figure A.15, Item 12). Note that the damping material on the abdominal ribs is thicker than that on the thoracic ribs. Note that the first thorax outer rib (Figure A.15, Item 3) is different from the thorax ribs 2 and 3 and the abdominal ribs (Figure A.15, Item 4), which are the same.

After the ribs are removed, detach the G5 mounting bracket (Figure A.21) from the non-struck side by removing two SHCS M3 x 12. Then, detach the G5 structural replacement by removing the four #6-32 × 1-1/4 BHCS. Detach the cover by removing the four BHCS M2.5 x 10. Next, remove the battery mounting bracket by detaching the two M5 x 30 SHCS that secure it to the spine box. Detach the spine ballast stand offs from the battery mounting bracket by removing the SHCS M3 x 12.

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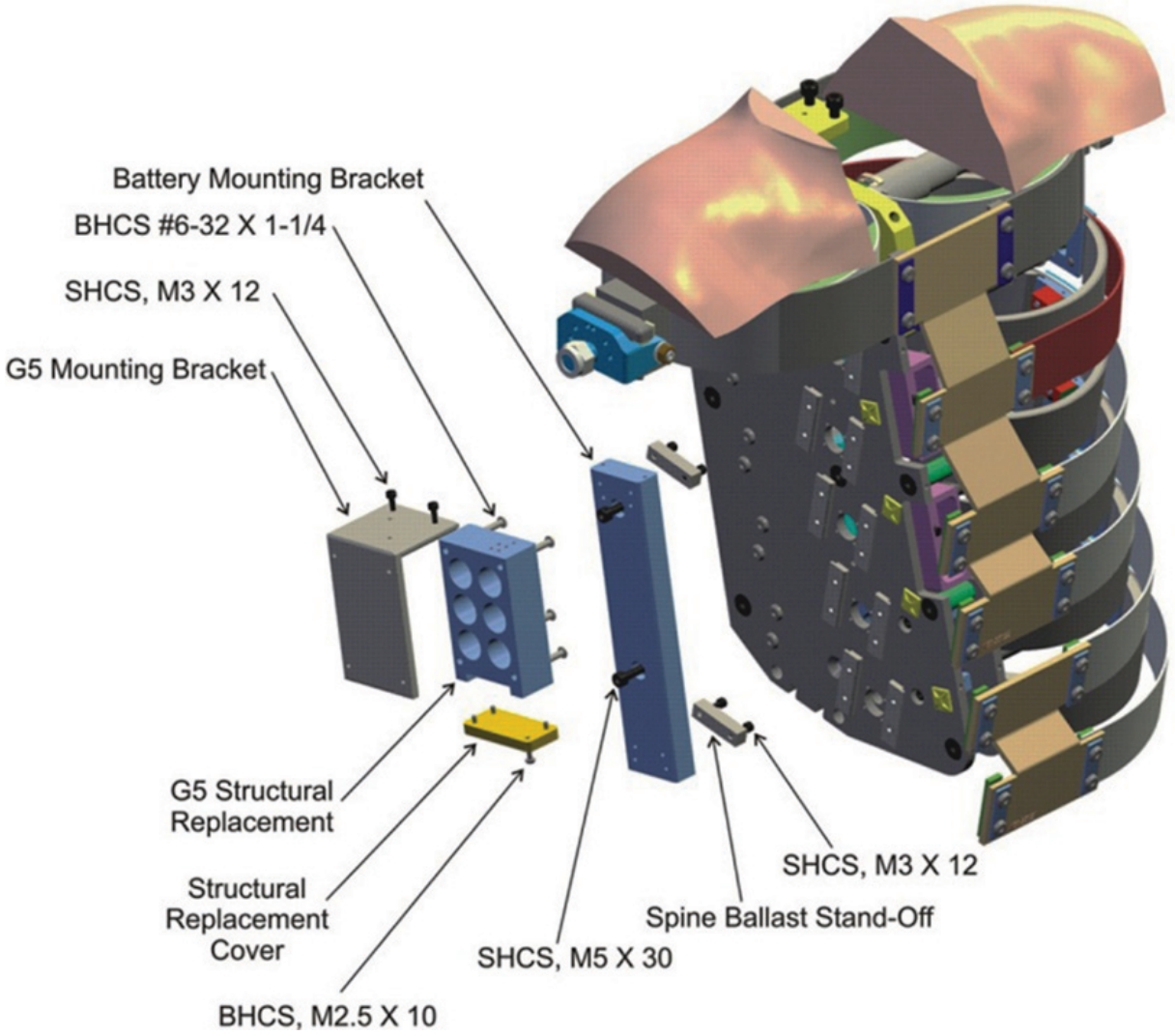


Figure A.21 — Non-impact side G5 assembly

A.3.2.4 Spine box disassembling

Detach the right side plate (Figure A.17, Item 8) from the spine box by removing 10 FHCS M6 × 10 (Figure A.17, Item 15). Note that the internal components of the spine box will now be visible (see Figure A.23).

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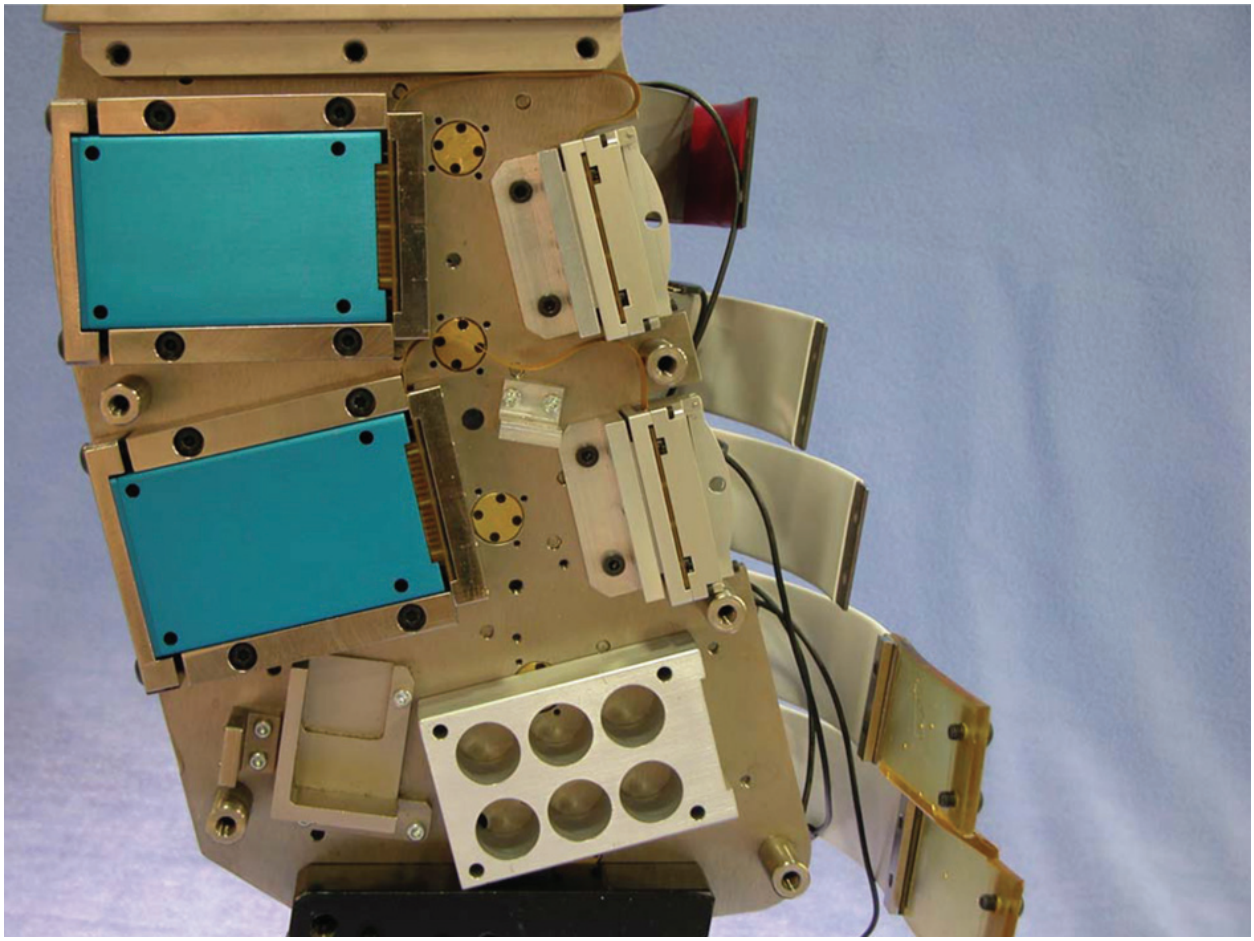


Figure A.22 — Internal spine box assembly

Note the rotational and linear accelerometer assembly shown in Figure A.23. To detach the rotational accelerometer assembly from the spine box, remove the three SHCS M3 × 10 (Figure A.17, Item 5) that secure it to the spine box. Remove the dual-axis tilt sensor (Figure A.17, Item 27) from the rotational accelerometer bracket by removing the SHCS from the back of the bracket. Detach the two rotational accelerometers by removing the two FHCS that secure each to the bracket.

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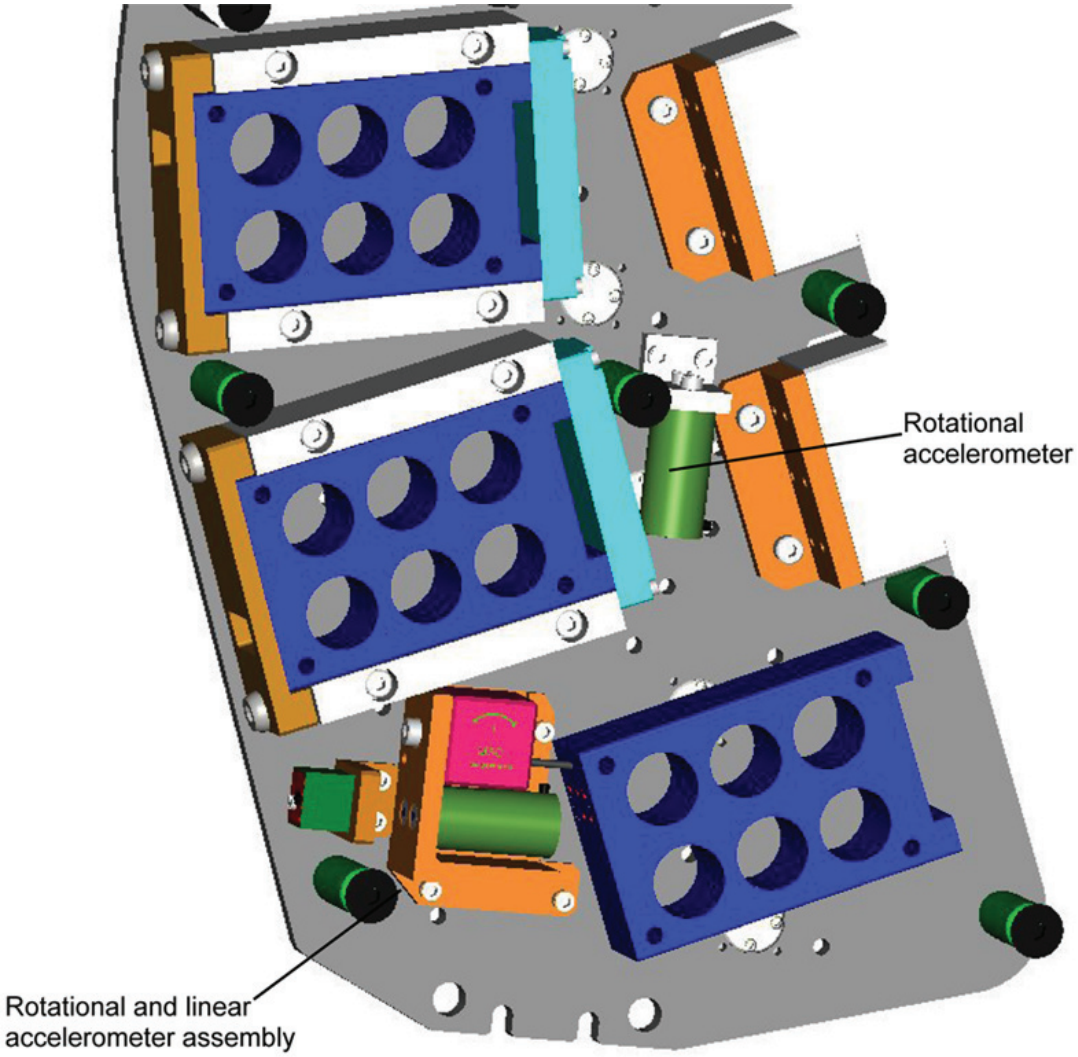


Figure A.23 — Angular accelerometer assembling

Begin removal of the upper or middle G5 module mass replacements (Figure A.17, Item 22) by removing two SHCS M4 × 25 (Figure A.17, Item 25) that secure the Number 2 mounting brackets (Figure A.17, Item 21) to the upper bracket weldment, spine box (Figure A.17, Item 2). Remove two more SHCS M4 × 25 (Figure A.17, Item 25) that secure the Number 1 mounting brackets (Figure A.17, Item 1) to the spine box. Remove the middle or upper G5 module mass replacement assembly (Figure A.17, Item 22). Detach the spine box cover plate (Figure A.17, Item 23) from the back of each G5 module mass replacement (Figure A.17, Item 22) by removing two BHCS M6 × 18 (Figure A.17, Item 19). Slide the G5 module mass replacement (Figure A.17, Item 22) from between the two mounting brackets (Figure A.17, Item 1 and 21). Detach each interposer mass replacement (Figure A.17, Item 3) from the mounting brackets by removing the four SHCS M2 × 12 (Figure A.17, Item 17). Remove the two backup plate mounting brackets (Figure A.17, Item 11) from the spine box by removing the two SHCS M4 × 10 (Figure A.17, Item 12) that hold each in place. Remove each connector housing mass replacement (Figure A.17, Item 10) from its backup plate mounting bracket (Figure A.17, Item 11) by removing three SHCS M3 × 8 (Figure A.17, Item 9). Remove the lower G5 module mass replacement (Figure A.17, Item 22) from the spine box by detaching two pin dowel M4 × 14 (Figure A.17, Item 30).

Turn the spine box over and remove seven FHCS M6 × 10 (Figure A.17, Item 15) to remove the seven spacers (Figure A.17, Item 6) from the left side plate (Figure A.17, Item 4). Remove three more of the FHCS M6 × 10 (Figure A.17, Item 15) to separate the upper spine box bracket weldment from the left-side plate (Figure A.17, Item 4).

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As shown in Figure A.24, note that six IR-TRACC ball joint assemblies (Figure A.17, Item 14) are secured to the struck-side plate, each with four FHCS M2,5 × 6 (Figure A.17, Item 13).



Figure A.24 — IR-TRACC ball joint assemblies are mounted to the struck-side plate of the spine box

A.3.3 Assembling

A.3.3.1 Assembling thorax and abdomen

Note that Figure A.25 shows the colour coding scheme for the WorldSID ribs and that 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 that the inner bands of the two abdominal ribs (Figure A.15, Item 13) have a thicker layer of damping material than the inner bands of the thoracic ribs (Figure A.15, Item 12), and that the inner band of the shoulder rib (Figure A.15, Item 11) is different from the other inner bands.

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Figure A.25 — Shoulder rib is grey, the first thoracic rib is red, and the second and third thoracic ribs and abdominal ribs are white

Begin assembly of the thorax by attaching the two spine ballast stand offs (Figure A.15, Item 40) to the battery mounting bracket (Figure A.15, Item 39) with SHCS M3 × 12 (Figure A.15, Item 46). Then attach the battery mounting bracket (Figure A.15, Item 39) with two SHCS M5x30 (Figure A.15, Item 43) that secure it to the spine box on the non-struck side. Attach the G5 structural replacement (Figure A.15, Item 42) with four BHCS #6-32 × 1-1/4 to the G5 mounting bracket (Figure A.15, Item 41). Attach the G5 cover (Figure A.15, Item 47) to the G5 replacement with BHCS M2.5 × 10 (Figure A.15, Item 29). Then attach the G5 mounting bracket (Figure A.15, Item 41) to the battery mounting bracket (Figure A.15, Item 39).

Begin assembly of the ribs from the bottom. Attach the lower abdominal rib (Figure A.15, Item 13) to the spine box at the rear using two BHCS M5 × 6 (Figure A.15, Item 26). Secure the inner band of the abdomen (Figure A.15, Item 13) with two damping clamps (Figure A.15, Item 24) and four BHCS M5 × 10 (Figure A.15, Item 10). 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.

Attach the IR-TRACC to the spine box with a BHCS M2,5 × 10 (Figure A.15, Item 29). Connect it to the rib accelerometer bracket (Figure A.15, Item 15) with the IR-TRACC mount screw (Figure A.15, Item 21), accessed from the bottom of the rib accelerometer bracket (Figure A.15, Item 15). Connect the rib clamping bracket (Figure A.15, Item 19) and the rib accelerometer mounting bracket (Figure A.15, Item 15) to the inner band and rib with four BHCS M5 × 10 (Figure A.15, Item 10). Secure the triaxial accelerometer (Figure A.15, Item 16) to the rib accelerometer mounting bracket (Figure A.15, Item 15) with a cheese screw M2 × 16 (Figure A.15, Item 33).

As each IR-TRACC assembly and accelerometer is installed, route the cables toward the centre front (Figure A.28 and Figure A.29) of the dummy and plug them into the G5 module connectors. See Annex G for more detailed wiring information.

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Note that Figure A.26 shows the arrangement of the components in the first thoracic WorldSID rib and that all of the ribs have a similar general assembly. Note that the inner band of the rib (Figure A.26, Item 33) is attached to the spine box with damping clamps (Figure A.26, Item 10) and FHCS. Note that the rib (Figure A.26, Item 28) is attached to the spine box (Figure A.26, Item 13) at the rear with BHCS, and to the thorax rib sternum (Figure A.26, Item 3) at the front using BHCS and the sternum mounting strip (Figure A.26, Item 4) and threaded sternum mounting strip (Figure A.26, Item 7). Attach the IR-TRACC assembly (Figure A.26, Item 14) with a BHCS to the ball joint components which are attached to the spine box. Secure the IR-TRACC to the rib accelerometer mounting bracket (Figure A.26, Item 32) with a special mounting screw accessed from the bottom. Note that a linear triaxial accelerometer (Figure A.26, Item 15) is attached to the rib accelerometer mounting bracket (Figure A.26, Item 32), which is then secured to the inner rib, rib, and rib clamping bracket (Figure A.26, Item 31) with a BHCS.

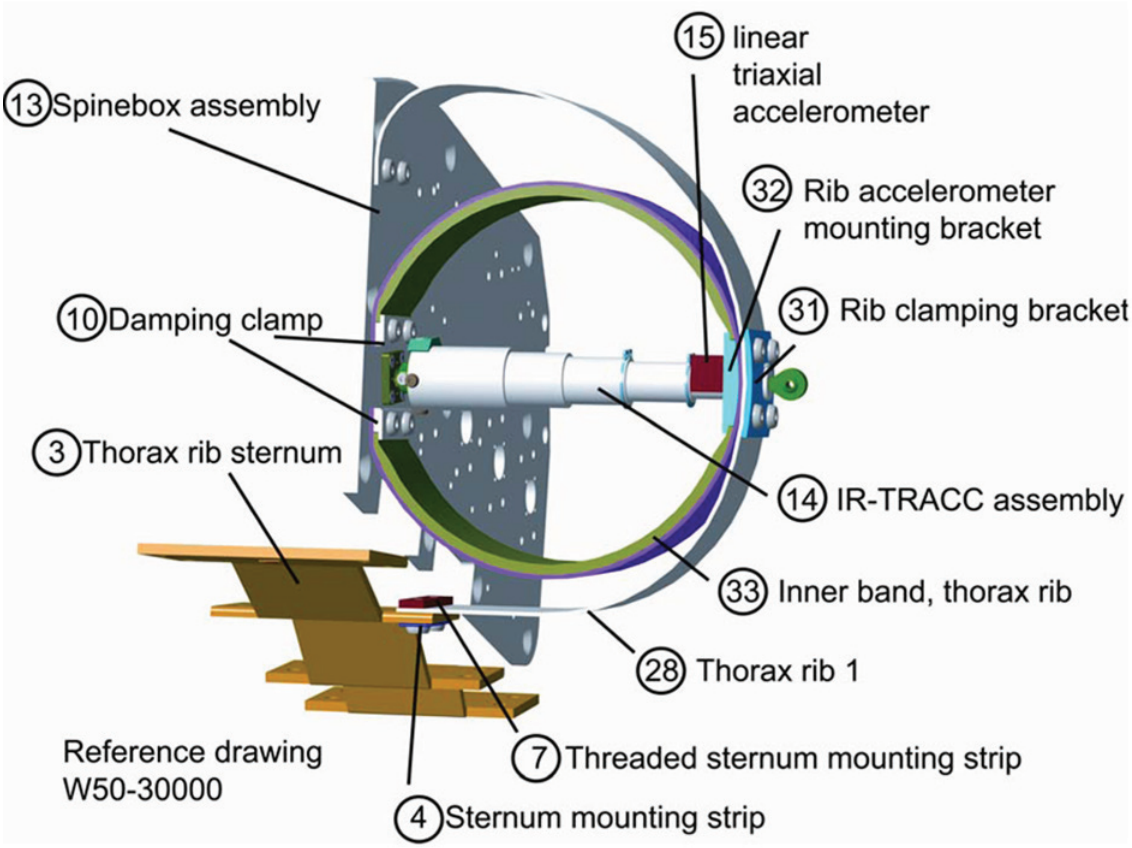


Figure A.26 — Components of thorax rib

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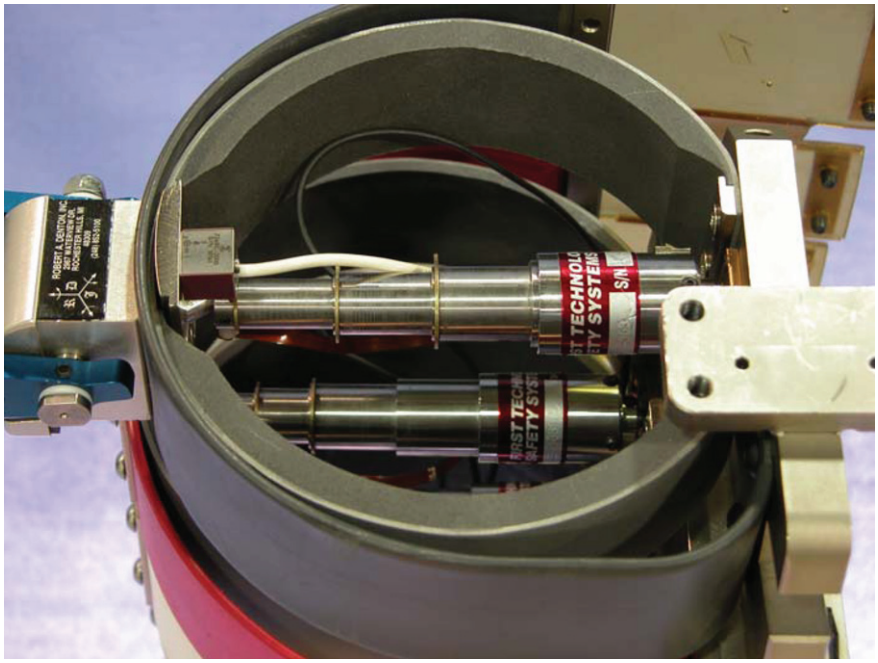


Figure A.27 — Wire routing for rib instrumentation

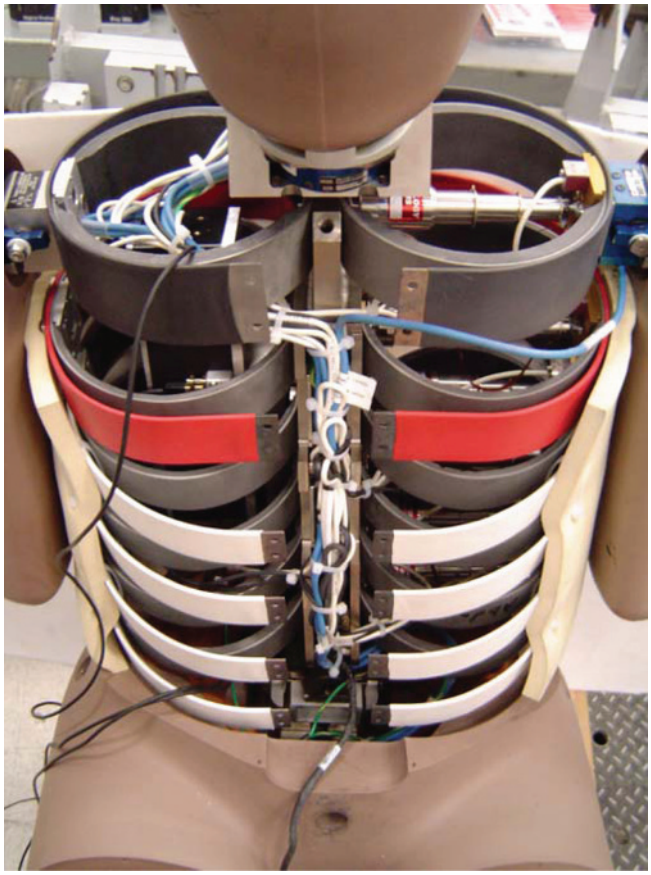


Figure A.28 — Plugging rib instrumentation cables into the front of the G5 modules mounted in the spine box

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Continue installing the ribs with the preceding procedure. Attach the shoulder rib mounting bracket (Figure A.15, Item 14) to the shoulder rib and shoulder load cell structural replacement (Table A.3, Item 23) with four FHCS M5 × 0,8 × 16 (Figure A.15, Item 20).

After the instrumentation is plugged into the connectors, position a threaded rib mounting strip (Figure A.15, Item 9) behind the front holes on each abdominal rib, and place the abdominal rib coupler (Figure A.15, Item 6) over it. Put the rib mounting strip (Figure A.26, Item 4) over the rib coupler and secure the rib at the front with two BHCS M5 × 10 (Figure A.15, Item 10). Note that the installed rib couplers are shown in Figure A.29.

Attach the lower neck bracket to the spine box with four SHCS M6 × 16 (Table A.3, Item 32). Attach the thorax pad (Figure A.15, Item 31) with Velcro®. Place the shoulder pads (Figure A.15, Items 27 and 28) in position.

To install the thorax pads, check the fit of the pad against the dummy to make sure the pad covers the ribs and press into place, engaging the Velcro® with light pressure.

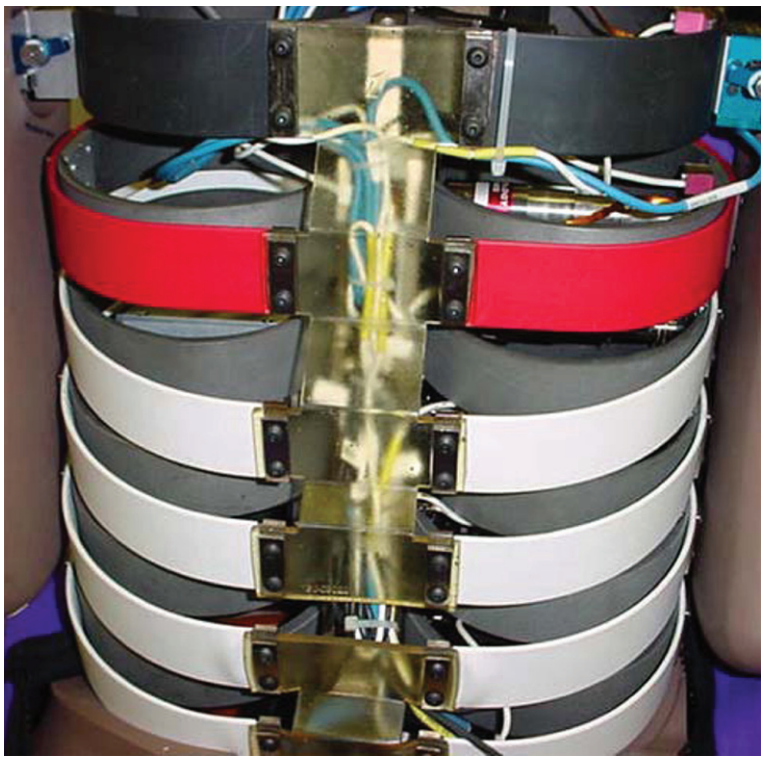


Figure A.29 — The rib and abdominal couplers are attached to the ribs after instrumentation is plugged in

A.3.3.2 Assembling spine box

Begin assembly of the spine box by mounting the ball joints for the IR-TRACC assemblies to the side plate so they face the struck-side of the dummy. Secure each ball joint (Figure A.17, Item 14) with four FHCS M2,5 × 6 (Figure A.17, Item 13). Attach the seven spacers (Figure A.17, Item 6) to the struck-side plate (Figure A.17, Item 4 or Item 8) using seven FHCS M6 × 10 (Figure A.17, Item 19). Attach the upper spine box bracket weldment (Figure A.17, Item 2) to the struck-side plate with three more FHCS M6 × 10 (Figure A.17, Item 19).

As shown in Figure A.30, attach the lower G5 module or its mass replacement (Table A.5, Item 22) to the spine box. Attach each backup plate mounting bracket (Figure A.17, Item 11) to the spine box with two M4 × 14 pin dowels (Figure A.17, Item 30). Connect each interposer or its mass replacement (Figure A.17, Item 3) to the mounting brackets Number 1 (Figure A.17, Item 1) and Number 2 (Figure A.17, Item 21) with four SHCS M2 × 12 (Figure A.17, Item 17). Secure the mounting brackets/interposers to the spine box with four SHCS M4 × 25 (Figure A.17, Item 25). Slide the G5 modules or their mass replacements (Figure A.17

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Item 22) into the mounting brackets and connect them to the interposers. Attach the spine box cover plate (Figure A.17, Item 23) to the back of each G5 module or its mass replacement with two BHCS M6 × 18 (Figure A.17, Item 19). Attach each connector housing or its mass replacement (Figure A.17, Item 10) to its backup plate mounting bracket (Figure A.17, Item 11) with three SHCS M3 × 8 (Figure A.17, Item 9).

Next, assemble the angular accelerometer assembly. Attach the z-axis angular accelerometer to the bottom of the bracket with two FHCS. Attach the x-axis rotational accelerometer to the back of the bracket with two FHCS so it is parallel to the bottom of the bracket. Attach the dual-axis tilt sensor (Figure A.17, Item 27) to the back of the bracket with a SHCS. Position the rotational accelerometer assembly on the spine box and secure it with three SHCS M3 × 10 (Figure A.17, Item 5). Plug the cables for the rotational accelerometers sensors into a G5 module, but leave the connectors for the dual-axis tilt sensor free to be plugged into the off-board readout during dummy setup.

Attach the T12 accelerometer mount (Figure A.17, Item 7) to the spine box with two SHCS M3 × 10 (Figure A.17, Item 5). Attach the accelerometer (Figure A.17, Item 16) to the mount with a cheese screw M2 × 16 (Figure A.17, Item 18). Orient the accelerometer so that the cable points upward and can be routed between the middle G5 module and angular accelerometer assembly to be plugged into the G5 module. Attach the linear triaxial accelerometer (Figure A.17, Item 16) to the top of the spine box weldment with a cheese screw M2 × 16 (Figure A.17, Item 18). Plug the cable for the upper accelerometer into the G5 module after the ribs are installed.

Attach the other side plate (Figure A.17, Item 4 or 8) to the spine box with 10 FHCS M6 × 10 (Figure A.17, Item 15). Make sure the cables from the T12 or angular accelerometer assembly are not pinched by the side plate.

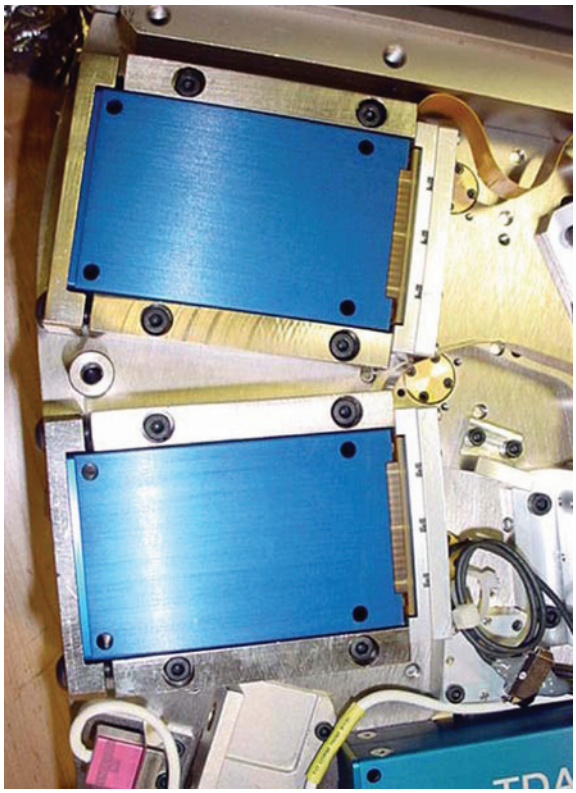


Figure A.30 — Installation of G5 modules

A.3.4 Instrumentation mounting

A.3.4.1 Thorax instrumentation

Note that the thorax instrumentation for the WorldSID includes an IR-TRACC deflection measurement assembly for each struck-side rib, plus a triaxial accelerometer attached to the inner struck side of each

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rib. Note that Figure A.31 illustrates the configuration for the assembly of the rib with instrumentation. Note that the IR-TRACC assembly (Figure A.31, Item 14) is attached to the spine box with a BHCS M2,5 (Figure A.31, Item 11), and that the other end of the IR-TRACC assembly is attached to the rib accelerometer mounting bracket (Figure A.31, Item 32) with an IR-TRACC rib mount screw (Figure A.31, Item 19) accessed from the bottom of the rib. Note that a linear triaxial accelerometer (Figure A.31, Item 15) is secured to the rib accelerometer mounting bracket (Figure A.31, Item 32) with a cheese screw M2 × 16 (Figure A.31, Item 37), and that the rib accelerometer mounting bracket (Figure A.31, Item 32) is secured to the inner band of the rib (Figure A.31, Item 33), the thorax rib (Figure A.31, Item 28), and the rib clamping bracket (Figure A.31, Item 31) with four BHCS M5 × 10 (Figure A.31, Item 1).

Note that a battery to power the G5 modules is part of the thorax assembly and that additional instrumentation attached to the spine box is described in the disassembly/assembly section for the spine box. Note that a shoulder load cell is also available for use with the WorldSID.

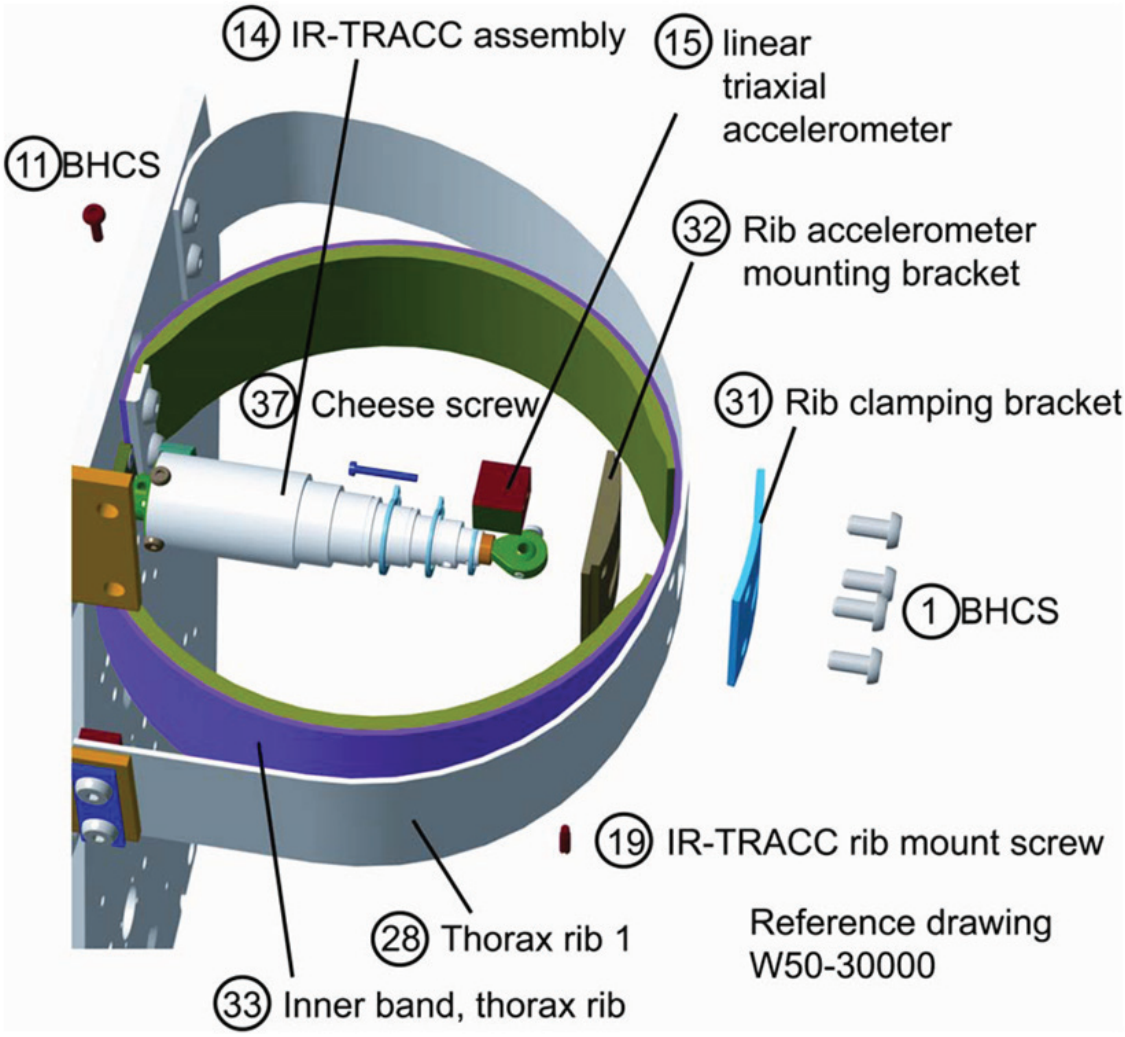


Figure A.31 — WorldSID rib instrumentation

A.3.4.2 Spine box instrumentation

Note that the spine box includes mounting positions for two G5 DAS modules, one of which is shown in Figure A.32. Note that for both of these, an interposer connector (see Figure A.33) is attached to the mounting brackets, and the DAS module is plugged into this connector. Note that the connector for each DAS (see Figure A.34), which is linked to the interposer connector, is secured to a bracket mounted to the spine box. Note that the arrangement of the DAS and connectors is shown in Figure A.35. Note

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