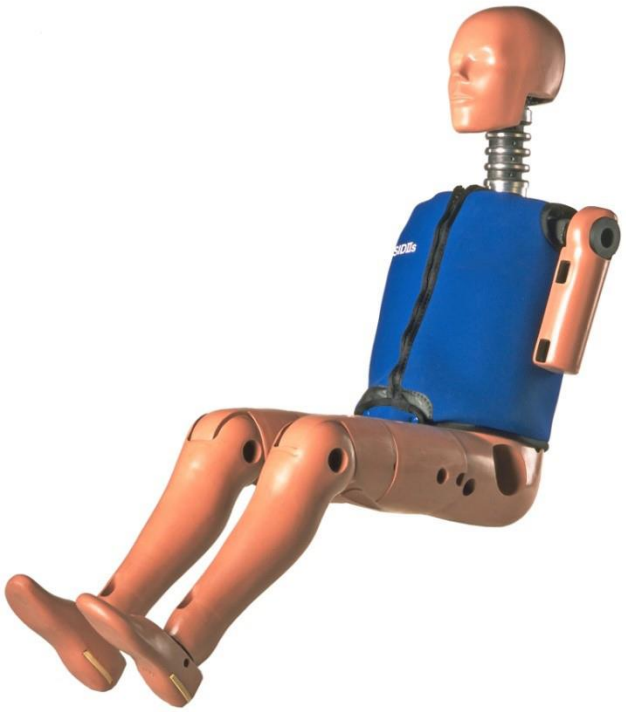
User Manual

SID-IIs Small Side Impact Dummy (SBL D)



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Notice: This product may contain lead

A list of components that may contain lead is being maintained on the Humanetics web site. The list, organized by dummy type, shows subcomponents that may currently or in the past have contained lead or a lead based alloy. Please refer to the Humanetics web site under ATD Lead Disclosure for information regarding lead in this product.
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Section 1 Introduction

Overview

In 1994, a project began to develop a second-generation small size side impact dummy (SID-IIs). The project was a joint effort by First Technology Safety Systems, the Small Sized Advanced Side Impact Dummy Task Group of the Occupant Safety Research Partnership (OSRP), and a United States Council for Automotive Research (USCAR) consortium. The groups identified a need for a dummy that would allow side impact injury assessment for an occupant who is the size of a small adult or teenager aged 12 to 14 years. Existing side impact dummies, which include the SID (FMVSS 214), EuroSID-1 (ECER95), and the BioSID, are used as research tools for side impact testing, but are all the size of a midsized male adult. The SID-IIs, shown in Figure 1, incorporated many of the best features of the existing side impact dummies as well as several new enhancements. It can represent either a driver or passenger in side impact tests, but the torso needs to be adjusted to accommodate each orientation.

Figure 1. SID-IIs

The response of the SID-IIs is based on a variety of international biomechanical resources compiled in ISO TR9790, but with tests involving massive thoracic rib fracture eliminated. These data were scaled to the size of the SID-IIs. The ISO biofidelity rating of the SID-IIs is 7.0, which corresponds to “good”.

1.1 **Illustrated Glossary**

This manual refers to several types of fasteners that are shown in Figure 2, together with their descriptions and the abbreviations used in the manual.

Figure 2. From left to right: Socket Screw Cup Point (SSCP), flat head cap screw (FHCS), button head cap screw (BHCS), socket head cap screw (SHCS), and socket head shoulder screw (SHSS).

Several types of standard tools are used in the assembly and disassembly of the dummy. T-handle wrenches (Figure 3) and hex wrenches (Figure 4) can be used to access most of the fasteners in the dummy. In some cases, access to fasteners is easier if a ratchet offset wrench with hex bits is used (Figure 5).

Figure 3. T-handle wrenches.

Figure 4. Hex wrenches.

Figure 5. Ratchet offset wrench with hex bits kit.

In addition to these standard tools, several specialty tools are used to disassemble, assemble, and check the dummy. The nodding block compression tool (Figure 6) is used to assembly the head-to-neck joint. An adaptor plate is needed for use with this head. The H-point tool (Figure 7) is used with an inclinometer to indicate pelvis angle. The use of these tools is described more thoroughly later in the manual.

Figure 6. Nodding block compression tool.

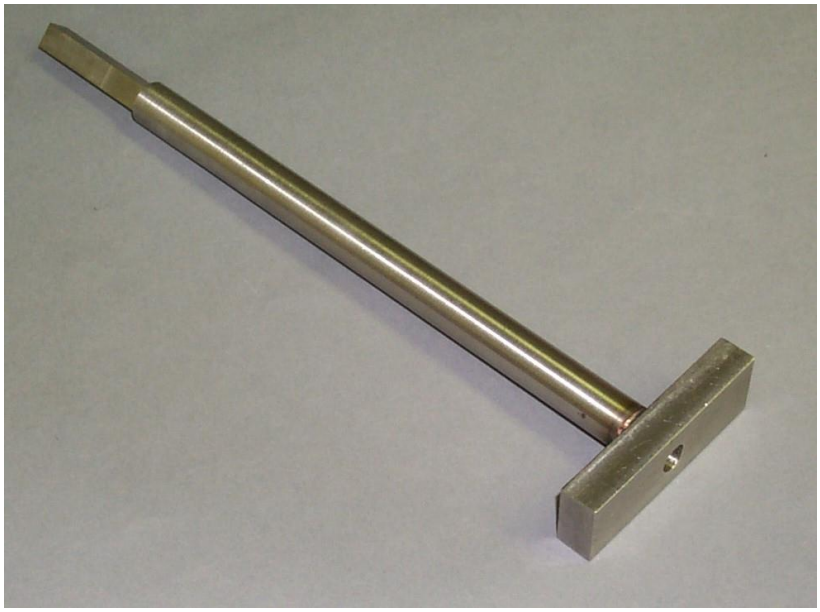

Figure 7. Pelvic angle measurement tool.

1.2 Recommended Torque Specifications

Unless specified otherwise, the fasteners used in the dummy should be approximately tightened to the following torque specifications. The torque specifications apply to clean and dry parts. A lubricated screw requires 15% to 25% less torque to obtain the same clamping force as a non-lubricated screw.

Table 1. Torque specifications

Size	Torque (in·lb)	Torque (N·m)
0-80	1.00	0.113
2-56	2.5	0.283
4-40	12.0	1.36
6-32	23.0	2.60
8-32	41.0	4.63
10-24	60.0	6.78
10-32	68.0	7.68
¼-20	144	16.3
¼-28	168	19.0
5/16-18	300	33.9
5/16-24	300	33.9
3/8-16	540	61.0
3/8-24	600	67.8

Typically, if more than one fastener is used to secure a part to the dummy, all of the fasteners should be inserted and tightened a few turns before any of the fasteners are torqued to the recommended level.

1.3 **Clothing**

The SID-IIs wears thermal underwear as its clothing (Figure 8). The specifications for its clothing, listed below.

- Shirt (part number 6001481)
  - 100% cotton, short sleeve, small size
  - the neckline should be small enough to prevent contact between a shoulder belt and the dummy's skin
  - should weigh no more than 0.14 kg (0.3 lb)

- Pants (part number 6001482)
  - 100% cotton, above sleeve, small size
  - should be trimmed to end above the dummy's knee
  - should weigh no more than 0.14 kg (0.3 lb)

- Shoes
  - Women's low dress black oxfords that meet military spec MIL-S-21711E
  - size is 7 ½ E
  - each shoe should weigh 0.41 +/- 0.09 kg (0.9 +/- 0.2 lb)
  - The shoe can be cut to extend the tongue so it is easier to put the shoe on the dummy. Talc may also be applied to the foot.

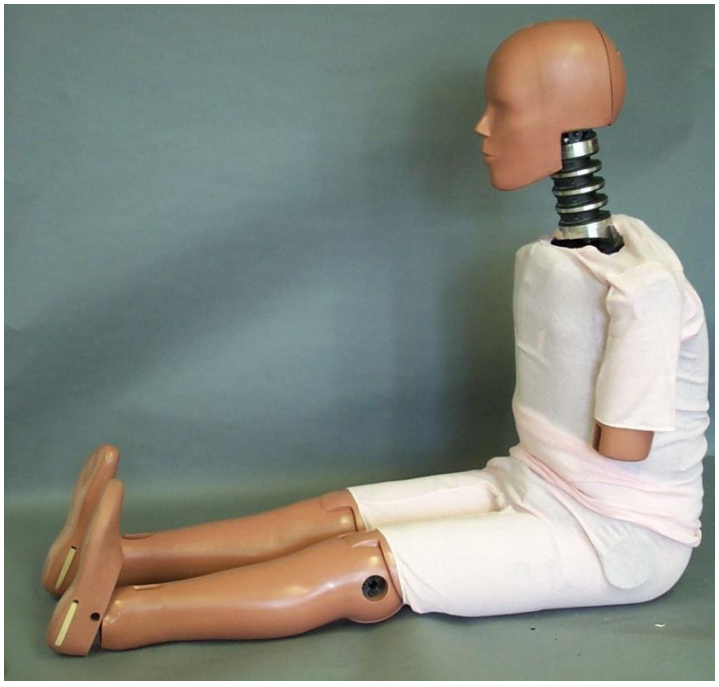

Figure 8. SID-IIs in clothing.

1.4 **Instrumentation Overview**

Figure 9 shows the locations of the load cells for the SID-IIs, while Table 2 lists all of the instrumentation available for the SID-IIs. The spine designations of T1, T4, and T12 are referenced to drawing SF-201, UMTRI Anthropometric Specifications for Small Female Dummy.

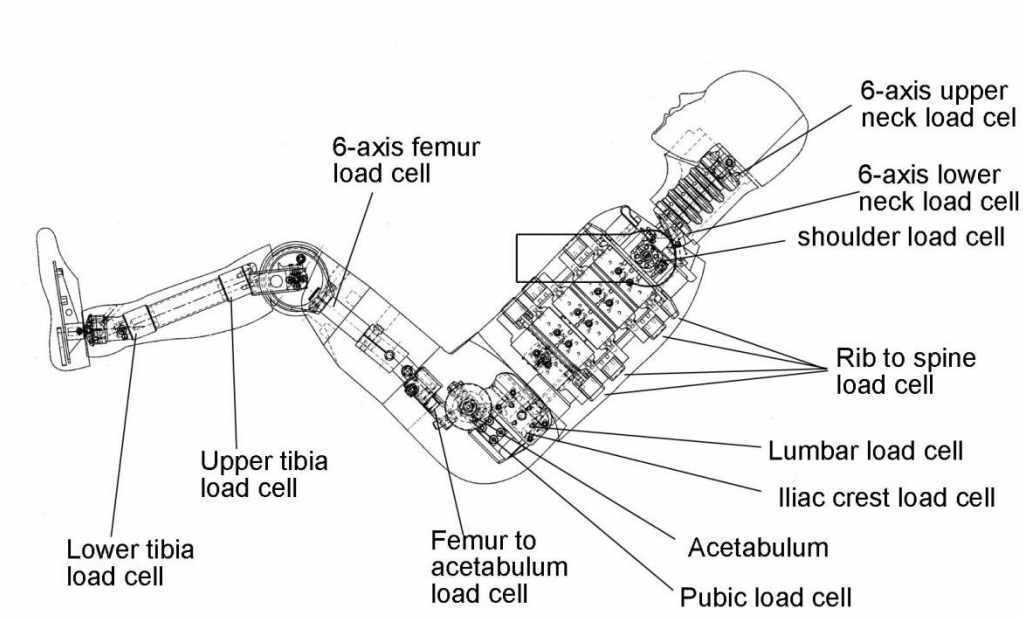

Figure 9. Instrumentation locations.

Table 2. Available SID-IIs instrumentation

	Instrument	Part Number	Number of Channels	Quantity	Comments
1	Head x, y, z accelerometers	IE-103	3	3	
2	Upper neck load cell	IF-205	6	1	700 ohm
		IF-206	6		120 ohm
3	Lower neck load cell	IF-255	6	1	350 ohm
		IF-209	6		120 ohm
4	Shoulder x, y, z accelerometers	IE-103	3	3	
5	Shoulder load cell	IF-344	3	1	350 ohm
		IF-343	3		120 ohm
6	Upper arm x, y, z accelerometers	IE-103	3	3	
7	Lower arm x, y, z accelerometers	IE-103	3	3	
8	T1 (top of spine box) x, y, z accelerometers	IE-103	3	3	
9	T4 (opposite thoracic rib #1) x, y, z accelerometers	IE-103	3	3	
10	Y accelerometers on opposite thoracic ribs 2 and 3 and abdominal rib 2	IE-103	3	3	
11	T12 (opposite abdominal rib 1) x, y, z accelerometers	IE-103	3	3	
12	Rib x, y, z accelerometers (3 thorax and 2 abdominal ribs)	IE-103	15	15	
13	Rib-to-spine load cell	IF-309	4	1	350 ohm
		IF-308	4		120 ohm
14	Rib linear potentiometer	IH-329	6	6	
15	Lumbar spine load cell	IF-414	6	1	350 ohm
		IF-408	6		120 ohm
16	Acetabulum load cell	IF-520	1	2	350 ohm
		IF-519	1		120 ohm
17	Pubic load cell	IF-529	1	1	350 ohm
		IF-521	1		120 ohm
18	Iliac crest load cell	IF-507	1	2	350 ohm
		IF-505	1		120 ohm
19	Pelvis x, y, z accelerometers	IE-103	3	3	
20	Upper femur load cell	IF-614	1	2	350 ohm
		IF-607	1		120 ohm
21	Lower femur load cell	IF-625	6	2	350 ohm
		IF-627	6		120 ohm
22	Upper tibia load cell	IF-820	4	2	350 ohm
		IF-830	4		120 ohm
23	Lower tibia load cell	IF-819	4	2	350 ohm
		IF-838	4		120 ohm
24	Knee Clevis load cell	IF-805	2	2	350 ohm
		IF-824	2		120 ohm

1.5 **Assembly Groups**

The SID-IIs dummy consists of the major assembly groups listed in Table 3 and shown in Figure 10. The head of the SID-IIs is similar to the standard 6-axis Hybrid III small female head assembly, but is modified to meet biomechanical corridors for left and right side impacts. The neck assembly is also similar to that of the Hybrid III small female, but was certified to meet biomechanical corridors for left and right lateral impacts. The dummy includes use of a neck shield. The shoulder/thorax/abdomen assembly consists of six ribs made of Vascomax® steel and dampening material to provide the required biomechanical response.

Table 3. SID-IIs assembly groups

Assembly Group	Part Number
Head	180-1000
Neck Neck shield	180-2000 180-2020
Upper Torso	180-3000
Lower Torso	180-4000
Arm, Near Arm, Right	180-6000-1 180-6000-2
Lower extremity, Left Lower extremity, Right	180-5000-1 180-5000-2

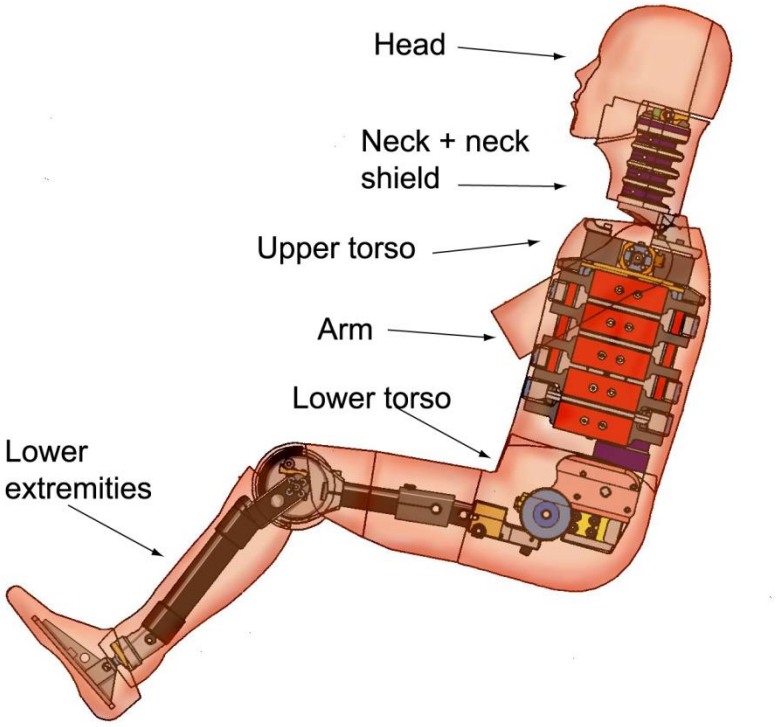

Figure 10. Assembly groups in SID-IIs.

2 Disassembly and Assembly Procedures

2.1 Initial Disassembly

2.1.1 Disassembly

To begin disassembly of the dummy, start by removing the chest jacket. Unzip the jacket at the back of the torso (Figure 11). Pull the jacket forward, letting the arm slip through the holes in the jacket.

Figure 11. Unfastening the chest jacket.

Remove the head-neck assembly from the upper torso by removing the 3/8-16 x 1 SHCS Nylok and clamping washer shown in Figure 12 that connect the upper and lower neck brackets.

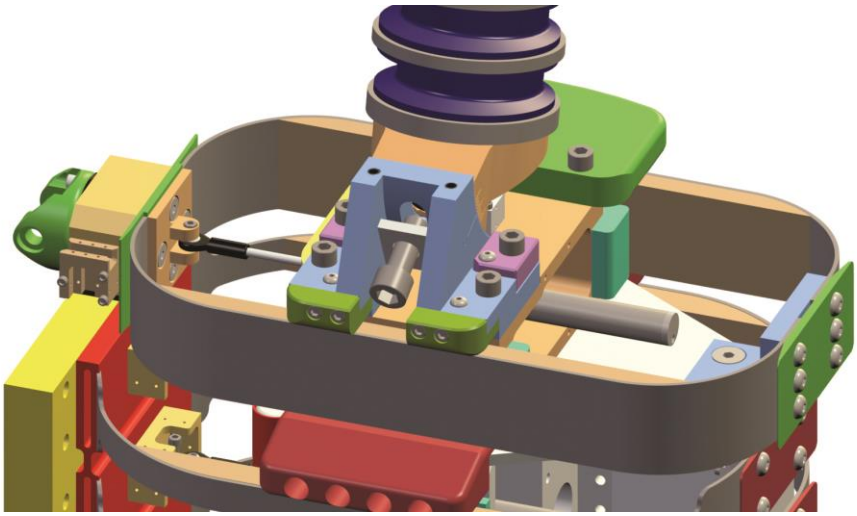

Figure 12. Removing the head-neck assembly from the upper torso.

The head-to-neck joint is shown in Figure 13. To remove the head from the neck, loosen the two #8-32 x 1/4 set screws (Item 11) that hold the pivot pin (Item 9), although they do not have to be removed completely (Figure 15).

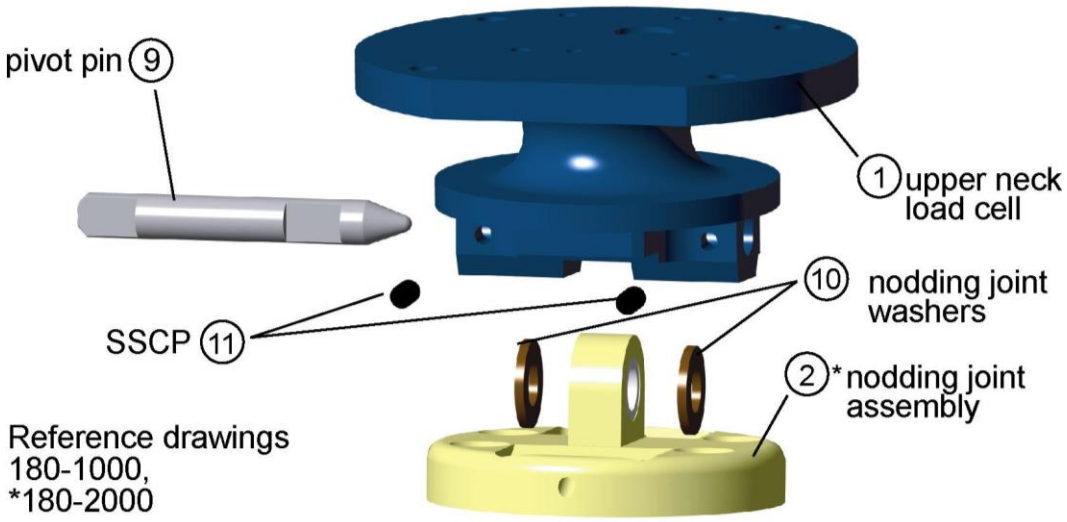

Figure 13. Components of head-to-neck joint.

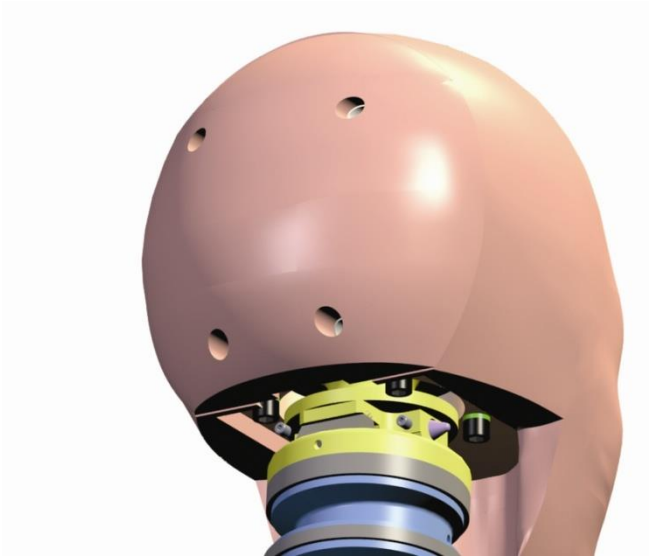

Figure 14. Loosening the neck pivot pin set screws.

The neck compression tool (185-0000) is used when separating the head and neck. To prepare the dummy for use with this tool, take off the skull cap by removing the four #10-24 x 1/2 SHCS that hold it in place (Figure 15). If the upper neck load cell is installed, disconnect the instrumentation cables.

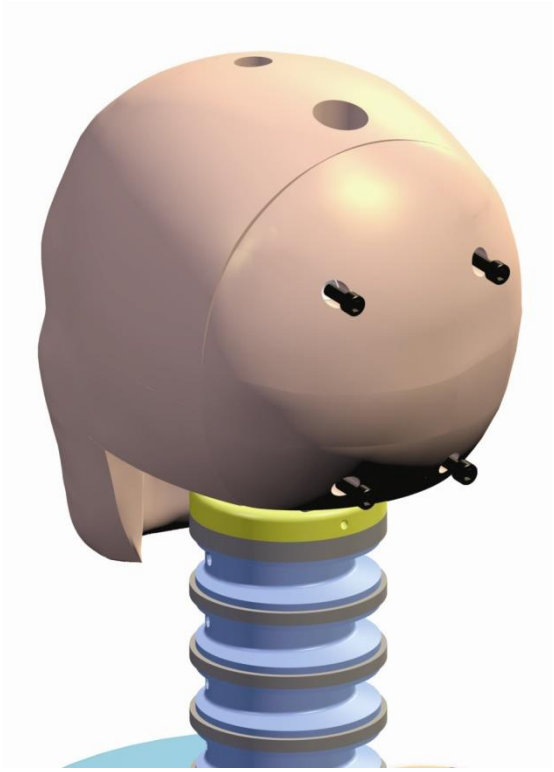

Figure 15. Removing the skull cap.

Attach the adaptor plate (TE-251-5F) for the nodding block compression tool to the back of the head using four #10-24 x 1/2 SHCS (Figure 16).

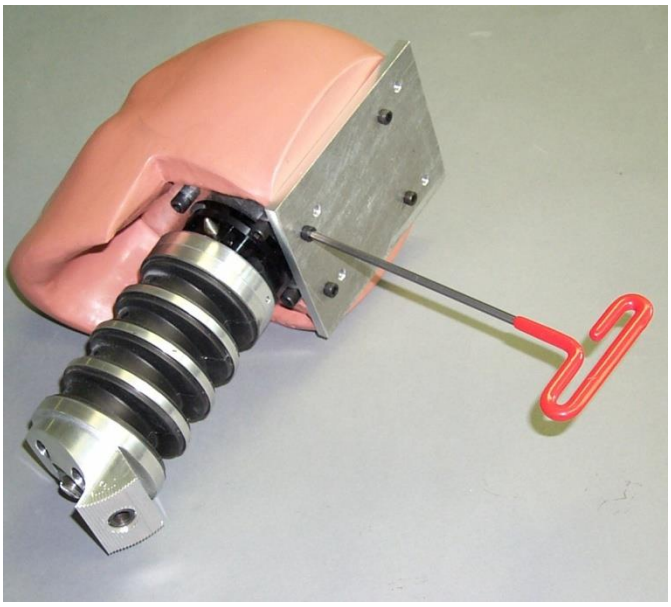

Figure 16. Attaching the adaptor plate of the nodding block compression tool.

Mount the neck compression bracket to the adaptor plate with two 1/4-20 x 1-3/8 screws. Adjust the knob so it contacts the lower end of the neck (Figure 17). Continue to apply pressure by turning the handle until the nodding blocks are compressed enough to relieve the load on the pivot pin. You can now slide the pivot pin out of the load cell or load cell replacement (Item 1), although a light tap with a rubber mallet may be necessary (Figure 18). If the pin cannot be removed easily, readjust the nodding block compression tool to apply more pressure.

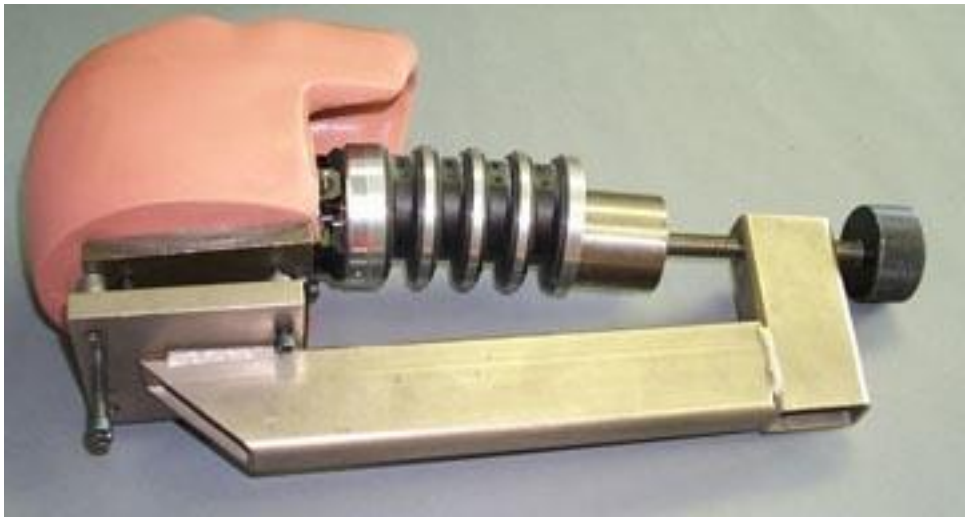

Figure 17. Using the nodding block compression tool.

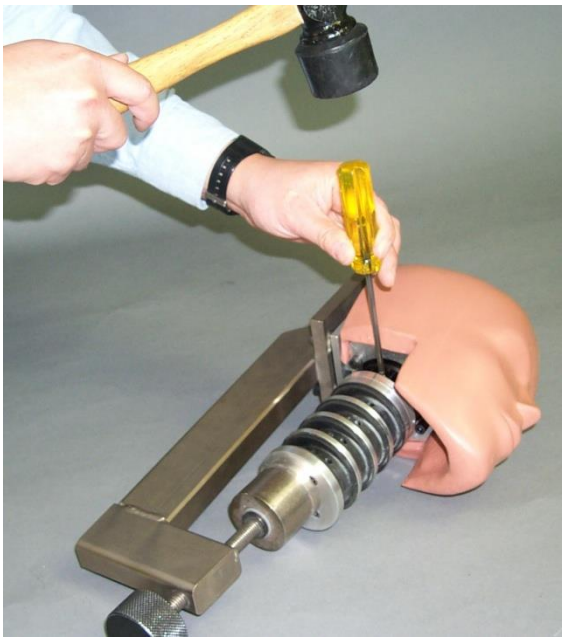

Figure 18. Removing the pivot pin.

After removing the pivot pin, remove the nodding block compression tool. The neck can now be pulled away from the head assembly. Two brass washers (Item 10) of the nodding joint (Item 2*) will fall out as the neck and head are separated. These washers are custom-sized for each head and neck assembly. Do not confuse these washers with those from other head-neck assemblies.

2.1.2 Instrumentation/Reassembly

If the brass washers need to be replaced, they must be trimmed by sanding to fit the particular head-neck joint being used. To trim the washers, rub them on coarse sandpaper and continually check the fit of the joint. Repeat the trimming until the nodding joint, upper neck load cell, and two washers have a snug fit when assembled.

The nodding block compression tool may be required to reattach the head to the neck. Referring to Figure 14, position the upper neck load cell (Item 1) over the nodding joint assembly (Item 2*), placing the brass washers (Item 10) in the joint as well. Insert the neck pivot pin (Item 9) into the neck load cell or its structural replacement. A rubber mallet may be used to lightly tap in the pin. Tighten the set screws (Item 11) that hold the pivot pin.

Next, install the T1 triaxial accelerometers as shown in Figure 19. When possible, route the cable through the ribs on the non-impact side and attach the cable so it is strain relieved.

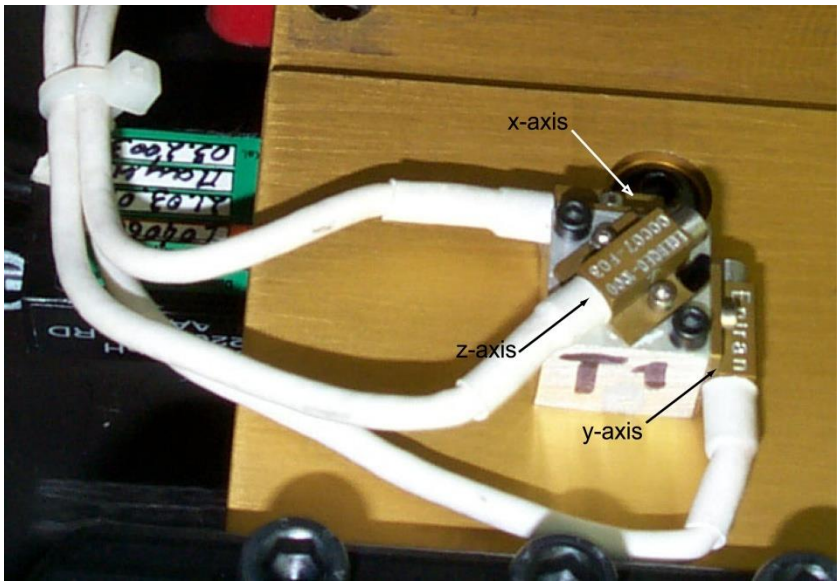

Figure 19. Installing the T1 triaxial accelerometers.

Once the head and neck are connected, tip the dummy on its side as shown in Figure 20 to allow easier installation of the lower neck load cell. If not already done, route the cables for the lower neck load cell (if not detachable) down through the ribcage on the non-struck side. Then attach the load cell to the bottom of the neck with four #10-24 X 5/8 SHCS. When the lower neck load cell is used, the shoulder rib stops are not used. In addition, different screws (two 1/4-20 x 2-1/4 SHCS) [9000376] in the rear and two ¼-20 x 5/8 SHCS [9000144] in the front included with the load cell are used to secure the lower neck load cell to the thorax.

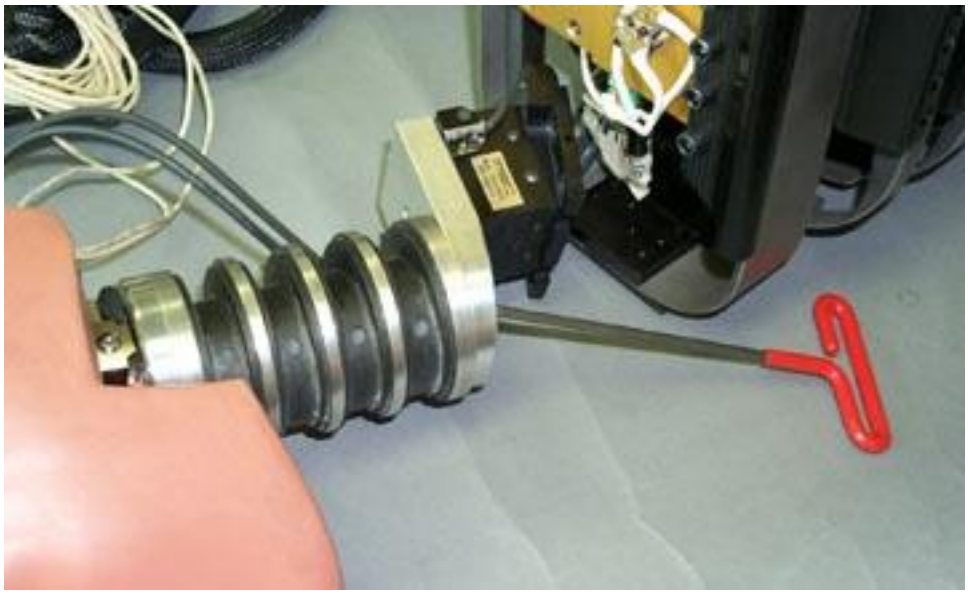

Figure 20. Installation of lower neck load cell.

If the lower neck load cell is not used, attach the upper part of the lower neck bracket to the neck using the four #10-24 X 5/8 SHCS. Then attach the neck to the dummy using the clamping washer and 3/8-16 x 1 SHCS Nylok. Make sure the curve of the clamping washer mates with the radius on the bottom of the lower neck bracket.

Make sure there is enough slack in the wires from the head and neck so the wires are not pulled when the head and neck are tipped fully forward (Figure 21).

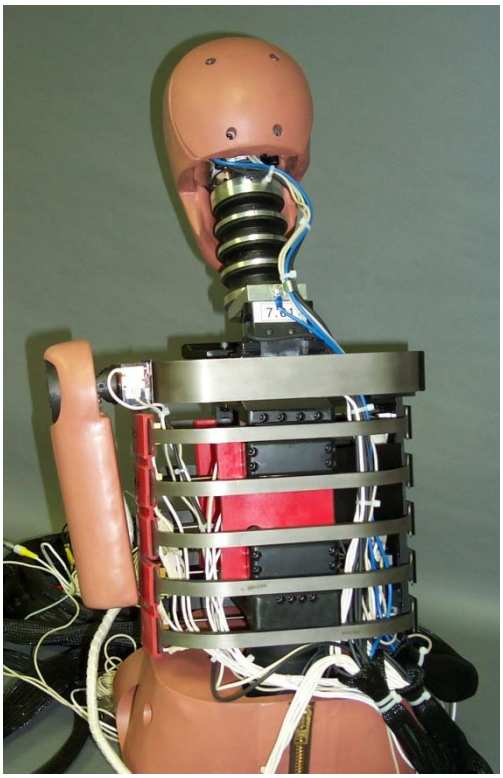

Figure 21. Rear view of dummy wiring configuration.

When possible, route the cables to the non-impact side. Using cable ties, gather all of the wiring from the dummy near the lumbar spine (Figure 22).

Figure 22. Wiring from upper and lower halves of the dummy is bundled together.

Place the dummy's arms through the holes in the chest jacket, and pull the jacket around the dummy's torso. Zip the jacket, encasing the dummy wiring inside (Figure 23).

Figure 23. Reinstallation of the dummy jacket with wiring inside.

2.2 **Head**

2.2.1 Parts List

Table 4. Parts list for head assembly (180-1000)

Item	Quantity	Part Number	Description
1	1	180-1003	Neck Transducer Structural Replacement
2	1	180-1001	Skull, Machining, 6 Axis
3	1	180-1004	Skull Cap, Machined
4	1	180-1002	Head skin
5	1	180-1006	Skin, Skull Cap
6	4	9000264	Screw, SHCS 1/4-28 x 7/8
7	4	9000624	Screw, SHCS #10-24 x ½
8	4	9000677	Stripper bolt shim washer
9	1	180-1005	Pivot Pin, Neck
10	2	180-1007	Nodding Joint Washer
11	2	9000452	Screw, SSCP #8-32 x ¼
12	1	180-0212	Mounting Block (Endevco 7264-2000) (Ref)
13	1	SA572-S80	Triaxial Mounting Block (Endevco 7264-2000) (Ref)
14	2	9000531	Screw, SHCS #2-56 x 5/8
15	4	9002652	Screw, SHCS #10-24 x 7/16 (Ref)
16	3	SA572-S4	Accelerometer, Piezoresistive (Ref)
17	6	9000152	Screw, SHCS #0-80 x 1/8 (Ref)

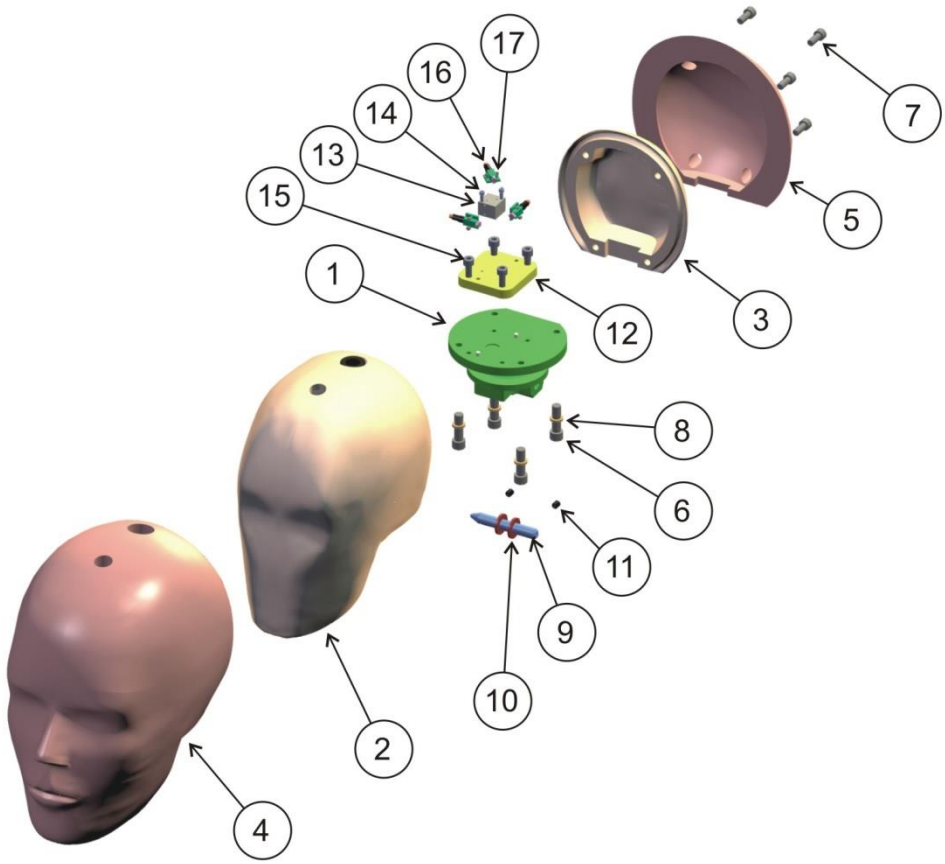

Figure 24. Exploded Head Assembly

2.2.2 Disassembly

If not already removed for use with the neck compression tool, take off the skull cap (Items 3 and 5) by removing the four #10-24 x 1/2 SHCS (Item 7) that hold it in place (Figure 25). If the upper neck load cell is installed, disconnect the instrumentation cables.

Figure 25. Skull cap removal.

The accelerometer mount (Item 12) is attached to the skull with four #10-32 x 5/8 SHCS (Item 15). These can be accessed through the hole in the top of the head using hex wrenches or through the back of the head using a ratchet wrench with a hex bit. After removing the screws, take the accelerometer mount out through the back of the head.

Figure 26. Accessing the accelerometer mount screws

To take out the upper neck load cell, or its structural replacement (Item 1), remove the four 1/4-28 x 7/8 SHCS (Item 6) and washers (Item 8); which connect it to the head and are accessed from the bottom of the skull (Figure 27). Then, reach in through the back of the skull and take out the upper neck load cell (Figure 28).

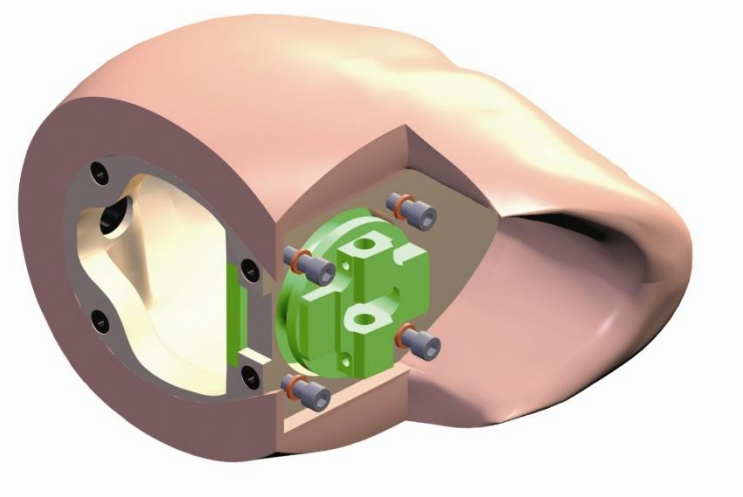

Figure 27. Four SHCS and washers connect the upper neck load cell to the head.

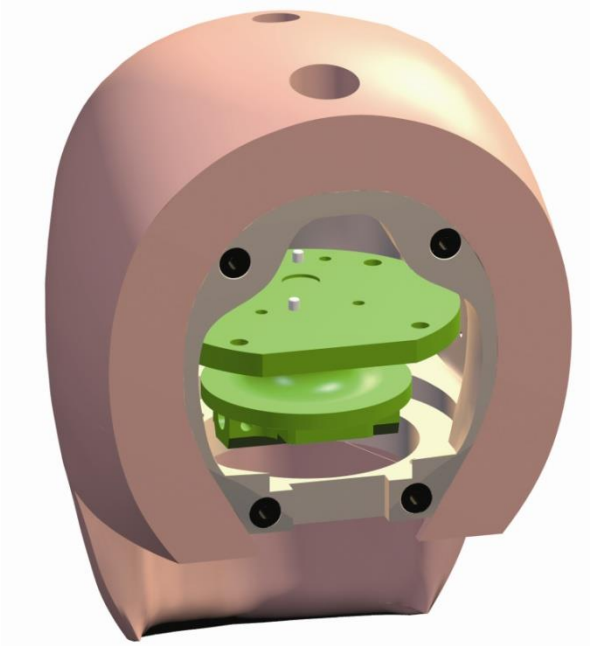

Figure 28. Removing the upper neck load cell through the back of the head.

Remove the head skin (Item 4) by lifting the skin away from the skull casting (Item 2) at the back of the skull, and peeling the flesh from the assembly (Figure 29).

Figure 29. Removing the head skin.

2.2.3 Inspection

- Check the head skin for tears and cracks. Replace head skins that have damage to either lateral area, because the damage or attempts to repair it may affect test results. If damage is located in areas other than the lateral regions, repair the head skin as described in section 4.1.
- Check the skull casting for any dents, cracks, or other damage. Replace if damaged.

2.2.4 Instrumentation/Reassembly

Place the head skin back on the skull casting. Insert the chin into the skin first and pull the flesh over the skull. Make sure the skin fits snugly, especially in the lateral regions.

Place the upper neck load cell in the head through the back of the skull. The load cell is oriented so the flat edge is aligned with the back opening of the head and the cable ports are closest to the back head opening. Attach it using the four 1/4-28 x 7/8 SHCS (Item 6) and washers (Item 8).

Install three triaxial accelerometers (IE-103, Item 16) to the triaxial mounting block (Item 13) using two #0-80 x 1/8 SHCS (Item 17) for each accelerometer. Attach the triaxial mounting block to the head accelerometer mounting plate (Item 12) using two #2-56 x 5/8 SHCS (Item 14). The configuration of the assembled head instrumentation is shown in Figure 30. Note which serial numbers correspond to the marked axes.

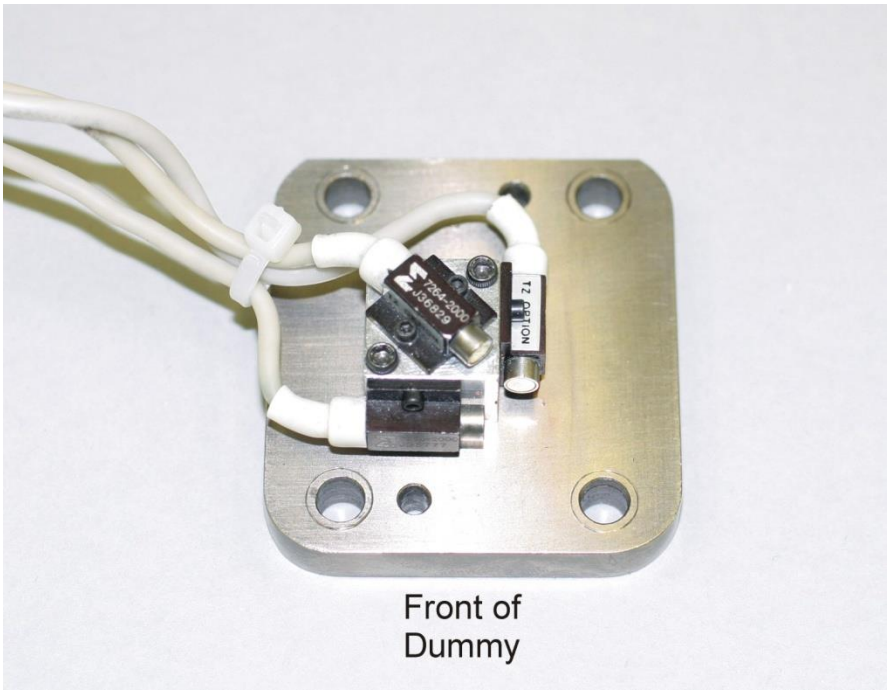

Figure 30. Orientation of head accelerometers.

Attach the head accelerometer mount using the four #10-32 x 5/8 SHCS (Item 15). (The accelerometer mount cannot be installed on the upper neck load cell outside the head, as the combination may not fit in the opening of the back of the head.)

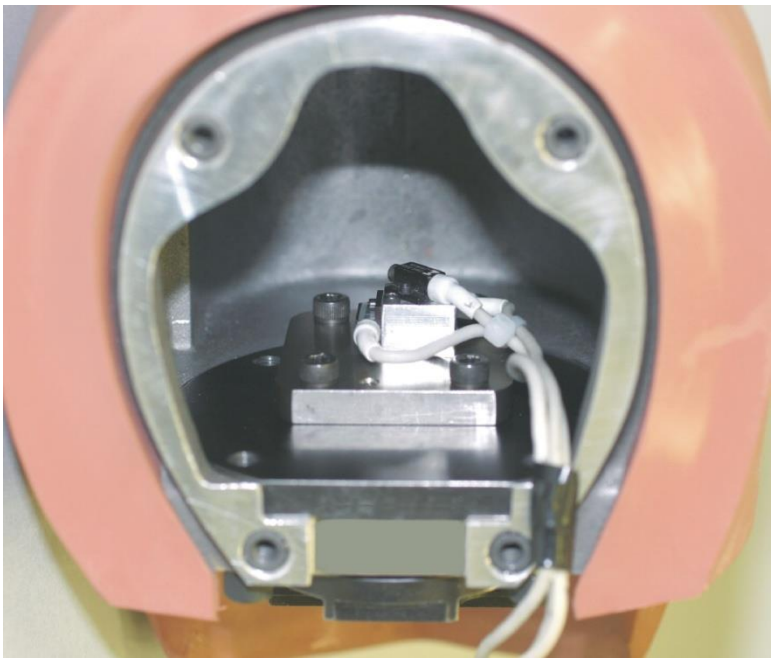

Figure 31. Head accelerometers installed.

If an upper neck load cell is installed, tie together the neck load cell cables and the head accelerometer cables using a cable tie. Position the group of cables so they pass through the recess located at the middle bottom of the skull. Attach the skull cap using the four #10-24 x 1/2 SHCS (Item 7), making sure they do not pinch the instrumentation cables.

2.3 Neck

2.3.1 Parts List

Table 5. Parts list for neck assembly (180-2000)

Item	Quantity	Part Number	Description
1	2	180-2009	Nodding Block, Neck
2	1	180-2010	Nodding Joint Assembly
3	4	9000566	Screw, FHCS #10-24 X 5/8
4	1	180-2004	Neck Bushing, Upper
5	1	180-2001	Molded Neck Test/Certified
6	1	180-2013	Neck Cable
7	4	9000710	Washer, 7/32 OD X 3/8 ID X 1/32
8	4	9000224	Screw, SHCS #10-24 X 5/8
9	1	180-2005	Neck Bushing, Lower
10	1	9001260	Washer 1.06 OD X .53 ID X .06
11	1	9000018	Hex Jam Nut ½-20
12	1	180-2006	Upper part of Lower Neck Bracket (Ref)

2.3.2 Disassembly

Refer to Figure 32, which shows an exploded view of the neck components with item numbers corresponding to reference drawing 180-2000 indicated. Part of the lower neck bracket is included with the thorax on reference drawing 180-3000. Begin disassembly of the neck by removing the four #10-24 x 5/8 FHCS (Item 3) from the top of the nodding joint assembly (Item 2). Remove the nodding blocks (Item 1) by just pulling them out of the nodding joint assembly.

Remove the 1/2-20 jam nut (Item 11) from the lower end of the neck cable (Item 6). Remove the lower neck hat-shaped Delrin® bushing (Item 9) from the base of the neck (Item 5). Pull the neck cable (Item 6) out of the top of the neck, and take the upper Delrin® neck cable bushing (Item 4) out of the inset for the ball end of the cable.

Detach the neck bracket (Item 12) from the neck (Item 5) by removing four #10-24 x 5/8 SHCS (Item 8) and washers (Item 7).

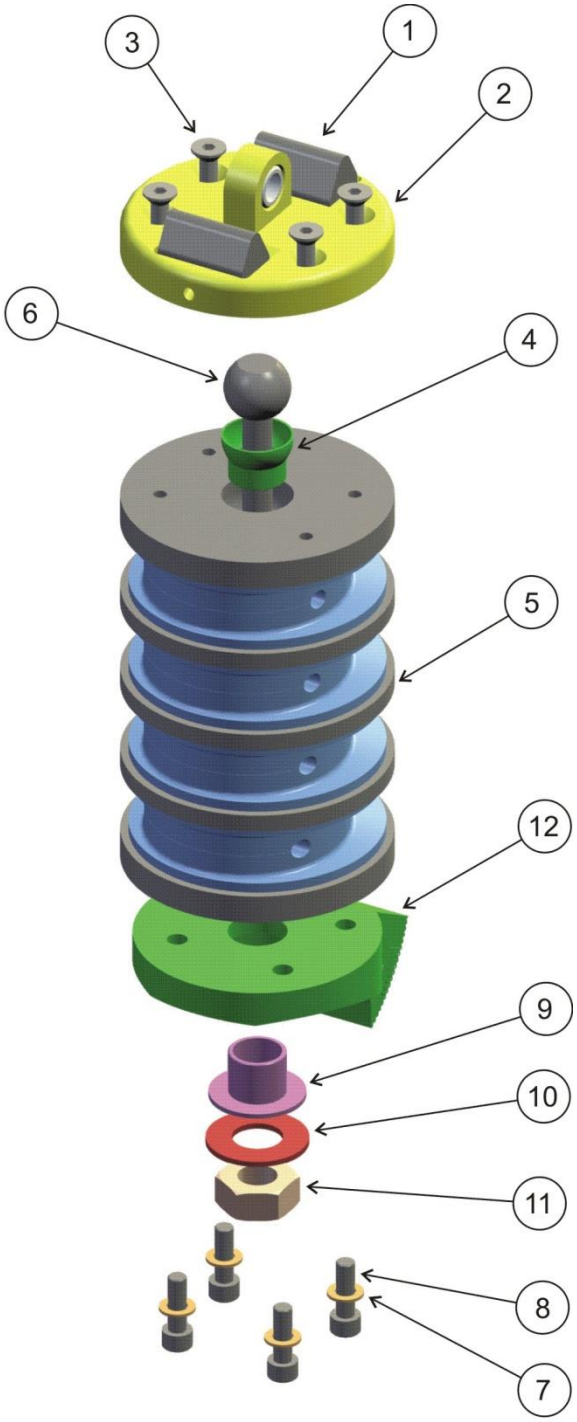

Figure 32. Exploded Neck Assembly

2.3.3 Inspection

- Inspect the molded component of the neck for deformation, tears, or breaks in the rubber, or any separation of the rubber from the metal plates. Replace the neck if damaged.
- Inspect the neck cable for any bulges, separated strands, or changes in diameter. Replace it if there is visible damage. If you cannot achieve the correct torque on the cable, replace it.
- Examine the nodding blocks. Replace them if they appear deformed. Check that the hardness of the nodding blocks frequently; the specification is 80-90 Shore “A” durometer.

2.3.4 Instrumentation/Reassembly

Referring to Figure 32, attach the neck bracket (Item 11) to the neck with four flat washers (Item 7) and four #10-24 x 5/8 SHCS (Item 8). Next, make sure the metal inset at the top of the neck is cleared of any scraps of rubber. Place the upper neck bushing (Item 4) into the top end of the neck (Item 5) and slide the neck cable (Item 6) through the neck, making sure the ball end of the cable is seated within the inset at the upper end of the neck. Insert the lower neck bushing (Item 9) into the bottom of the neck around the lower end of the cable. Attach the hex nut (Item 10) to the end of the cable. Place a screwdriver into the slotted end of the neck cable and torque the neck cable nut to 1.2 +/- 0.11 N-m (11 +/- 1 in-lb).

Attach the nodding joint assembly (Item 2) to the upper end of the neck using the four #10-24 x 5/8 FHCS (Item 3). Install the nodding blocks (Item 1) so they are oriented properly (Figure 33). They must be installed so the 90 degree angle is toward the base of the head and the 60 degree angle is facing the nodding joint. The front and back nodding blocks are the same.

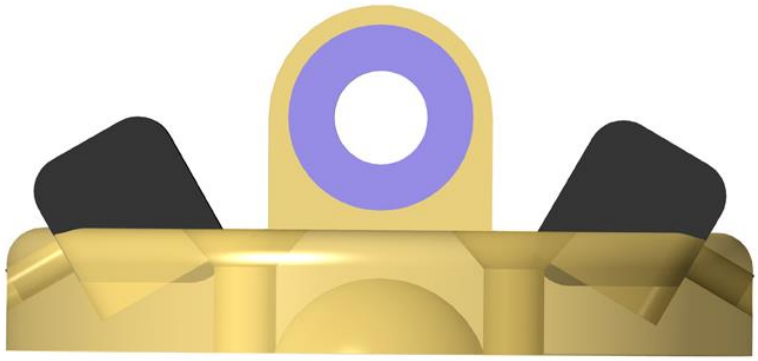

Figure 33. Nodding block orientation.

2.4 Upper Torso

2.4.1 Parts List

Table 6. Parts list for thorax assembly (180-3000)

Item	Quantity	Part No.	Description
1	1	180-3140	WELDMENT, SPINE BOX
2	2	180-3628	LOWER RIB PAD-UPPER TORSO
3	2	180-3614	UPPER RIB STOP-UPPER TORSO
4	4	180-3613	MIDDLE RIB STOP-UPPER TORSO
5	3	180-3362	THORAX RIB & DAMPING MATERIAL ASSEMBLY
6	2	180-3616	LOWER RIB STOP-UPPER TORSO
7	2	180-3368	ABDOMEN RIB & DAMPING MATERIAL ASSEMBLY-UPPER TORSO
8	5	180-3004	RIB STIFFENER LOWER
9	1	180-3360	UPPER BIB-RIBS
10	1	180-3361	LOWER BIB-RIBS
11	1	180-3625	NECK MOUNT BLOCK ASSEMBLY
12	1	180-3815	LOWER HALF NECK ASSEMBLY, LOADCELL REPLACEMENT
13	1	180-3501	STERNUM
14	1	180-3352	RIB MOUNT, SHOULDER
15	1	180-3355	SHOULDER RIB & DAMPING MATERIAL ASSEMBLY, TESTED/CERT.
16	1	180-3003	RIB STIFFENER SHOULDER
17	1	180-3326	LINEAR POT HOOK SHOULDER RIB
18	1	180-3325	SHOULDER RIB STIFFENER
19	1	180-3330	SHOULDER LOADCELL SIMULATOR, ASSEMBLY
20	1	180-3329	WASHER-SHOULDER
21	1	180-3327	SHOULDER YOKE ASSEMBLY
22	1	180-3011	ACCEL MOUNT SHOULDER LOAD CELL
23	1	9000067	SCREW, SHSS 3/8 X 3/8
24	2	9001370	SCREW, SHCS 1/4-20 X 2-3/4
25	4	9000133	SCREW, SHCS 1/4-20 X 1
26	2	9000447	SCREW, FHCS 1/4-20 X 3/4
27	26	9000026	SCREW, BHCS #10-32 X 1/2
28	32	9000151	SCREW, SHCS #10-32 X 3/4
29	10	9000538	SCREW, BHCS #10-32 X 3/8
30	14	9000137	SCREW, SHCS #10-32 X 5/8
31	4	9000725	SCREW, FHCS #10-32 X 5/8
32	1	9000377	SCREW, SHCS #4-40 X 1/2
33	5	180-3310	LINEAR POT HOOK ASSY-LOWER RIBS, ENHANCED
34	15	9000531	SCREW, SHCS #2-56 X 5/8
35	5	9000654	SCREW, SHCS #4-40 X 7/16
36	10	180-3240	LINEAR POT BEARING PIVOT SCREW, MODIFIED
37	10	9000701	WASHER, #10 LOCK SPRING
38	1	180-3451	THORAX PAD, SID-IIs
39	1	180-3452	ABDOMINAL PAD, SID-IIs
40	1	180-3450	CHEST JACKET SIDIIS (NOT SHOWN)
41	4	180-3210	LINEAR POT FRAME ASS'Y

42	10	6000004	CABLE TIE, 7.4 INCH (NOT SHOWN)
43	1	180-3220-1	RIB STOP ASSEMBLY, A
44	1	180-3220-2	RIB STOP ASSEMBLY, B
45	1	180-3369	UPPER SHOULDER RIB STOP
46	1	180-3370	LOWER SHOULDER RIB STOP
47	4	9000272	SCREW, FHCS #4-40 X 5/8

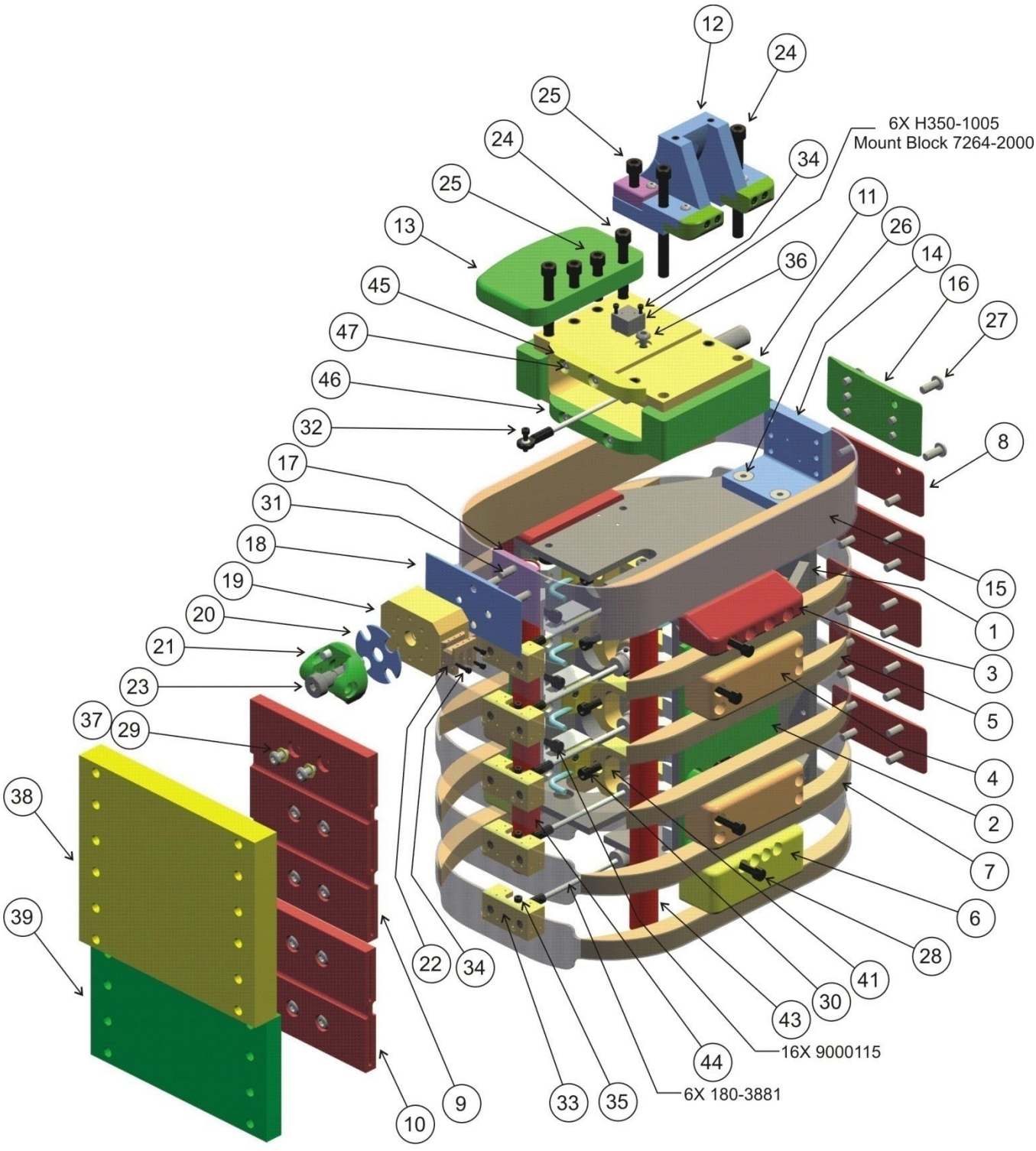

Figure 34. Exploded Upper Torso Assembly

2.4.2 Disassembly

Start disassembly of the upper torso by removing the lower half neck assembly (Item 12) from the upper torso. First remove the two 1/4-20 x 2-3/4 SHCS (Item 24) from the rear side of the bracket (Figure 12), and then the two 1/4-20 x 1 SHCS (Item 25) from the front side of the bracket. The lower half neck assembly can now be taken off the upper torso.

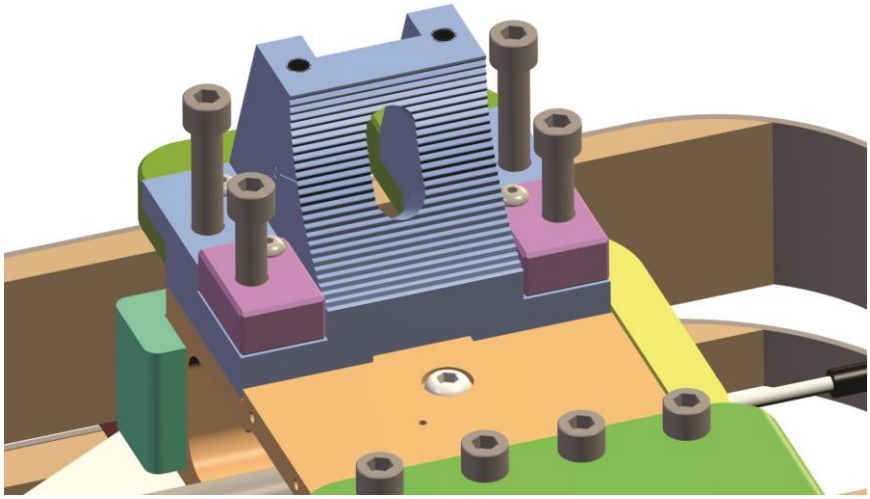

Figure 35. Removing the lower half neck assembly from the upper torso.

As shown in Figure 35, begin removal of the potentiometer assembly from the linear pot hook (Item 17) by loosening the #4-40 x 7/16 SHCS (Item 35) that holds the shaft of the potentiometer to the linear pot hook.

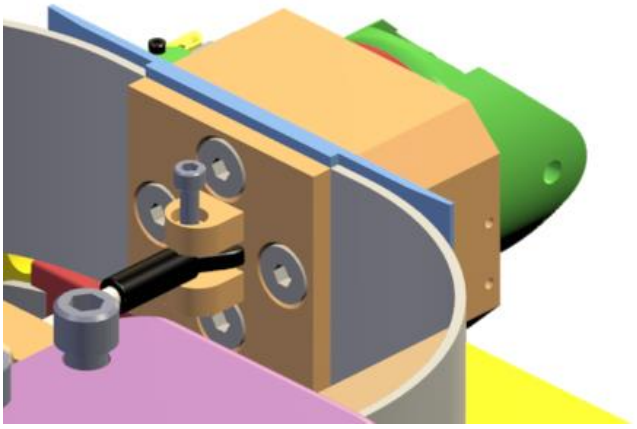

Figure 36. Removing the potentiometer assembly.

Figure 36 shows the location of the two 1/4-20 x 1 SHCS (Item 25) that attach the neck mounting block assembly (Item 11), sternum (Item 13), and potentiometer assembly (Item 43) to the upper torso. The neck mounting block assembly contains urethane shoulder rib pads on the front and back sides that are glued on and should not be removed.

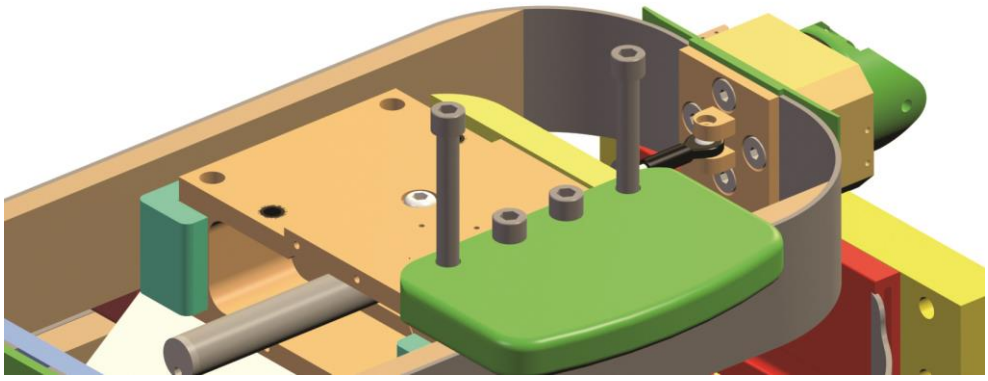

Figure 37. Removing the neck mounting block assembly.

As shown in Figure 37, detach the sternum from the neck mounting block assembly by removing the two ¼-20 x 2-3/4 SHCS (Item 24) that hold it in place.

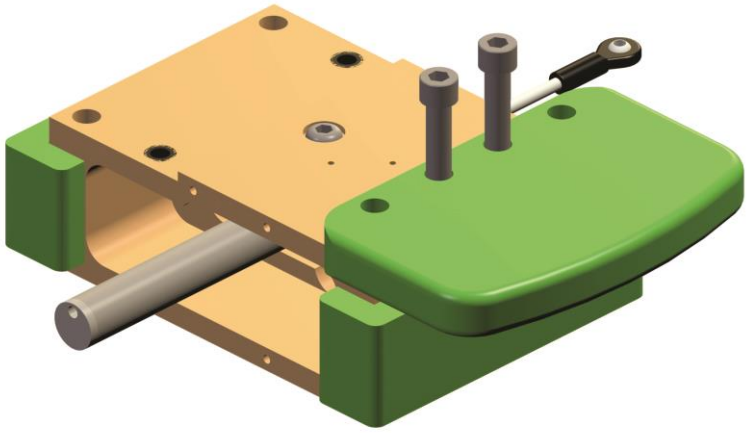

Figure 38. Detaching the clavicle.

Two modified BHCS (Item 36) connect the shoulder rib potentiometer to the neck mounting block assembly. As shown in Figure 39, one is accessed from the top, while the other is accessed from the bottom. Once the modified BHCS are removed, you can slide the potentiometer out from the assembly.

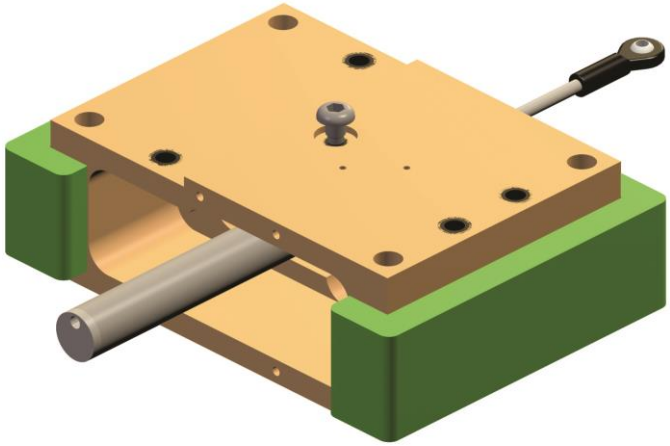

Figure 39. BHCS attach the shoulder rib potentiometer to the neck mounting block assembly.

The rib stiffener shoulder (Item 16) is attached to the upper torso with six #10-32 x 1/2 BHCS (Item 27) as shown in Figure 40. When these screws are removed, the rib mount (Item 14) will be loosened. The shoulder rib stiffener is thicker and wider than the other five rib stiffeners.

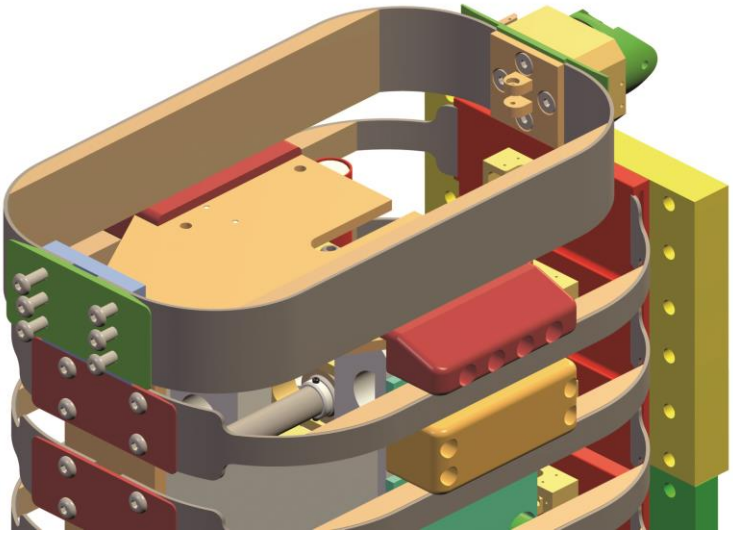

Figure 40. Removing the six BHCS that attach the rib stiffener to the upper torso.

The remaining components attached to the shoulder rib can be disassembled by removing the four #10-32 x 5/8 FHCS (Item 31) that hold them in place (Figure 41). The linear pot hook (Item 17), shoulder rib stiffener (Item 18), and assembled shoulder yoke/load cell (Item 21) will be free to remove.

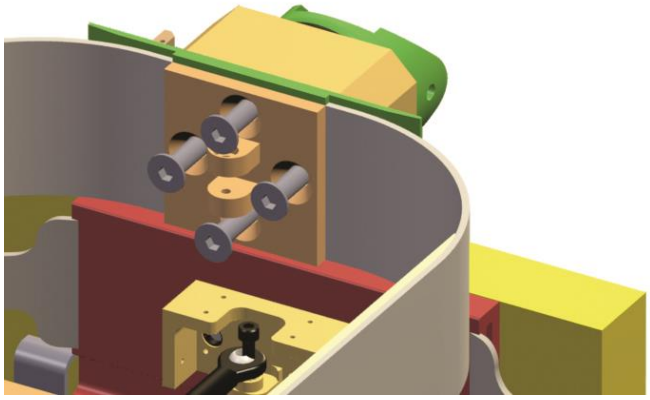

Figure 41. Removing components attached to the shoulder rib on the impact side.

Next, disassemble the load cell and shoulder yoke by removing the 3/8 x 3/8 SHSS (Item 23) from the shoulder yoke assembly (Item 21) (Figure 42). A washer (Item 20) located between the load cell and the yoke will fall out when the SHSS is removed.

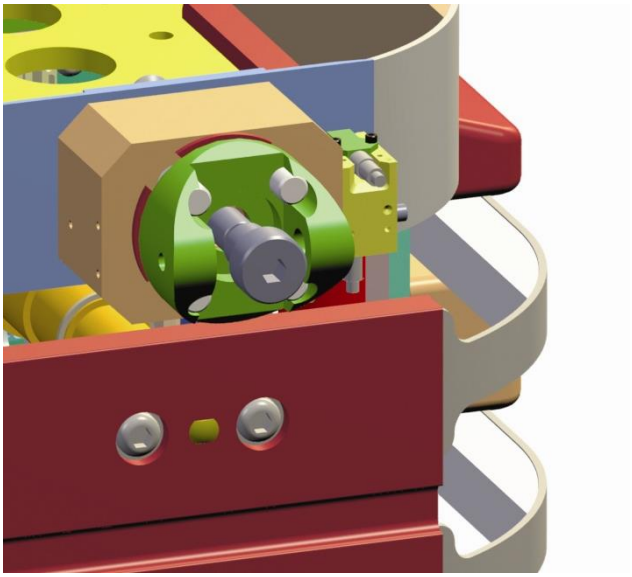

Figure 42. Separating the shoulder yoke and load cell.

As shown in Figure 43, the shoulder load cell accelerometer mount (Item 22) is removed by taking out the three #2-56 x 5/8 SHCS (Item 34) used to secure the mount.

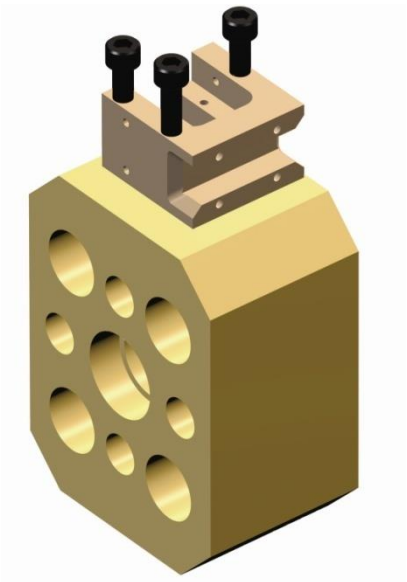

Figure 43. Removing the shoulder load cell accelerometer mount.

The shoulder rib mount (Item 14) is held in position by two 1/4-20 x 3/4 FHCS (Item 26), as shown in Figure 44.

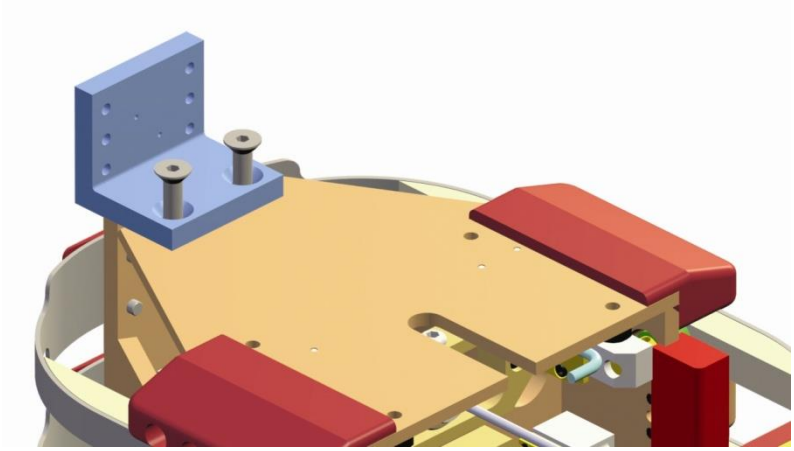

Figure 44. Removing the shoulder rib mount.

Two foam pads (Items 38 and 39) are mounted to the impact side of the ribs (Figure 45 & 46) with cable tie wraps (Item 42). Unhook the cable tie wraps and remove the pads.

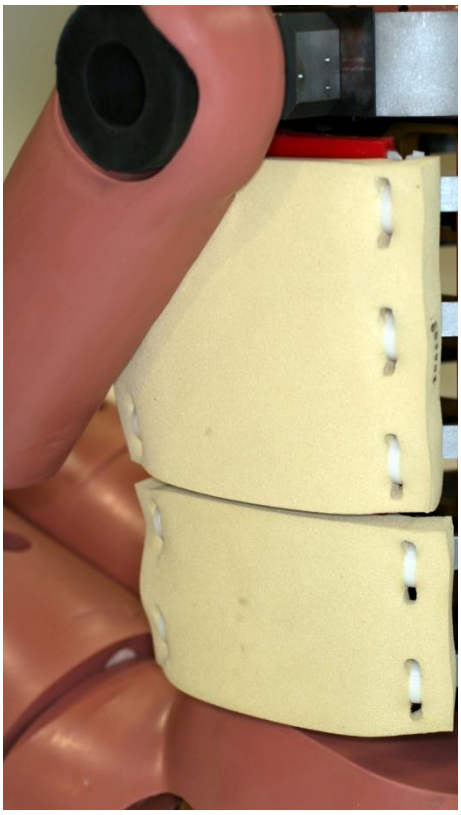

Figure 45. Position of foam pads.

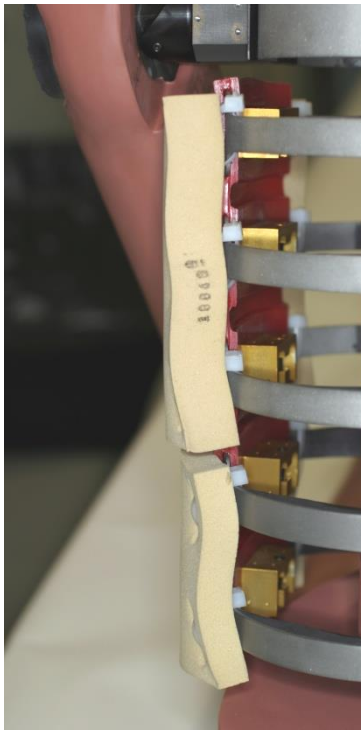

Figure 46. Cable Ties holding foam pads in place.

Before removing the ribs, take out the two #10-32 x 3/8 BHCS (Item 29) and washers (Item 37) that hold each potentiometer hook (Item 33) in place (Figure 47).

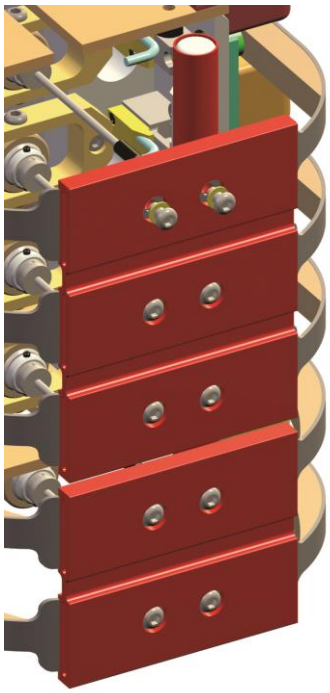

Figure 47. Detaching potentiometer hooks from ribs.

As shown in Figure 48, each thoracic rib (Item 5) and abdomen rib (Item 7) is held in place by four #10-32 x 1/2 BHCS (Item 27). After the ribs are unscrewed, they can be carefully pulled from the spine box. The ribs cannot be disassembled from the urethane pads (Items 9 and 10) that connect them on the struck side. The rib stiffeners will also now be free to remove.

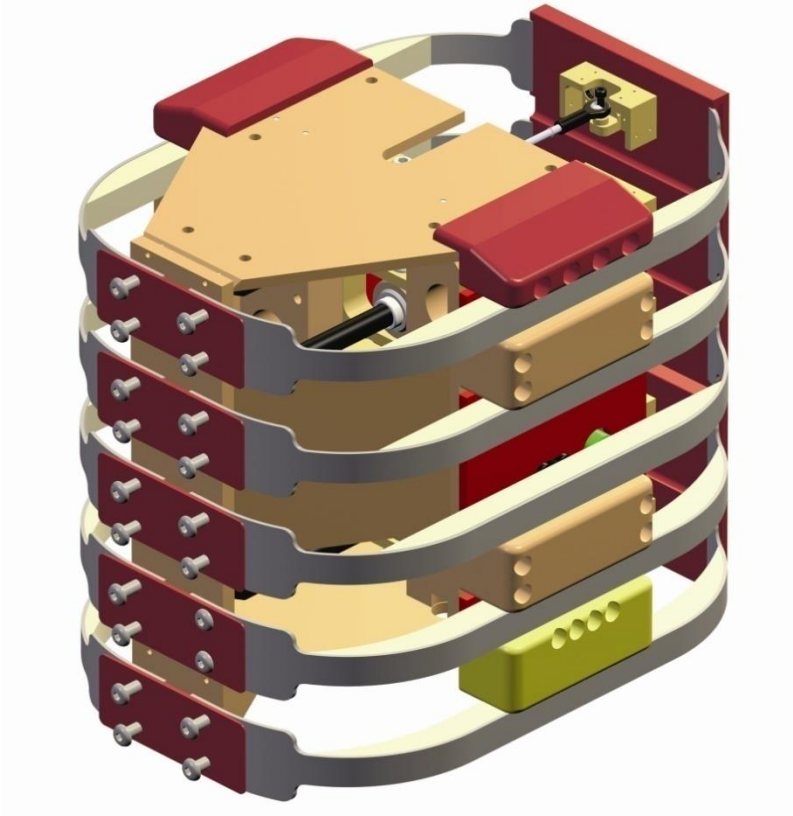

Figure 48. Removal of BHCS that hold thoracic ribs in place.

The chest deflection assemblies are disassembled next. As shown in Figure 49, remove the linear pot frame assembly (Item 41) from the upper torso by removing the two #10-32 x 5/8 SHCS (Item 30) that hold each one in position. The entire potentiometer assembly can now be removed from the spine box. Repeat for the remaining deflection assemblies.

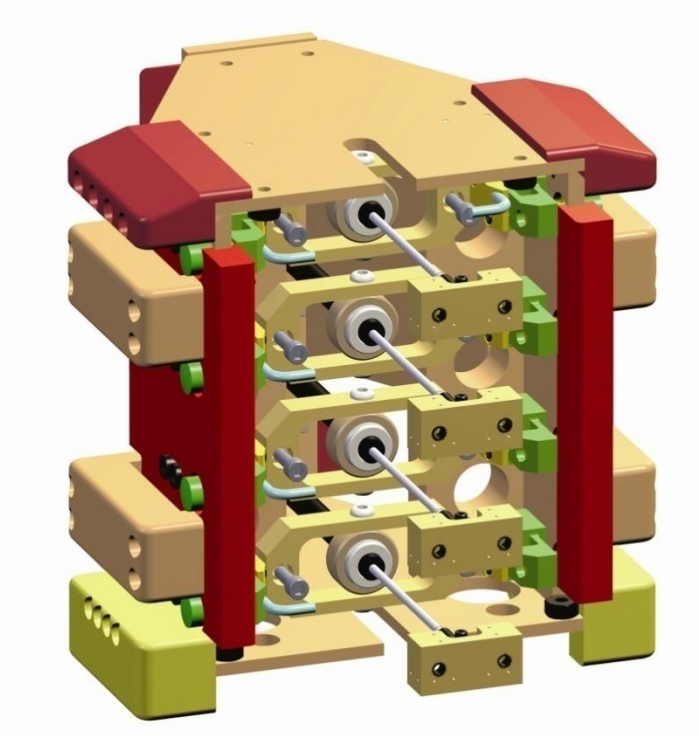

Figure 49. Removing the chest deflection assemblies.

The chest deflection assembly can be further disassembled as shown in Figure 50. Item numbers refer to those marked in this figure and on reference drawing 180-3858. Remove the two modified #10-32 BHCS (Item 2) that hold the potentiometer assembly (Item 1) in place and allow the assembly to pivot. The potentiometer can now be removed from the frame. Detach the potentiometer hook (Item 4) by removing the #4-40 x 5/8 SHCS (Item 5).

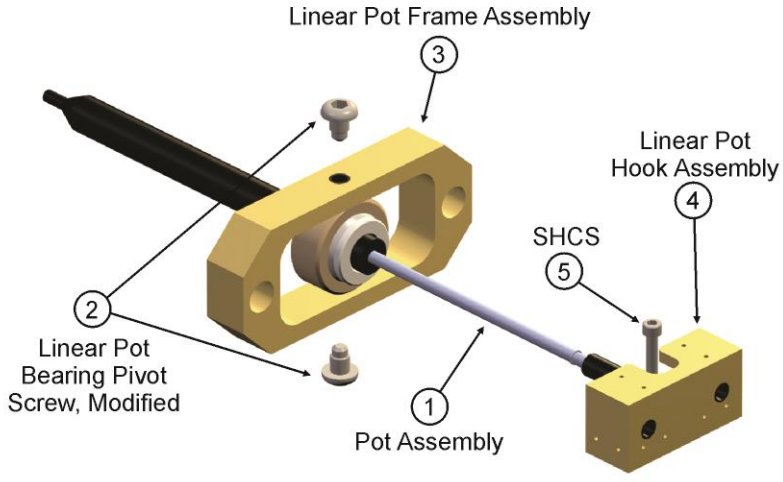

Figure 50. Disassembly of the chest deflection assembly.

Figure 51 shows front view of four ribs stops (Items 3, 4, and 6) located on the front and rear of the upper torso. The screws that attach the rib stops to the spine box also hold in place a red urethane rib pad (Item 2). Each rib stop assembly is attached to the upper torso with four #10-32 x 3/4 SHCS (Item 28). After these are removed, the urethane rib pad will be free for removal. Repeat for the rib stops and pad on the back of the dummy.

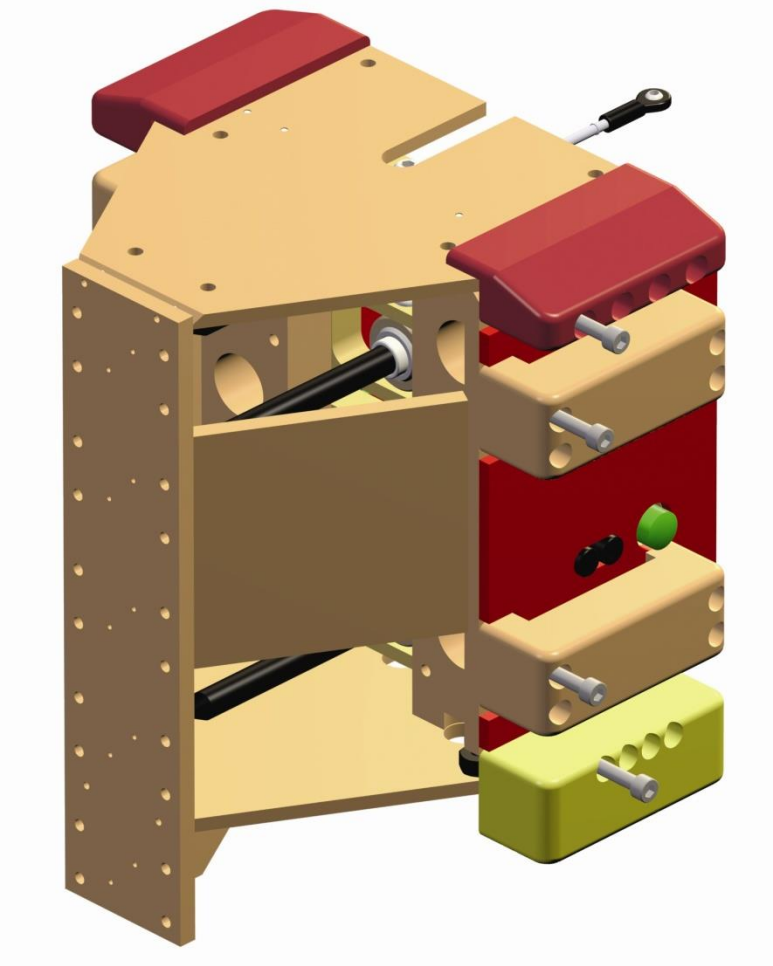

Figure 51. Locations of the front rib pads and stops (same arrangement in rear is not shown.)

Finally, separate the spine box from the lower torso. To do this, remove two 1/4-20 x 5/8 SHCS in the back and two from the front that connect the lumbar mounting plate to the spine box using a ratchet or hex wrench (Figure 52). The spine box will then lift off the lower torso.

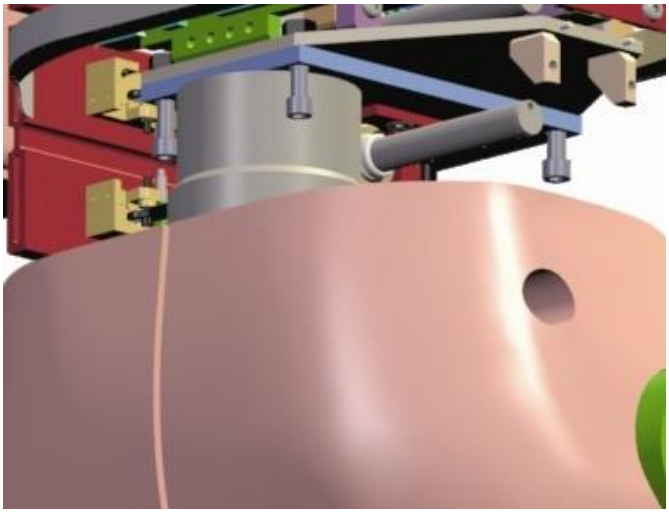

Figure 52. Separating upper and lower torso by removing four 1/4-20 x 5/8 SHCS.

2.4.3 Inspection

- Check the ribs for damage. If any significant damage is seen, replace the ribs.
- Check the rib stops for damage and replace if necessary. Make sure the stops do not interfere with the chest deflection transducer assembly.
- Check the attachment of the urethane shoulder rib pads to the mounting block. If they are loose, detach them and glue them back into position with Loctite.
- Make sure the potentiometers move freely.

2.4.4 Instrumentation/Reassembly

First, position the red urethane rib pad over the front of the spine box. Attach the four rib stops (Items 3, 4, and 6), each held in place with four #10-32 x 3/4 SHCS (Item 28). Repeat the procedure for the rib pad and rib stops on the back of the dummy.

The locations of the non-struck side rib accelerometers are shown in Figure 53. The orientations of the accelerometers can be rotated to permit easier routing of the cables to the rear of the dummy, shown in Figure 54. First, attach each accelerometer (IE-103) to the accelerometer block with two #0-80 x 1/8 SHCS. Then attach each set of accelerometers to the spine box with two #2-56 x 5/8 SHCS. Note the serial numbers and locations of the accelerometers.

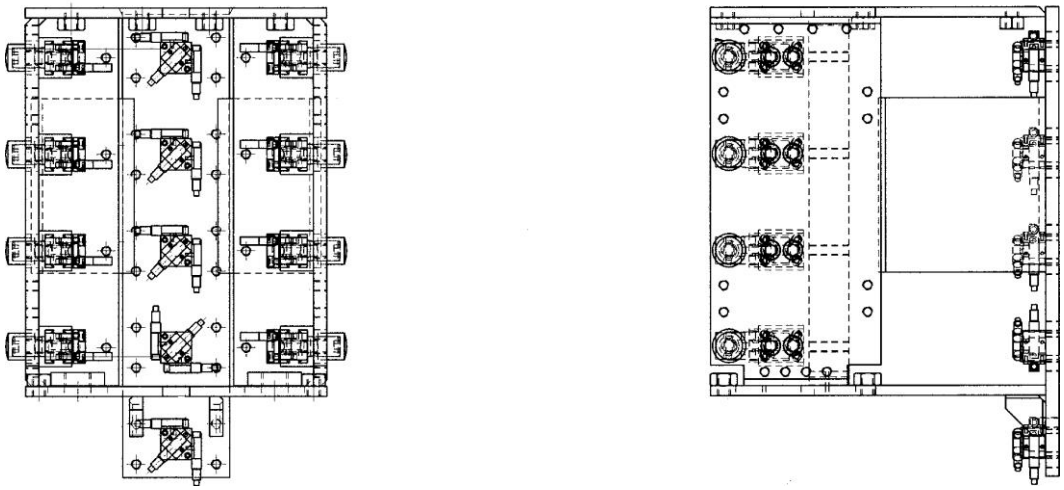

Figure 53. Diagram of non-struck side thorax accelerometers.

Figure 54. Cable routing for non-struck side thorax accelerometers.

The accelerometers on the struck side are mounted directly to the linear pot hook assemblies. As shown in Figure 55, up to six accelerometers can be mounted for each rib. If more than three accelerometers are used, the accelerometers closest to the front of the dummy should be considered the primary response, with those located closest to the rear of the dummy the redundant response. Position the accelerometers as shown.

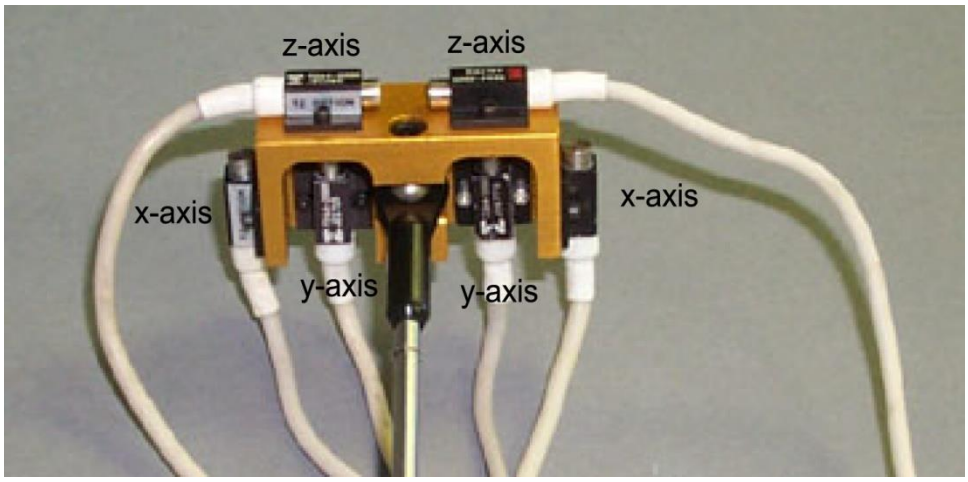

Figure 55. Struck side accelerometers.

Next, referring to item numbers in Figure 50 and reference drawing 180-3858, partially reassemble the chest potentiometers for the upper abdominal rib and the thoracic ribs. Secure the potentiometer to the frame with the two modified #10-32 BHCS (Item 2). Make sure the side of the frame with the larger holes is facing the hook end of the potentiometer. As shown in Figure 56, insert the four potentiometers through the rear opening on the non-struck side of the spine box so the wiring is properly routed. Insert all four potentiometers before securing them to the spine box or they will not fit through. Starting from the bottom of the spine box, attach the frame to the spine box using two #10-32 x 5/8 SHCS (Item 5) for each chest deflection assembly. Then attach each potentiometer hook with the #4-40 x 5/8 SHCS (Item 4). The wires for these accelerometers are routed towards the lumbar spine on the struck side of the dummy as shown in Figure 56.

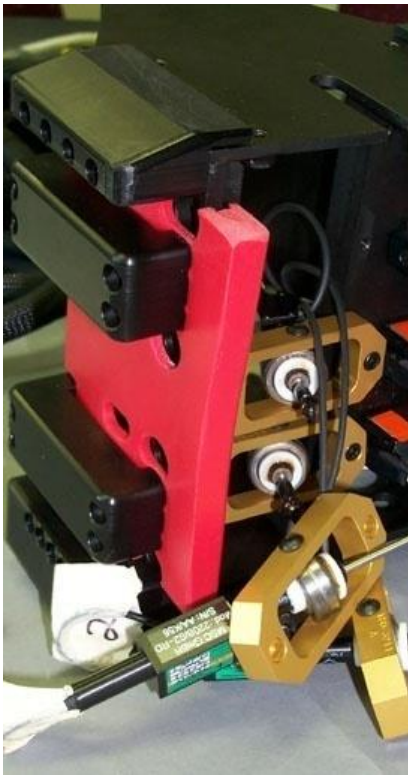

Figure 56. Insert chest potentiometers into spine box through rear non-struck bottom opening to allow proper cable routing before securing the chest potentiometers.

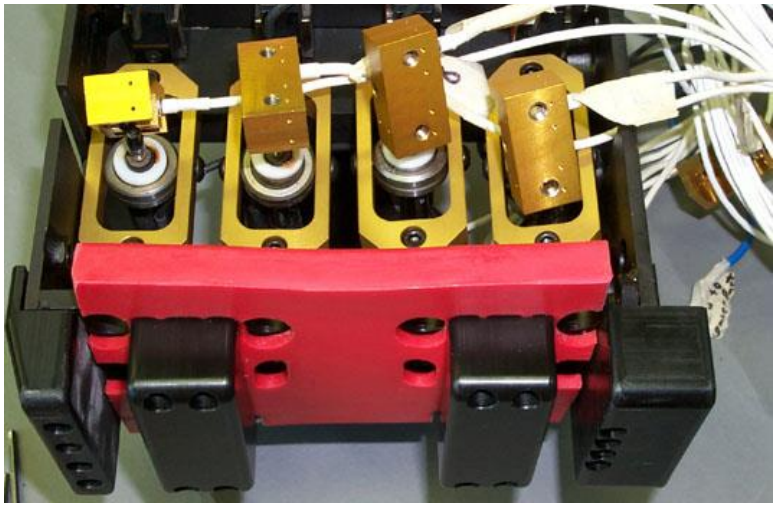

Figure 57. Cable routing for struck side accelerometers.

Insert the shoulder rib potentiometer through the bottom non-struck side of the ribs up to its general position so the wires are properly routed to the non-struck side inside the ribcage. Now that all of the instrumentation attached to the spine box is installed, attach the spine box to the lower torso using the four 1/4-20 x 5/8 SHCS. Attach the potentiometer hook for the lower abdominal rib with the #4-40 x 7/16 SHCS (Item 35). Also at this point, if the neck load cell cables are not detachable from the load cells, the neck load cells should be placed near the top of the thorax and the cables routed down to exit on the bottom non-struck side of thorax.

The next step in upper torso assembly is attaching the ribs. Gently pull apart the abdominal ribs and position them between the rib guides. Attach each rib to the non-struck side with four #10-32 x 1/2 BHCS (Item 27), positioning the rib stiffener between the screw and rib with the curved side facing the dummy. Attach the potentiometer hook assemblies to the struck side of the ribs using two #10-32 x 3/8 BHCS (Item 29) and washers (Item 37). Make sure the cables for the potentiometers and accelerometers are not pinched by the ribs. Repeat the rib installation procedure for the thoracic ribs. Install the foam pads (Items 38 and 39) on the impact side of the ribs (Figure 45 & 46) with cable tie wraps (Item 42).

Attach the shoulder rib mount (Item 14) using two 1/4-20 x 3/4 FHCS (Item 26). Place the shoulder washer (Item 20) between the shoulder load cell and the shoulder yoke assembly (Item 21). Secure with the 3/8 x 3/8 SHSS (Item 23).

Attach the shoulder accelerometers to the accelerometer mount with two #0-80 x 1/8 SHCS for each accelerometer, but do not yet attach the mount to the shoulder. The orientation of the accelerometers when mounted to the rear left side is shown installed in Figure 58, while the orientation when mounted to the front left side is shown installed in Figure 59.

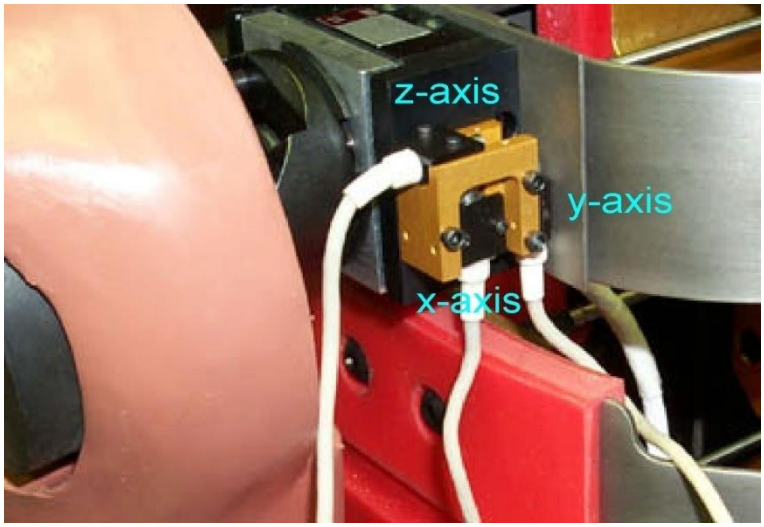

Figure 58. Orientation of shoulder accelerometers mounted to the rear.

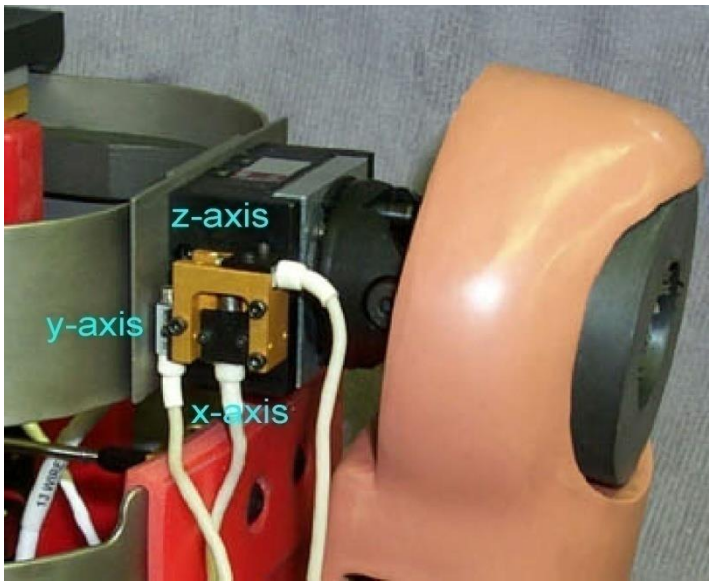

Figure 59. Orientation of shoulder accelerometers mounted to the front.

Next, take the shoulder accelerometers and shoulder load cell assembly and insert them into the ribcage from below the first abdominal rib on the struck side. This will let the cables route underneath the shoulder rib, into the ribcage, and to the lumbar spine area. Attach the shoulder rib (Item 15) to the rib mount using six #10-32 x 1/2 BHCS (Item 27), making sure the cables for the shoulder instrumentation pass underneath the shoulder rib. The shoulder rib stiffener, shown in Figure 60, is thicker than the other five rib stiffeners and has the curved side towards the dummy.

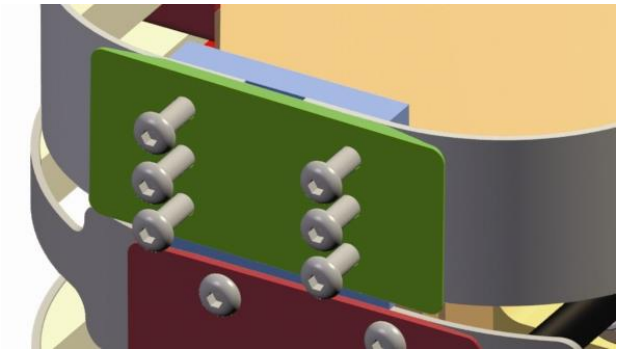

Figure 60. Orientation of shoulder rib stiffener.

Attach the potentiometer hook (Item 17), shoulder rib stiffener (Item 18), and assembled shoulder yoke/load cell (Item 21) to the shoulder rib using the four #10-32 x 5/8 FHCS (Item 31) that hold them in place. As shown in Figure 61 orient the potentiometer hook to allow proper placement of the potentiometer. The flange on the stiffener hooks over the top of the shoulder rib to assist in installation. Finally, attach the accelerometer mount (Item 22) to the shoulder load cell using three #2-56 x 5/8 SHCS (Item 34) as shown in Figures 59 or 60.

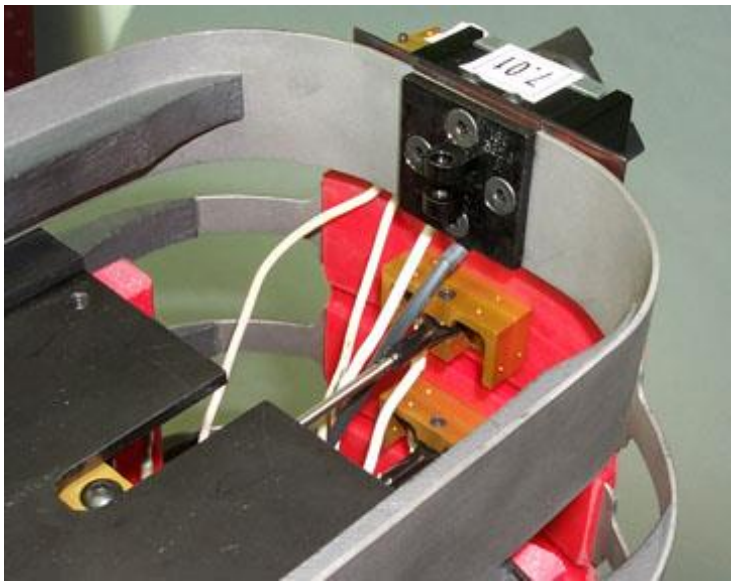

Figure 61. Orientation of shoulder rib potentiometer hook and cable routing for shoulder instrumentation.

Attach the clavicle to the neck mounting block assembly with two ¼-20 x 2-3/4 SHCS (Item 24). Connect the shoulder rib potentiometer (already positioned in the general area) to the neck mounting block assembly using two modified BHCS (Item 36). The neck mounting block assembly is attached to the upper torso with two additional 1/4-20 x 1 SHCS (Item 25) fasteners. Connect the shoulder potentiometer to the potentiometer hook using a #4-40 x 5/8 SHCS.

If the lower neck load cell is not being used, secure the lower half neck assembly to the upper torso at this point. Two 1/4-20 x 2-3/4 SHCS (Item 24) secure the rear side of the bracket (Figure 12), and two 1/4-20 x 1 SHCS (Item 25) attach the front side of the bracket. If the lower neck load cell is used, replacements for these components are attached later in the reassembly after the neck components are assembled.

2.5 Arms

2.5.1 Parts List

Table 7. Parts list for arm assemblies (180-6000-1/ -2)

Item	Quantity (per arm)	Part Number	Description
1	1	180-6011-1, -2	Arm flesh
2	1	180-6019	Arm plug
4	1	9000249	FHCS #10-32 x 3/8
4	1	9000535	Screw, SHSS 1/4 X 1
5	1	6000076	Bearing
6	1	9000356	Roll pin
7	2	SA572-S80	Accelerometer mount

2.5.2 Disassembly

As shown in Figure 62, the SID-IIs uses only one half arm at a time. The arm is mounted to the “struck” side. However, there are left and right versions of the arm available, depending on whether the dummy is positioned as the driver or passenger.

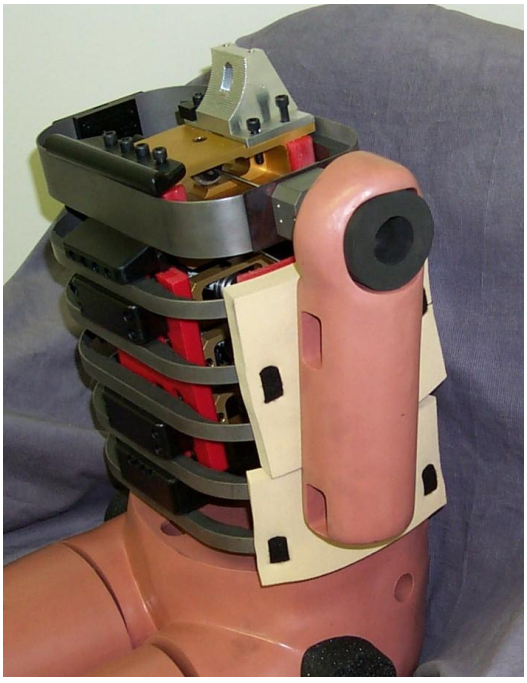

Figure 62. SID-IIs with arm mounted on the left side for impact in the driver position.

Figure 63 shows an exploded view of the arm components. Detach the arm from the shoulder by removing the ¼ x 1 SHSS (Item 4). Remove the #10-32 x 3/8 FHCS (Item 3) to allow removal of the arm plug (Item 2) from the molded flesh (Item 1).

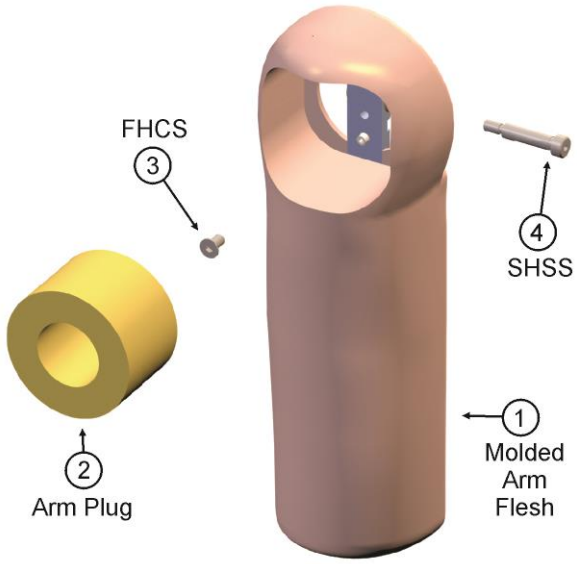

Figure 63. Exploded Arm Assembly

2.5.3 Inspection

- Check the arm flesh for damage. If the damage is minor, repair the flesh according to the methods described in Appendix 4.1. If the damage is more significant, return the arm to FTSS so it can be remolded.
- Inspect the rubber plug for damage. Replace if there is substantial damage.

2.5.4 Reassembly

Make sure you are using the correct arm for the selected impact position. When in place, two openings on the arm should face the front of the dummy. If not, obtain the other molded arm.

If desired, two sets of triaxial accelerometers may be mounted to the arm. Figure 64, shows the locations of the accelerometers. First attach the accelerometers to the mounting blocks using two #0-80 x 1/8 SHCS for each accelerometer.

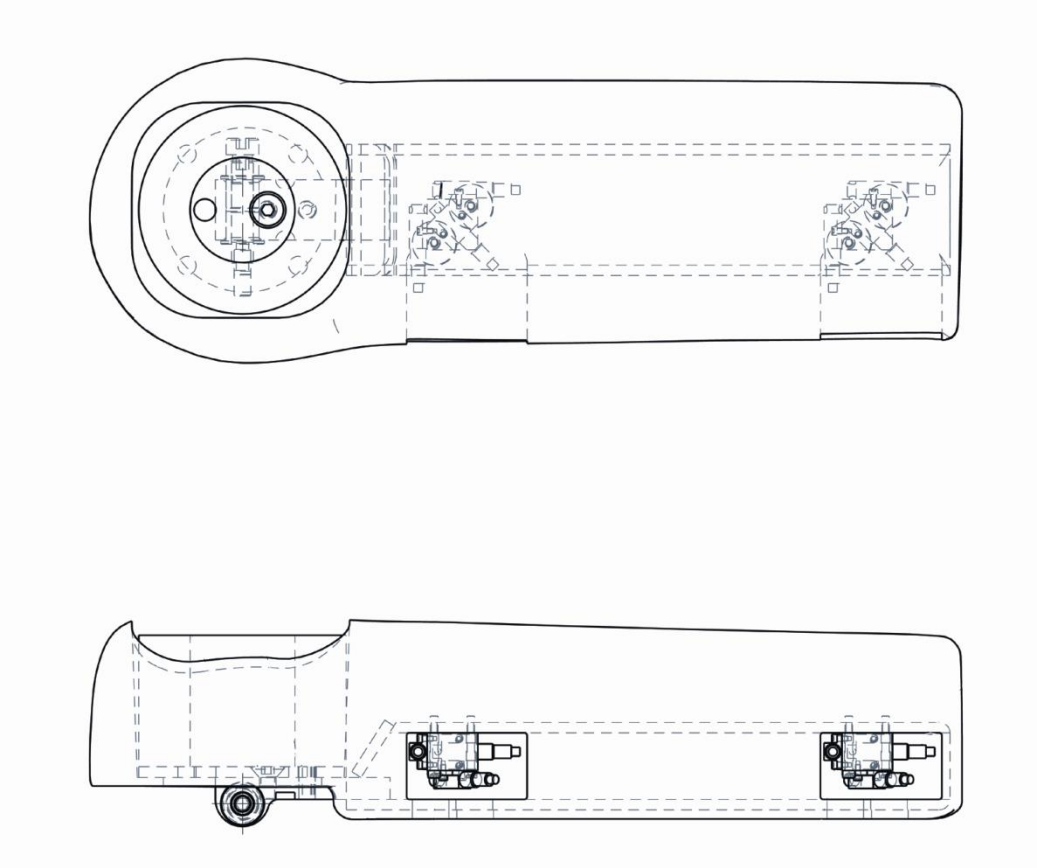

Figure 64. Diagram of arm accelerometer orientations.

All of the accelerometer cables should exit the upper hole on the front part of the arm. If you are having difficulty pushing the lower arm accelerometers through the top access hole down into position near the lower access hole, use the procedure illustrated in Figure 65. Loosely loop a cable tie around the accelerometer block. Insert an extra cable in through the bottom arm access hole, out the top arm access hole, through the cable tie, and back through the upper and lower access holes. Pull on the extra cable to bring the lower arm accelerometers through the arm cavity to be positioned near the lower access hole. Remove the cable tie around the lower accelerometer block before securing it in place with two #2-56 x 5/8 SHCS. As shown in Figure 66, these screws are accessed through the two openings on the inner side of the arm.

Figure 65. Technique for inserting lower arm accelerometers that allows proper routing of cables.

Figure 66. Accessing accelerometer screws in the arm.

Refer to the exploded view of the arm components in Figure 63 when reassembling the arm. Insert the arm plug (Item 2) into the arm flesh, making sure it is positioned properly to meet the roll pin. Attach the plug using the #10-32 x 3/8 FHCS (Item 3). Secure the arm to the shoulder using the ¼ x 1 SHSS (Item 4).

2.6 **Lower Torso**

2.6.1 Parts List

Table 8. Parts list for lower torso assembly (180-4000)

Item	Quantity	Part NO.	Description
1	1	180-4332	Pelvic Bone, Machined
2	1	180-4300	Lumbar Spine Load cell Simulator
3	2	180-4311	Wing Load cell Simulator
4	2	180-4325	Iliac Wing Backer Plate
5	1	180-4322-1	Iliac Wing, Molded Left
6	1	180-4322-2	Iliac Wing, Molded Right
7	1	180-4401-1	Femur Mount Plate Left
8	1	180-4401-2	Femur Mount Plate Right
9	2	180-4402	Femur Holding Shaft
10	1	180-4461	Pubic Load cell Simulator
11	1	180-4340	Lumbar Ballast Block
12	1	180-4210	Spine, Molded- Lumbar
13	1	180-2004	Neck Bushing Upper
14	1	180-4213	Lumbar Cable
15	1	180-4100	Lumbar Mounting Plate
16	1	180-2005	Neck Bushing Lower
17	1	9000018	Hex Jam Nut ½-20
18	1	180-3410	Linear Pot Frame Bottom Rib
19	2	9001388	Hex Jam Nut 5/8-18
20	4	180-4410	Inner Bushing Pelvis
21	1	180-4423-2	Femur Assembly, Right
22	10	9001191	Screw, FHCS ¼-20 X 5/8
23	2	9000770	Screw, SHCS #10-32 X 7/8
24	4	9000328	Screw, SHCS 5/16-18 X 1-3/4
25	2	9000249	Screw, FHCS #10-32 X 3/8
26	1	180-4423-1	Femur Assembly, Left
27	2	9000144	Screw, SHCS 1/4-20 X 5/8
28	4	9000086	Screw, SHCS 1/4-20 X 7/8
29	16	9000137	Screw, SHCS #10-32 X 3/8
30	2	9001194	Screw, FHCS ¼-20 x 1-1/4
31	1	9000054	Washer, Flat #10 x .50 x .049
32	2	180-4440	Acetabulum Load cell Simulator
33	2	180-4450-3	Pelvis Plug, Tested & Cert.
34	2	9000055	Screw, SHSS 1/2 X 1-1/4
35	1	180-4343	Pelvis, Molded
36	2	180-3240	Linear Pot Bearing Pivot Screw, Modified

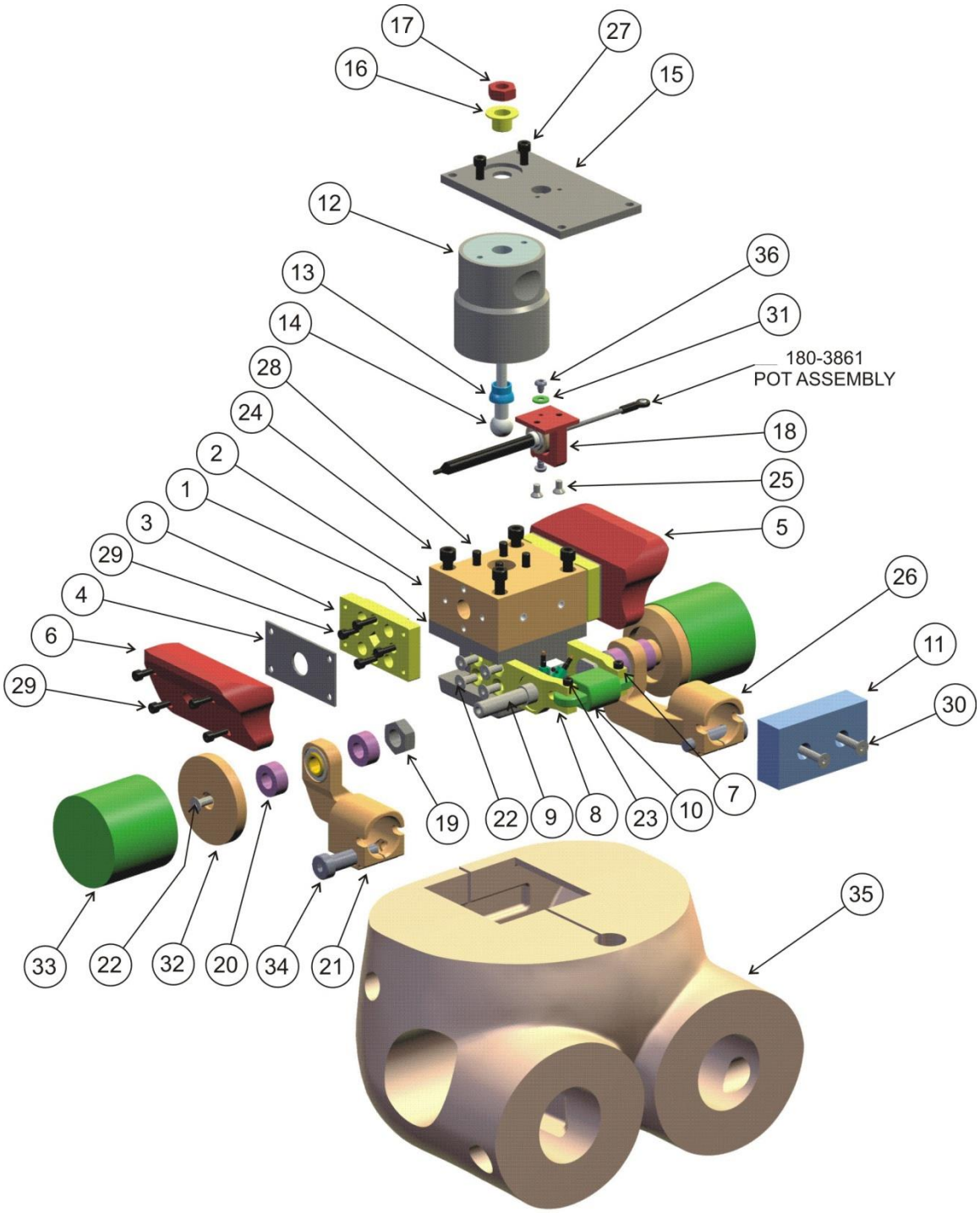

Figure 67. Exploded Lower Torso Assembly

2.6.2 Disassembly

Before disassembling the lower torso, separate the leg from the pelvis. The thigh and pelvis are attached by a ½ x 1 1/4 SHSS accessed from the most forward hole on either side of the pelvis (Figure 68).

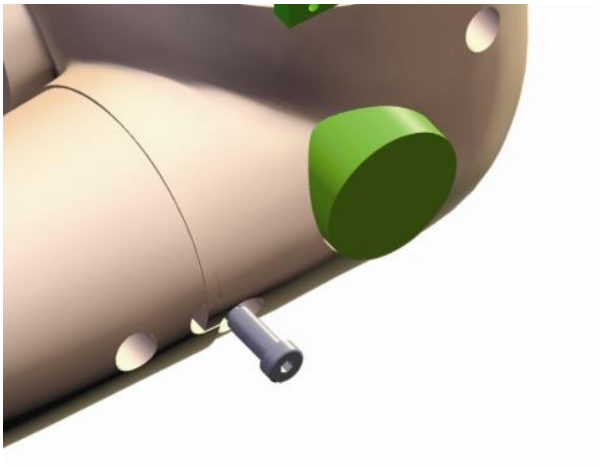

Figure 68. The pelvis and leg are attached by a ½ x 1 1/4 SHSS.

Begin disassembly of the lower torso by removing the pelvis plugs (Item 33) the left and right sides of the pelvis. These are removed by twisting and pulling the plugs out of the cavity in the pelvis. Next, remove the 1/4-20 x 5/8 FHCS that attach the acetabulum load cells (Item 32) from the left and right sides of the pelvis (Figure 69).

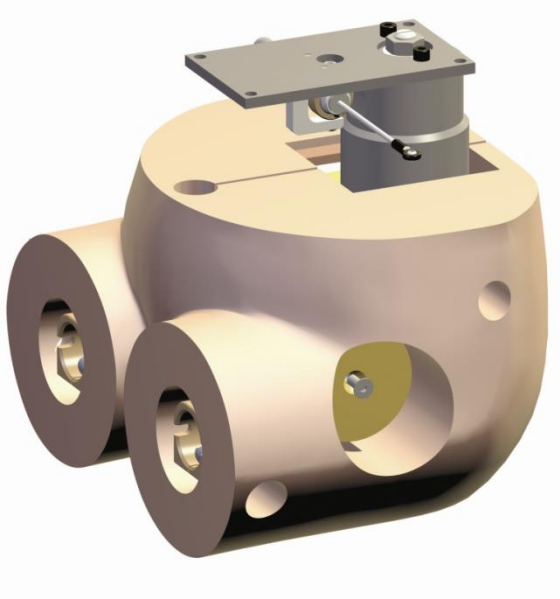

Figure 69. Removing Acetabulum load cells.

As shown in Figure 70, the lower extremities can now be detached from the pelvis by removing the urethane inner bushings (Item 20) from the left and right femur holding shafts (Item 9). The femurs can then be slid off the shafts and pulled through the front openings in the pelvis.

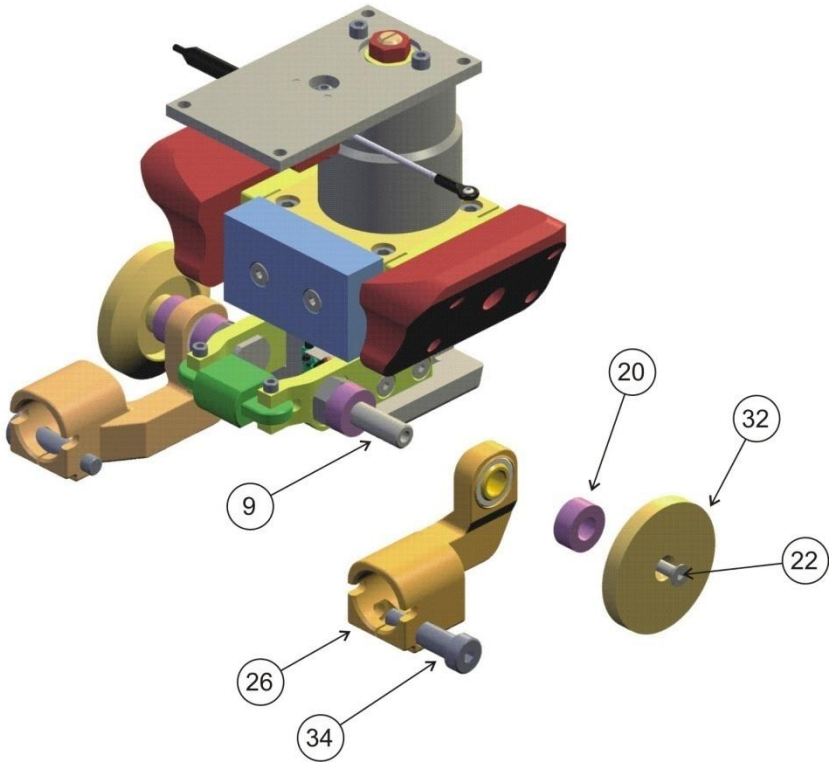

Figure 70. Removing the lower extremities from the pelvis.

After the lower extremities are detached, unzip the pelvis flesh (Figure 71). Pull the sides of the flesh away from the pelvis bone assembly. Be careful not to rip or tear the flesh as it is pulled from the iliac wings.

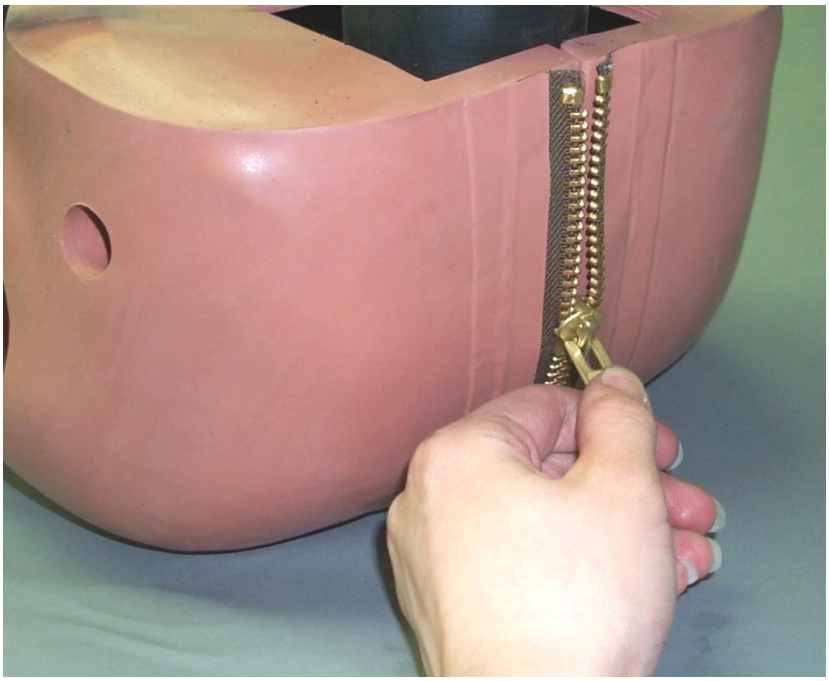

Figure 71. Unzipping the pelvis flesh.

The next step in disassembling the pelvis is removing the lumbar spine. An exploded view of the upper components of the lumbar spine is shown in Figure 72. First, remove the lumbar mounting plate (Item 15) by taking out the two 1/4-20 x 5/8 SHCS (Item 27) and the 1/2-20 hex jam nut (Item 17). Take the plate off of the lumbar spine (Item 12) and remove the bushing (Item 16) from the top of the lumbar spine cable.

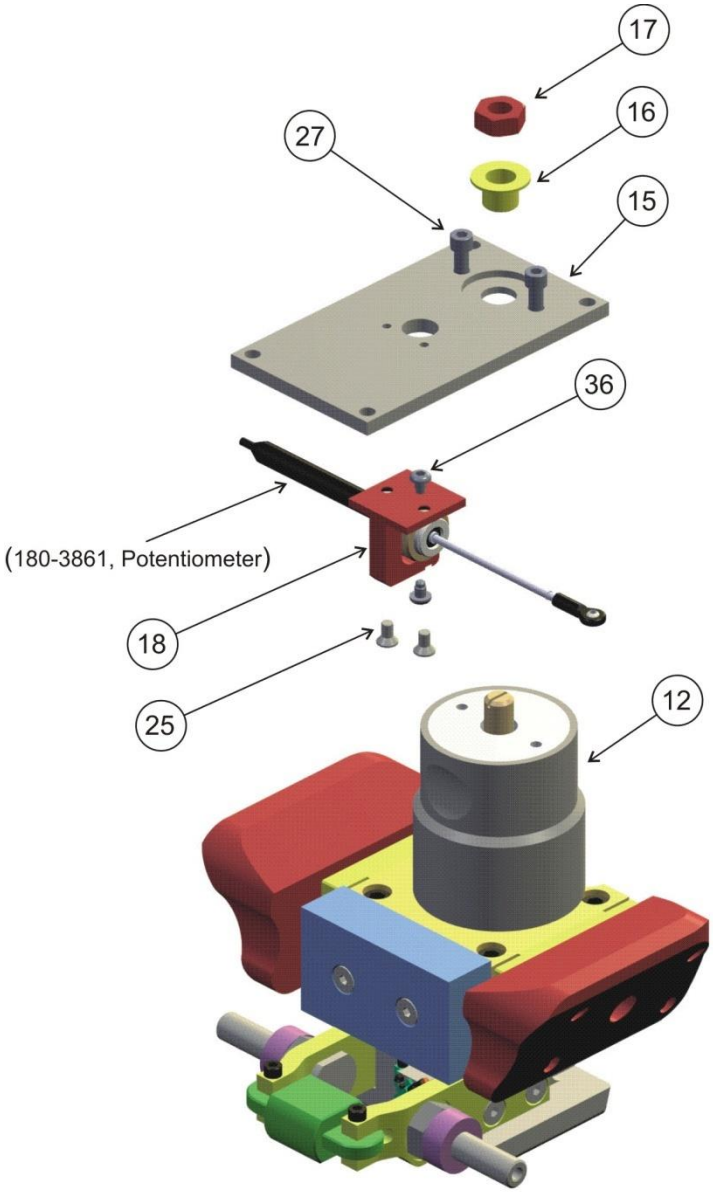

Figure 72. Exploded view of upper components of lumbar spine.

A potentiometer assembly is attached to the bottom of the lumbar mounting plate. Remove the potentiometer frame (Item 18) from the plate by removing the two #10-32 x 3/8 FHCS (Item 25). The potentiometer is removed from the frame by unscrewing the two modified BHCS (Item 36). The lumbar spine, plus the lumbar load cell, the iliac wing load cells, and the iliac wings, is detached from the pelvis by removing the four 5/16-18 x 1-3/4 SHCS (Item 24).

Figure 73 shows an exploded view of the components attached to the lower end of the lumbar spine. First, remove the four 1/4-20 x 7/8 SHCS (Item 28) from the bottom of the lumbar spine load cell. The lumbar spine (Item 12) can now be detached from the assembly. Slide the lumbar cable (Item 14) from the bottom of the lumbar spine, and detach the lower spine cable bushing (Item 13).

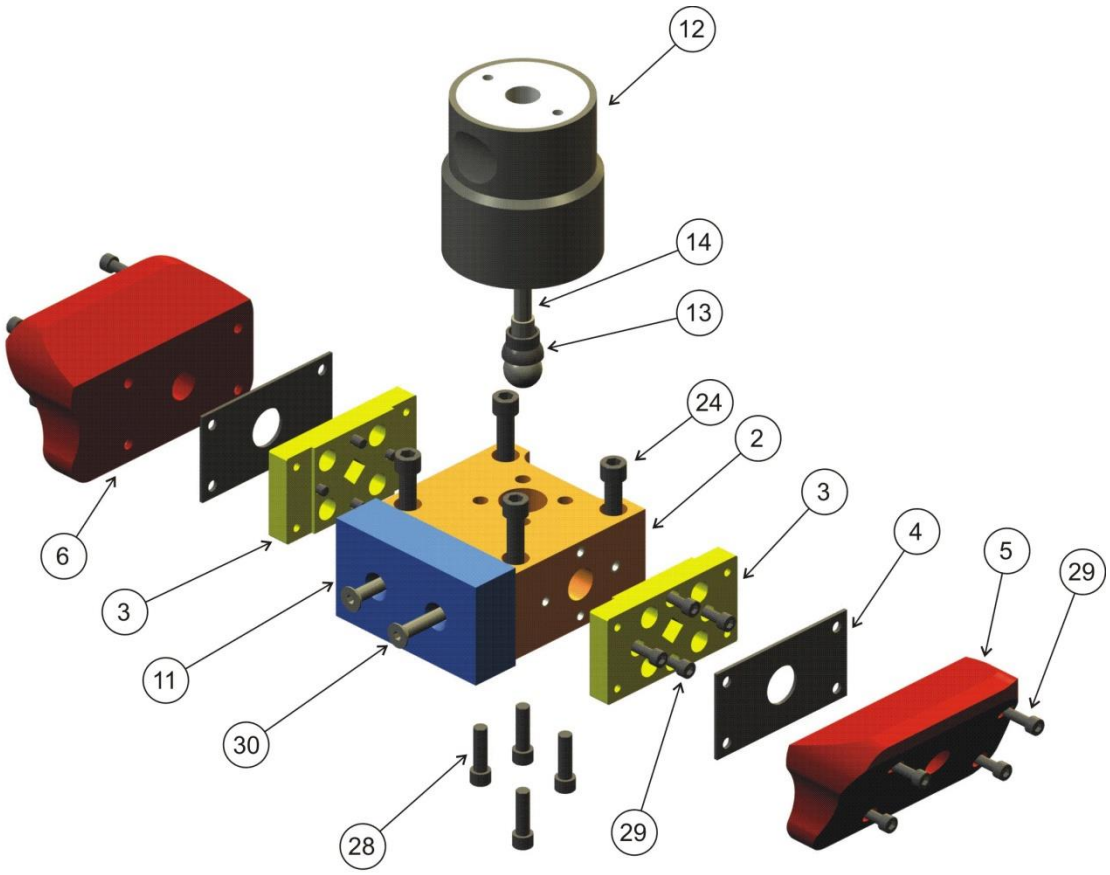

Figure 73. Components attached to lower end of lumbar spine.

The left and right molded iliac wings (Items 5 and 6) and the iliac wing backer plate (Item 4) are disassembled by removing the four #10-32 x 5/8 SHCS (Item 29) that hold each iliac wing in place. Next, remove the iliac wing load cells (Item 3) by unscrewing the four #10-32 x 5/8 SHCS (Item 29) that hold them (or their replacements) in place.

As shown in Figure 74, the lumbar ballast block is removed from the lumbar load cell by removing two 1/4-20 x 1-1/4 SHCS.

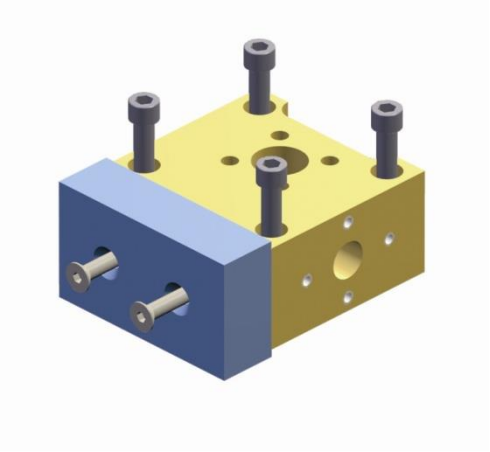

Figure 74. Removing the lumbar ballast from the load cell.

The H-point is a reference point used for positioning the dummy in a test vehicle seat. It represents a line passing through the centerline of the right and left hip sockets. For the SID-IIs, it is located at the center of the pelvis plug (Figure 75). The Pelvic Angle Gage, which fits into a square hole in the pelvis as shown in Figure 76, can be used with a level to determine the pelvic angle.

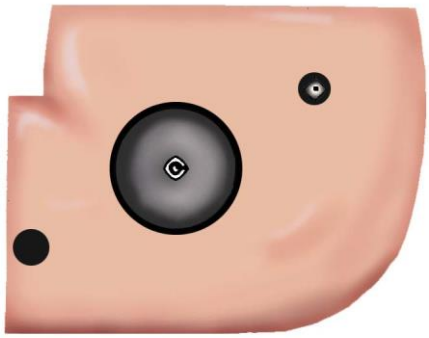

Figure 75. Location of H-point.

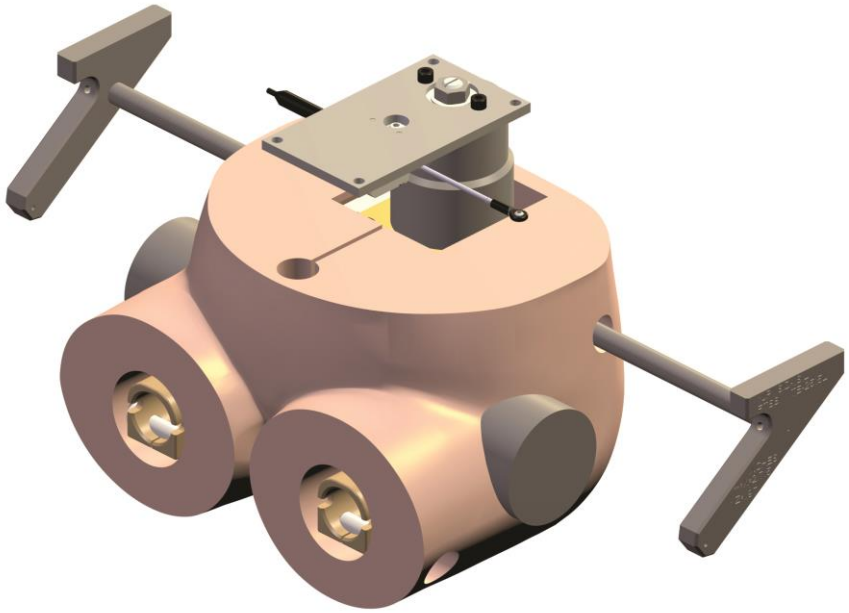

Figure 76. H-Point Tool in place to allow measurement of h-point and pelvis angle.

Figure 77 shows an exploded view of the remaining assembled pelvis components. Remove the femur mount plates (Item 7 and 8) from each side of the pelvis bone by removing the four 1/4-20 x 5/8 FHCS (Item 22) from each side. The femur mount plates and the pubic symphysis load cell (Item 10) (or its replacement) will be free for removal. To detach the pubic symphysis load cell, remove the two #10-32 x 7/8 SHCS (Item 23). Finally, remove the femur holding shafts (Item 9) from the mounting plates by removing the 5/8-18 hex jam nuts (Items 19) and pushing the shaft out of the holes in the mounting plates.

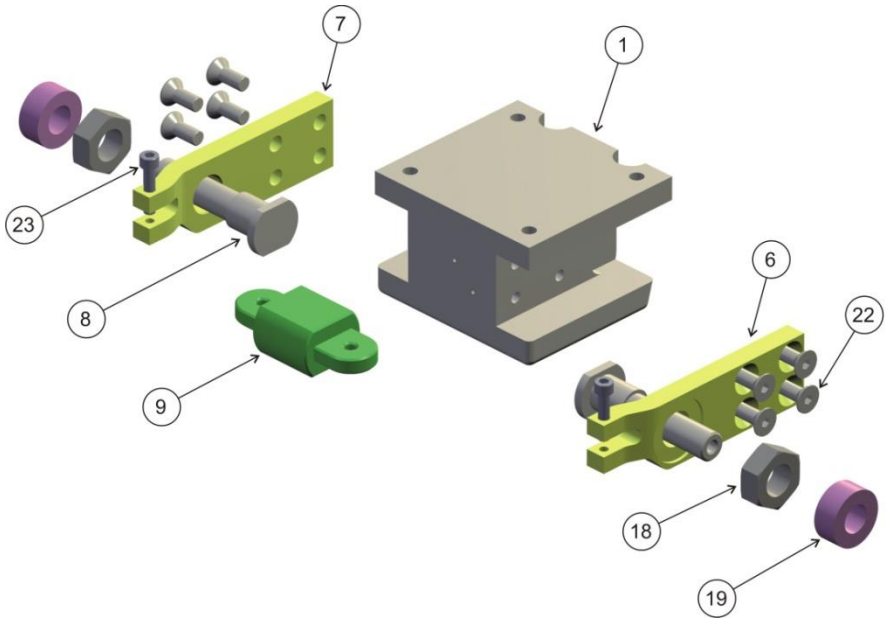

Figure 77. Exploded view of remaining pelvis components.

2.6.3 Inspection

- Check the pelvis flesh for any cracks or tears. Repair damaged flesh according to the methods of Appendix 4.1.
- Check the lumbar spine for any cracks or tears in the rubber. Replace it if necessary.
- Examine the upper and lower cable spine bushings for any damage. Replace if necessary.
- Check the lumbar spine cable for broken or frayed wires or any bulges in the cable. Replace if damaged.

2.6.4 Instrumentation/Reassembly

Refer to Figure 77 when reassembling the lower torso. First insert the femur holding shafts (Item 9) into the holes of the mounting plates (Items 7 and 8. Secure them in place using the 5/8-18 hex jam nuts (Items 19). Attach the femur mounting plates using four 1/4-20 x 5/8 FHCS (Item 22) for each side. Attach the pelvis accelerometers (IE-103) to the accelerometer block using two #0-80 x 1/8 SHCS for each accelerometer. Attach the accelerometer block to the pelvis bone using two #2-56 x 5/8 SHCS. The orientation of the pelvis accelerometers is shown in Figure 76. Note which serial numbers correspond to each axis. Affix a cable tie holder to the pelvis and secure the accelerometer cables with some slack as shown. The cables for the pelvis accelerometers are then routed to the rear of the dummy.

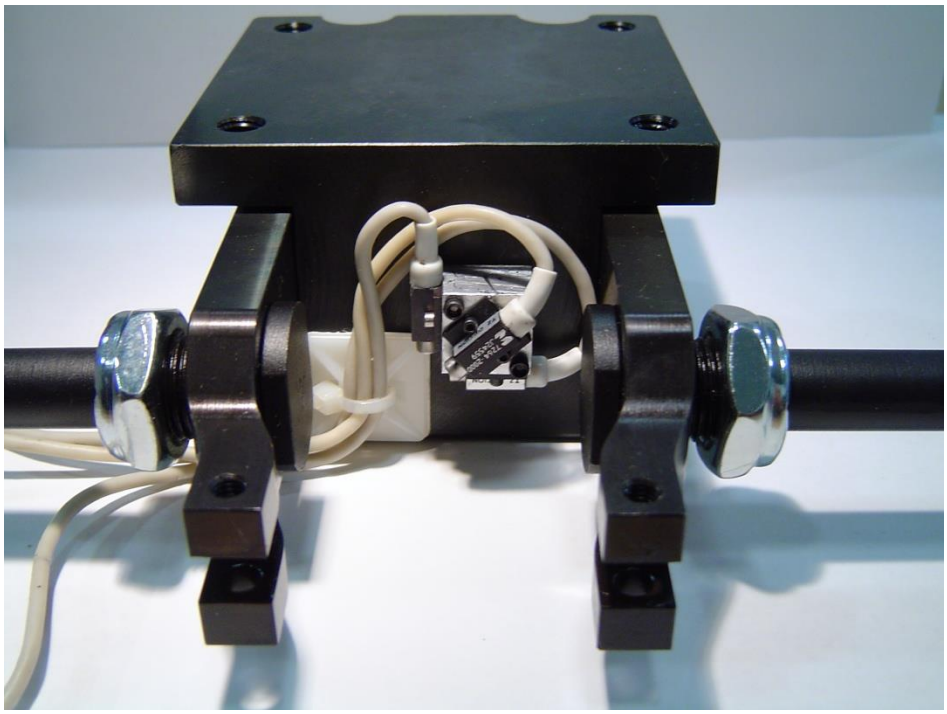

Figure 78. Orientation of pelvis accelerometers and wiring routing.

Attach the pubic symphysis load cell (Item 10) using two #10-32 x 7/8 SHCS (Item 23). Route the cables for the pubic symphysis load cell to the rear as shown in Figure 79.

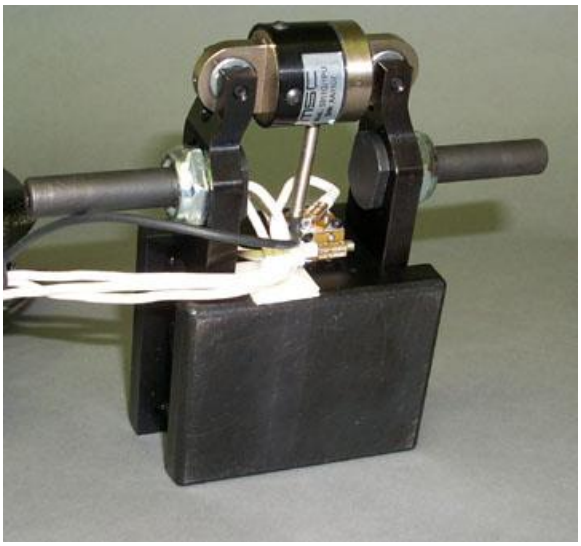

Figure 79. Orientation and cable routing for pubic symphysis load cell.

For the next phase of lower torso reassembly, refer to Figure 73. As shown in Figure 80, install each iliac wing load cell (Item 3) with four #10-32 x 5/8 SHCS (Item 29) to the lumbar spine load cell (Item 2). All of these load cells are positioned so the cables are pointed to the rear of the dummy. Then attach the left and right molded iliac wings (Items 5 and 6) using the four #10-32 x 5/8 SHCS (Item 29) that hold each iliac wing in place.

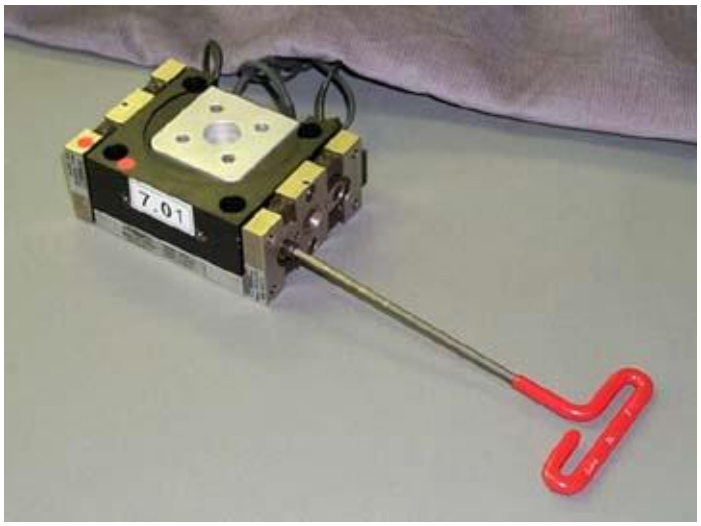

Figure 80. Installation of iliac wing load cells with cables routed to the rear.

Next, slide the lower spine cable bushing (Item 13) over the lumbar spine cable (Item 14). Insert the lumbar spine cable into the bottom of the lumbar spine. Secure the lumbar spine to the lumbar spine load cell using four 1/4-20 x 7/8 SHCS (Item 28) accessed from the bottom of the load cell. Make sure the lumbar spine is oriented so the slight cutout in the rubber (to avoid interference with the potentiometer) is facing the front. Attach the lumbar ballast block to the lumbar load cell with two 1/2-20 x 1-1/4 SHCS. Different lumbar ballast blocks are used with the lumbar load cell and the lumbar load cell replacements. However, the hole spacing, on the two ballast pieces, are different so the incorrect ballast cannot be used.

Refer to Figures 73 and 74, attach the lumbar assembly to the remaining part of the pelvis using four 5-16 x 1-3/4 SHCS (Item 24). Attach the potentiometer for the lower abdominal rib to the lumbar mounting plate using two modified BHCS (Item 36). A washer is inserted through the top of the mounting plate before the screw is inserted. Make sure the hook end is positioned towards the struck side of the dummy. The cables for the potentiometer will be routed toward the non-struck side of the dummy towards the back. Position the lumbar mounting plate (Item 15) over the lumbar spine and secure with the two 1/4-20 x 5/8 SHCS (Item 27). Insert the bushing (Item 16) through the hole in the lumbar mounting plate over the threaded end of the lumbar cable. Attach the 1/2-20 hex jam nut (Item 17) and torque it to 11 +/- 1 in-lb.

Place urethane bushings over each of the femur shafts. As shown in Figure 81, take the upper femur to acetabulum load cells and insert them from the top opening of the pelvis through the front openings of the pelvis so the cables are in position along the inside bottom surface of the pelvis flesh. Place the acetabulum load cells through the top opening of the pelvis through the side openings in the pelvis so the cables are also in position.

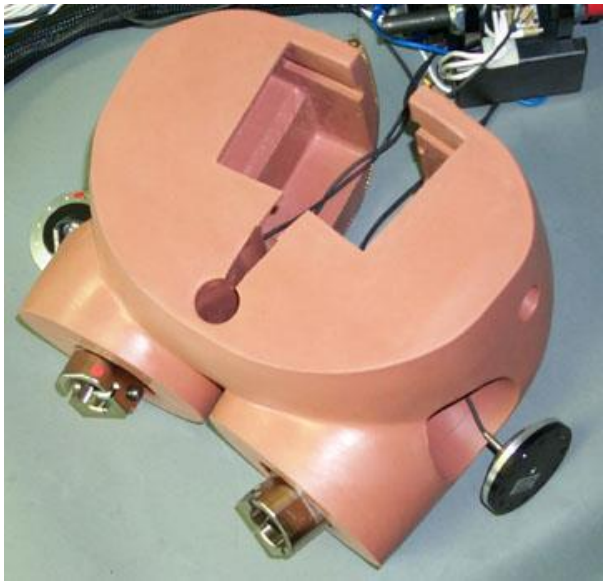

Figure 81. Installing the pelvis flesh.

As shown in Figure 82, place the pelvis flesh on its non-struck side and insert the pelvis assembly, making sure cables are all routed to the back. Position the struck side of the pelvis flesh over the rest of the pelvis assembly. Accessing through the front and side openings of the pelvis flesh, install the femur to acetabulum load cells over the femur shafts. Insert the urethane bushings over the ends of the femur shafts before installing the acetabulum load cells with that have built-in fasteners. The cables for these four load cells are routed through under the iliums to the rear of the dummy as shown in Figure 83. Route all the cables up to the lumbar spine and zip the pelvis flesh.

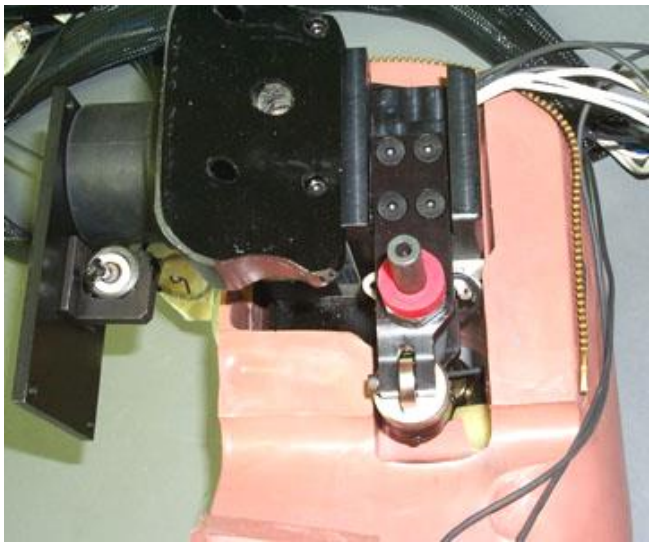

Figure 82. Insert non-struck side of the pelvis into the flesh first.

Figure 83. Routing of cables for upper femur to acetabulum load cells and for acetabulum load cells.

If the femur to acetabulum and acetabulum load cell replacements are used instead, they do not need to be put in position before inserting the pelvis assembly into the flesh. The last step in reassembling the lower torso is to install the pelvis plugs.

2.7 Lower Extremities

2.7.1 Parts Lists

Table 9. Parts list for leg assembly (180-5000-1/-2)

Item	Quantity	Part Number	Description
1	2	180-5100-1/-2	Upper Leg Assembly
2	2	9000449	Screw, SHCS 3/8-16 x 1-3/4
3	2	180-5300-1/-2	Knee Assembly
4	16	9000249	Screw, FHCS #10-32 x 3/8
5	2	180-5505	Structural Replacement
6	2	180-5700	Ankle Assembly
7	2	180-5900-1/-2	Foot Assembly, Molded
8	2	9000619	Screw, SHSS 1/4 x 5/8
9	2	180-5520	Lower Leg Flesh
10	2	180-5705	Ankle Bumper Assembly

Table 10. Parts list for ankle assembly (180-5700)

Item	Quantity	Part Number	Description
1	1	180-5701	Upper Ankle Shell
2	1	180-5702	Lower Ankle Shell
3	1	180-5703	Ankle Shaft
4	1	180-5704	Stop Pin Retainer
5	1	9000044	Dowel Pin 3/16 x 3/8
6	2	180-5707	Ankle Friction Pad
7	2	9000073	Screw, SSCP 5/16-18 x 3/8
8	2	9000452	Screw, SSCP #8-32 x 1/4
9	4	9000247	Screw, BHCS #6-32 x 1/2
10	1	180-5708	Ankle Attachment Bolt
11	3	9001279	Screw, FHCS #6-32 x 1/2

Table 11. Parts list for knee assembly (180-5300-1/-2)

Item	Quantity	Part Number	Description
1	1	180-5304	Inboard Knee Replacement
2	1	18-5305	Outboard Knee Replacement
3	1	180-5381	Washer
4	2	180-5303	Compression Washer
5	1	180-5302	Rotation Stop Cover
6	1	180-5320	Knee Skin
7	1	180-5360	Machined Knee Cap
8	1	180-5340	Knee Insert
9	1	180-5301	Rotation Stop Arm
10	2	180-5382	Shoulder Bolt
11	2	9000076	BHCS #8-32 x ½

2.7.2 Disassembly

Start disassembly of the lower extremities by removing the 3/8-16 x 1-1/2 SHCS that connects the upper leg bone to the load cell simulator (Figure 84). The upper leg flesh can be removed from the upper leg weldment if necessary.

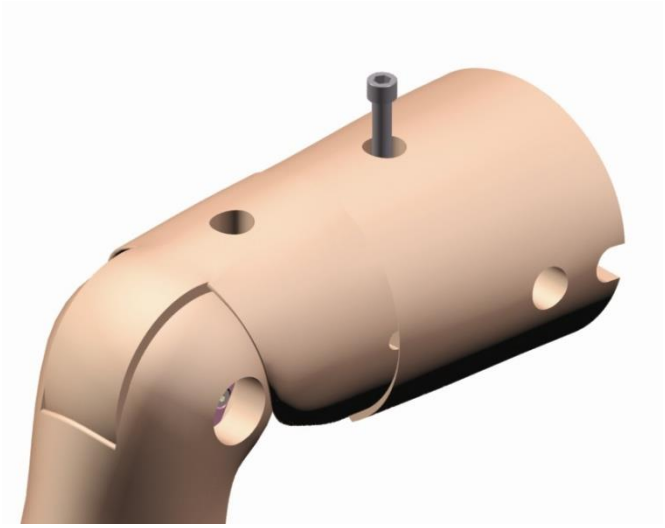

Figure 84. Detaching the thigh from the lower extremity.

Next remove the 3/8-16 x 1-3/4 SHCS that connects the load cell simulator to the knee assembly (Figure 85). The load cell simulator can be detached from the knee assembly.

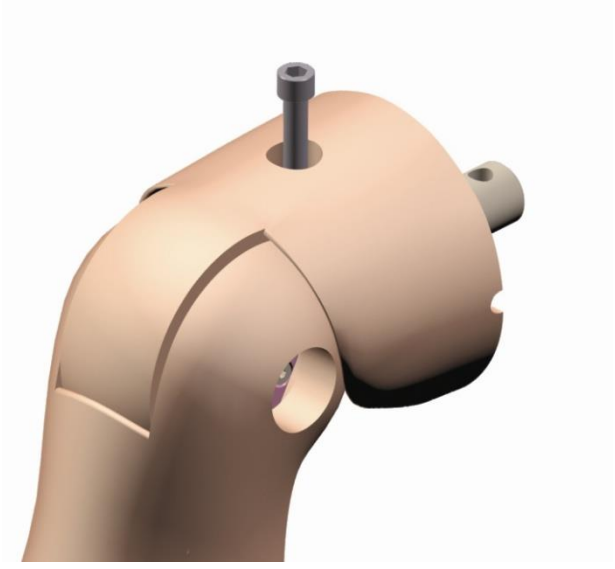

Figure 85. Detaching the femur load cell simulator from the knee assembly.

Detach the knee from the lower leg by removing the four #10-32 x 3/8 FHCS (Item 4) accessible through holes in the flesh from either side of the knee (Figure 86).

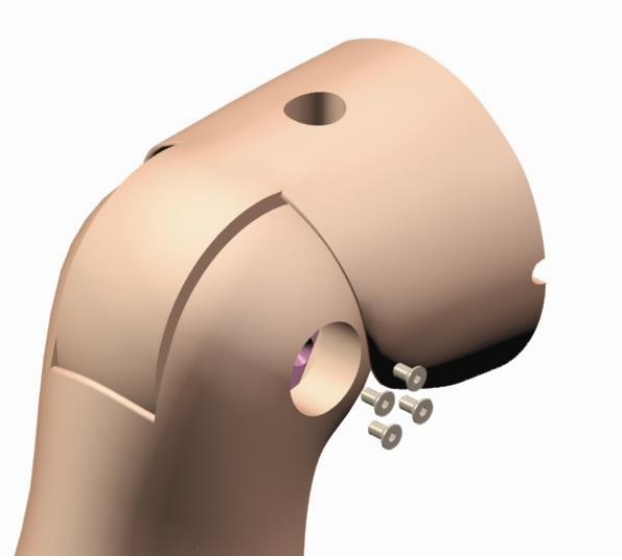

Figure 86. Removing the knee from the lower leg.

Remove the knee flesh by prying it away from the machined knee components. The knee insert can be removed from the recess inside the knee flesh (Figure 87).

Figure 87. Removing insert from knee.

An exploded view of the knee joint is shown in Figure 88. Disassemble the knee joint by removing the SHSS (Item 10) and washer (Item 5), which will detach the inboard and outboard knee replacements (Items 1 and 2). The rotation stop arm (Item 9) can be removed from the knee replacement by removing the two #8-32 x ½ BHCS (Item 11).

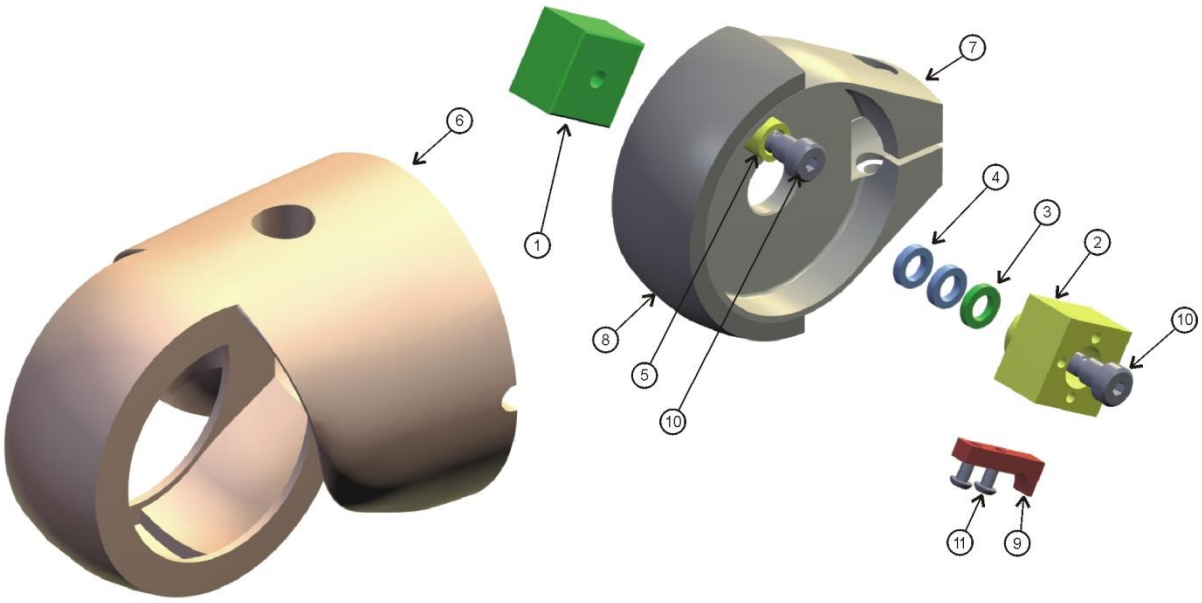

Figure 88. Exploded Knee Assembly

Detach the foot and ankle from the lower leg by removing the tibia bone from the flesh. The lower leg flesh can be removed.

An exploded view of the ankle joint is shown in Figure 89. Detach the ankle and foot from the lower leg assembly by removing the ankle attachment bolt (Item 10). Separate the foot (Item 7*) from the ankle by removing the 1/4 x 5/8 SHSS (Item 8*).

Remove the 5/16-18 x 3/8 SSCP ankle set screw (Item7) and ankle friction pad (Item 6) from the upper ankle shell (Item 1).

Remove the four #6-32 x 1/2 BHCS (Item 9) and three # 6-32 x 1/2 FHCS (Item 11) that attach the lower ankle shell (Item 2). Once the lower ankle shell is removed, the ankle shaft (Item 3) will be free of the upper ankle shell. The dowel pin (Item 5) and #8-32 x 1-1/4 SSCP can then be removed.

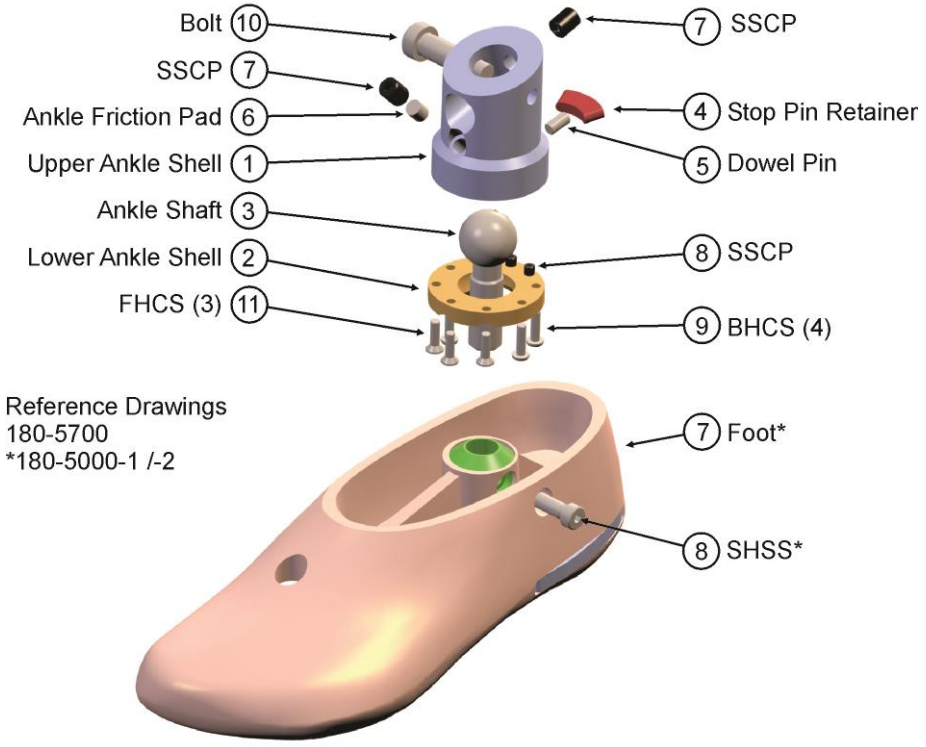

Figure 89. Exploded Ankle Assembly

2.7.3 Inspection

- Inspect the ball-end of the ankle shaft and the hemispherical portions of the upper and lower ankle shells for any damage or galling. Damage to these areas can cause problems in achieving proper ankle joint torque. Replace any damaged parts.
- Inspect the condition of the ankle friction pad (Item 5) and make sure it is included, as this component also affects ankle joint torque.
- Inspect the lower leg, knee, and upper leg flesh. If damage is minor, repair according to the directions found in Appendix A. If damage is extensive, replace the flesh component.
- Inspect the knee insert for damage and replace if necessary.

2.7.4 Instrumentation/Reassembly

Refer to Figure 89 when reassembling the ankle. Place the ankle shaft (Item 3) into the upper ankle shell (Item 2). Twist the shaft so the slot is visible through the hole dowel pin. Insert the dowel pin (Item 5) into the slot and insert the #8-32 x 1-1/4 SSCP (Item 8). Position the lower ankle shell (Item 2) over the shaft and secure it with seven #6-32 x ½ BHCS. Insert the ankle friction pad (Item 6) into the upper ankle shell (Item 1) and insert the two 5/16-18 x 3/8 SSCP ankle set screw (Item 7). Attach the foot (Item 7*) to the ankle with the 1/4 x 5/8 SHSS (Item 8*). Connect the ankle and foot to the lower leg assembly with the ankle attachment bolt (Item 10).

Refer to Figure 88 when reassembling the knee. Attach the rotation stop arm (Item 9) to the knee replacement using the two #8-32 x ½ BHCS (Item 11). Connect the inboard and outboard knee replacements (Items 1 and 2) using the SHSS (Item 10) and washer (Item 4).

Place the knee insert back into the knee and place the flesh over they machined knee. Attach the knee to the upper leg using #10-32 x 3/8 FHCS accessed from either side of the knee. Connect the load cell to the knee using 3/8-16 x 1-3/4 SHCS. Place the thigh flesh over the upper leg bone and attach the leg to the pelvis with a 3/8-16 x 1-1/2 SHCS.

2.8 Converting the SID-IIs between Driver and Passenger Configurations

The SID-IIs is designed to represent either a driver or passenger configuration. The following procedures explain how to convert the SID-IIs from a driver to a passenger configuration.

- Remove the jacket.
- Remove only the two rearmost ¼-20 x 2-3/4 SHCS that connect the lower neck bracket to the neck mounting block.
- Remove only the two outer ¼-20 x 2-1/2 SHCS that connect the clavicle and neck block to the thorax.
- Remove the #4-40 x 5/8 SHCS that connects the shoulder linear potentiometer to the potentiometer hook.
- Remove the assembled head, neck, and neck mounting block from the dummy.
- Disconnect the arm from the shoulder by removing the ¼-20 x 1 SHSS.
- Remove the lower abdominal rib potentiometer hook from the rib by removing the two lowest #10-32 x 3/8 BHCS. Since accelerometers are also mounted to this hook, make sure the cables are not tied to the ribs.
- Remove the four ¼-20 x 5/8 SHCS that connect the upper torso to the lower torso. Rotate the torso 180 degrees and reconnect.
- Detach the lower abdominal and shoulder deflection potentiometers by removing the modified BHCS that hold them in their frames. Reorient them so the potentiometer rod points to the impact side.
- Reconnect the lower abdominal rib potentiometer hook to the rib with the two lowest #10-32 x 3/8 BHCS.
- Reattach the arm to the shoulder with a ¼-20 x 1 SHSS. Make sure the correct arm is selected, as there is a different left and right arm.
- Position the assembled head, neck, and neck mounting block on the dummy. Attach with the two outer ¼-20 x 2-1/2 SHCS that connect the clavicle and neck block and the two rearmost ¼-20 x 2-3/4 SHCS that connect the lower neck bracket to the neck mounting block.
- Use a #4-40 x 5/8 SHCS to connect the shoulder linear potentiometer to the potentiometer hook.

3 Certification Procedures

NOTE: All certification tests in this manual are illustrated for left side certifications. Right side certification tests follow the same procedures. Setups for the right side are mirror images of those presented. For information on reversing the assembly of the dummy to the right side, see the *"Procedures for Assembly, Disassembly, and Inspection of the SID-IIsD Side Impact Crash Test Dummy"*(PADI) document

3.1 Head Certification Procedure

3.1.1 Required Instrumentation

- Head X accelerometer
- Head Y accelerometer
- Head Z accelerometer

3.1.2 Pretest Preparation

- Remove the skullcap from the head assembly (part No. 180-1000) and inspect for defects. If defects are present, repair or replace.
- Install the 3 accelerometers onto the mount (Figure 90) assuring that all axes are oriented properly.
- Install the accelerometer mount into the head (Figure 91) and tighten all screws.

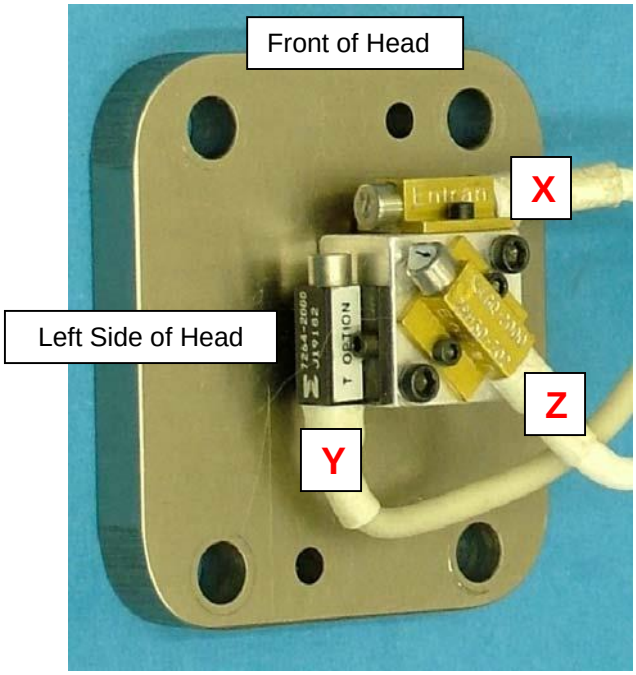

Figure 90. Installing head accelerometers

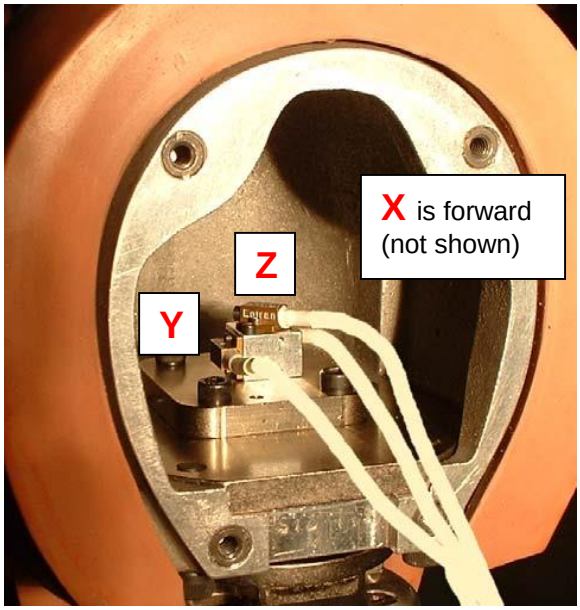

Figure 91. Installing accelerometers in head

- Replace the skullcap, taking care not to damage accelerometer wiring protruding from the head (Figure 92).
- When replacing the skullcap, use the standard skullcap bolts for all but the bottom left (for left side impacts) or bottom right (for right side impacts) bolts. Instead, insert a threaded 4.2 cm long (1.3 cm of the 4.2 cm is threaded) hex rod so that it protrudes from the skullcap. Tighten the rod into the threaded hole with a wrench. This rod will be used to route the cabling which holds the head assembly for test.
- Install the upper neck structural replacement to the base of the head.
- Clean the headskin with isopropyl alcohol and allow it to dry thoroughly.

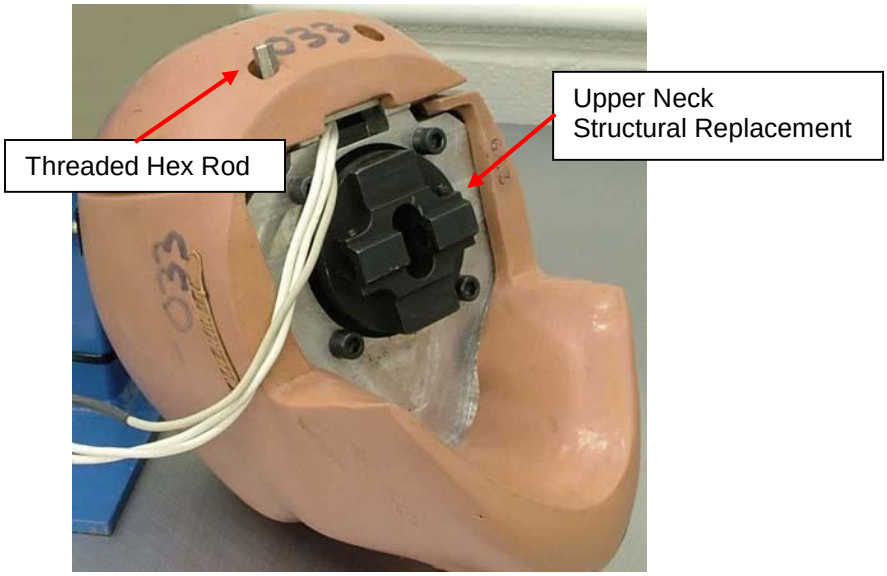

Figure 92. Head reassembly with hex rod installed for routing suspension cable

- Install the threaded Teflon® cylinder with suspension cable attached into the top of the head (Figure 93).

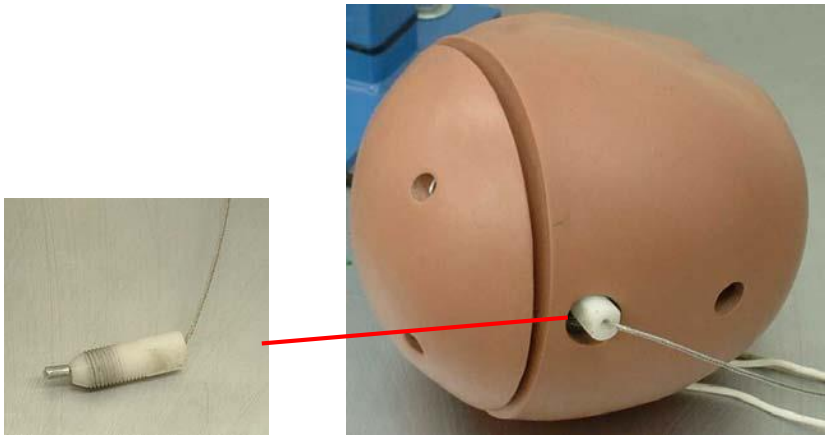

Figure 93. Securing the suspension cable to the top of the head

- Suspend the head assembly using the head suspension cables (Figure 94). Route the suspension cable around the protruding hex bolt, and between the lips.

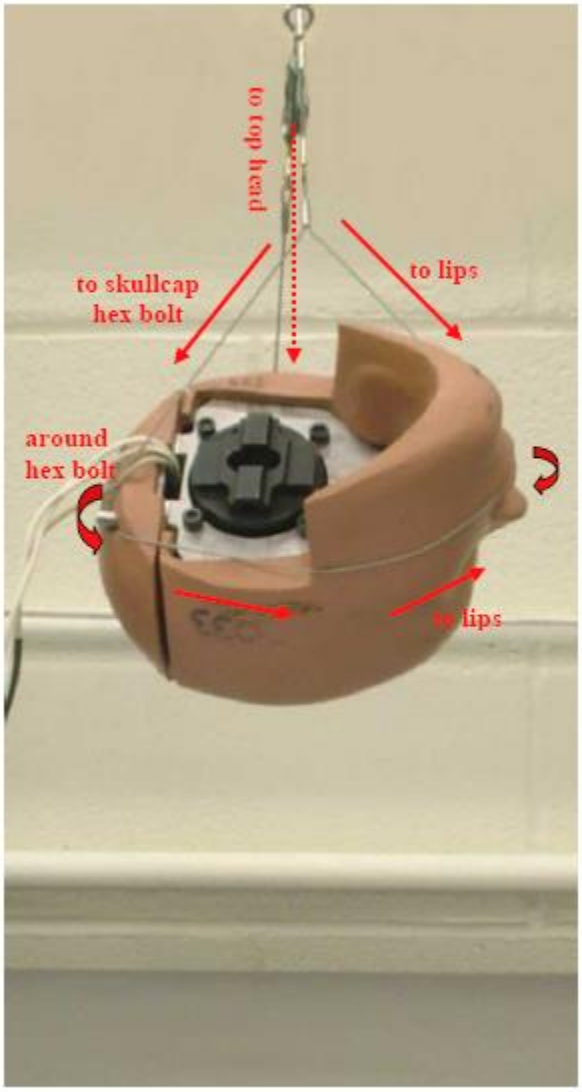

Figure 94. Routing the suspension cables for head drop tests (left side impact shown)

- Adjust the head so that the skull base/D-plane is 35° ± 1 from the vertical (Figure 95).

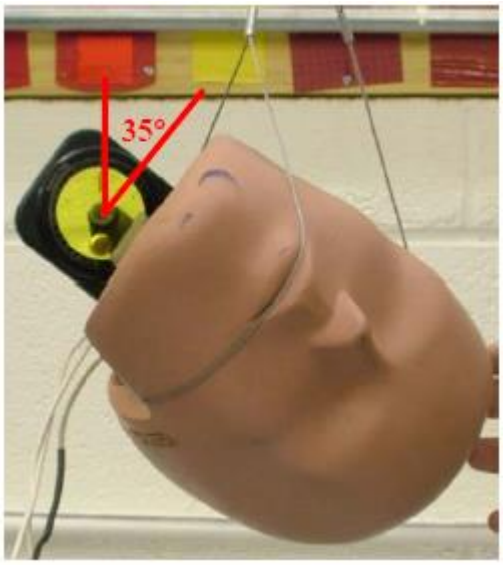

Figure 95. Adjusting the D-plane to 35° (left side impact shown)

- Level the head so that it is horizontal in the fore-aft direction (Figure 96).

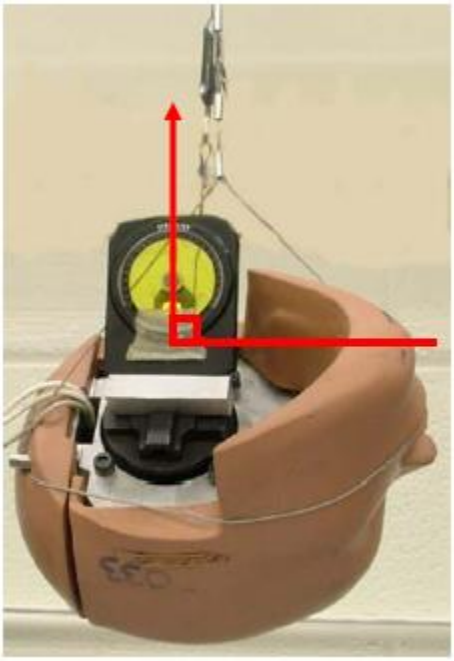

Figure 96. Leveling the head in the fore-alt direction (left side impact shown)

- Raise the head assembly so that it is 200 mm ± 1 (7.87” ± 0.04) from the impact point to the lowest point on the head (Figure 97).
- Clean the impact surface with isopropyl alcohol.

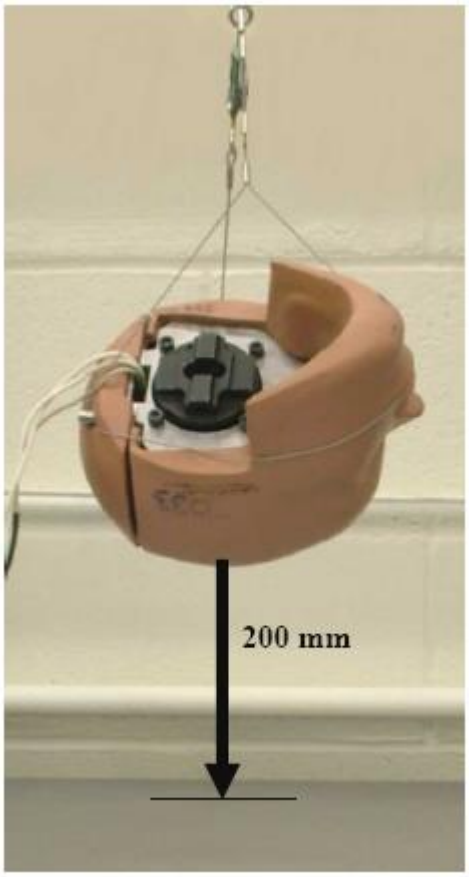

Figure 97. Raising head to proper drop height

3.2 Head Certification Test Procedure

- Configure the head certification test as described in the pre-test preparation above.
- Release the head assembly so that it falls freely to the impact surface at the proper temperature and humidity specifications.
- The data acquisition system conforms to SAE Recommended Practice J211.
- The head accelerations are collected and filtered using a Channel Class 1000 phaseless filter.
- Time zero is defined as the time of contact between the head and the impact surface. All channels are at a zero level at this point.
- Calculate the resultant head acceleration using the formula:

$$a_{res} = [(a_x)^2 + (a_y)^2 + (a_z)^2]^{1/2}$$

- The peak head resultant acceleration and peak head X acceleration lies within the proper specifications.
- Wait at least 2 hours between successive head certification tests on the same side of the head.

3.3 Neck Certification Procedure

3.3.1 Head Form & Neck Assembly

The head form that is used in the neck certification test is designed to simulate the SID-IIsD head. Table 12 lists the parts that make up the head form. The head form consists of a center bracket and a front and a rear disk (Figure 98a). The front disk represents the front of the dummy head (stamped “front head”) and the rear disk represents the rear of the dummy head (stamped “rear head”). A rotary potentiometer (often referred to as a “pot”) is mounted on the rear disk (Figure 98a) and is referred to here as the head potentiometer. An extension shaft is attached to the head potentiometer shaft by the pot shaft collar (Figure 98b).

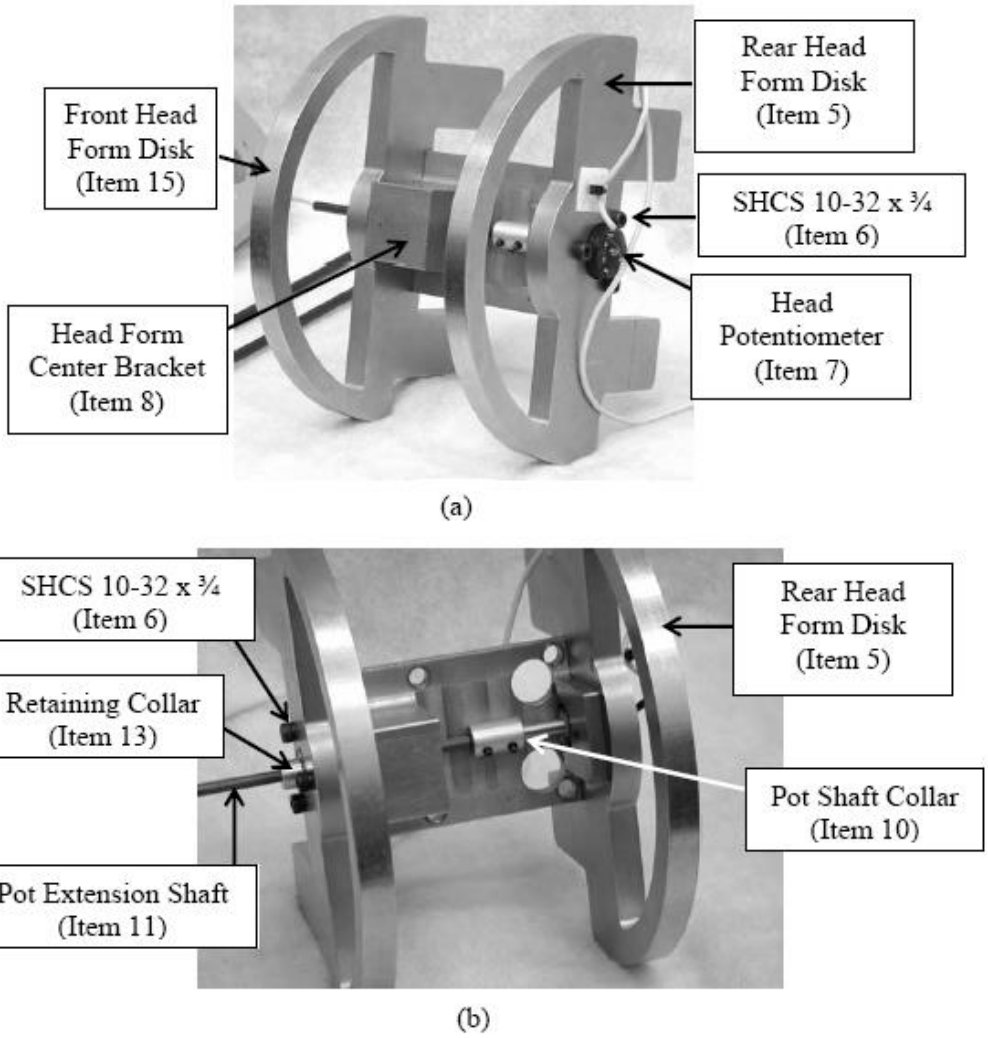

Figure 98. Head form assembly

Table 12. Head Form Parts

Item	Quantity	Part Number	Description
1	1	SA572-S11	6 channel upper neck load cell
2	4	9000115	Screw, SHCS ¼-28 x ½
3	1	180-1005	Pivot Pin, Neck Transducer
4	2	180-1007	Washer, Nodding Joint
5	1	180-9062	Head Form Rear Disk
6	6	9000151	Screw, SHCS #10-32 x ¾
7	1	SA572-S51	Chest Rotary Potentiometer
8	1	180-9011	Head Form Center Bracket
9	1	9000033	Roll Pin, 1/16 x 5/32 long
10	1	180-9051	Pot Shaft Collar
11	1	180-9050	Pot Extension Shaft
12	1	9002317	Ball Bearing
13	1	180-9052	Retaining Collar
14	4	9002360	Screw, SSCP #6-32 x 1/8
15	1	180-9061	Head Form Front Disk
16	2	9000452	Screw, SSCP #8-32 x ¼

A six-axis upper neck load cell (Item 1, Figure 99a) is mounted under the head form center bracket. The neck assembly is connected to the load cell by a pivot pin, two washers, and two set screws (Item 16, Figure 99a). The base of the neck is mounted on the neck mounting plate with four 10-24 x ⅝ SHCS and four flat washers (Figure 99b), with the bib simulator located between the base of the neck and the neck mounting plate. Four ¼ -20 SHCS are used to mount the neck and head form assembly to the Part 572 neck pendulum. Table 13 lists the parts that make up the head form assembly.

Table 13. Head Form Parts

Item	Quantity	Part Number	Description
17	1	180-9002	Head Form
18	1	180-9060	Spacer
19	1	180-9040	Potentiometer Inner-Rod Assembly
20	1	180-9030	Potentiometer Outer-Rod Assembly
21	1	180-2000	Neck Assembly (Ref.)
22	1	180-9058	Neck Mounting Plate
23	2	9001021	Screw, SHSS 5/16 x 5/8
24	2	180-9021	Bracket, Potentiometer Pivot
25	4	9000155	Screw, SSCP #6-40 x ¼
26	2	SA572-S51	Chest Rotary Potentiometer
27	2	180-9010	Potentiometer Housing Assembly
28	1	180-3006	Simulator, Bib
29	4	9000224	Screw, SHCS #10-24 x 5/8

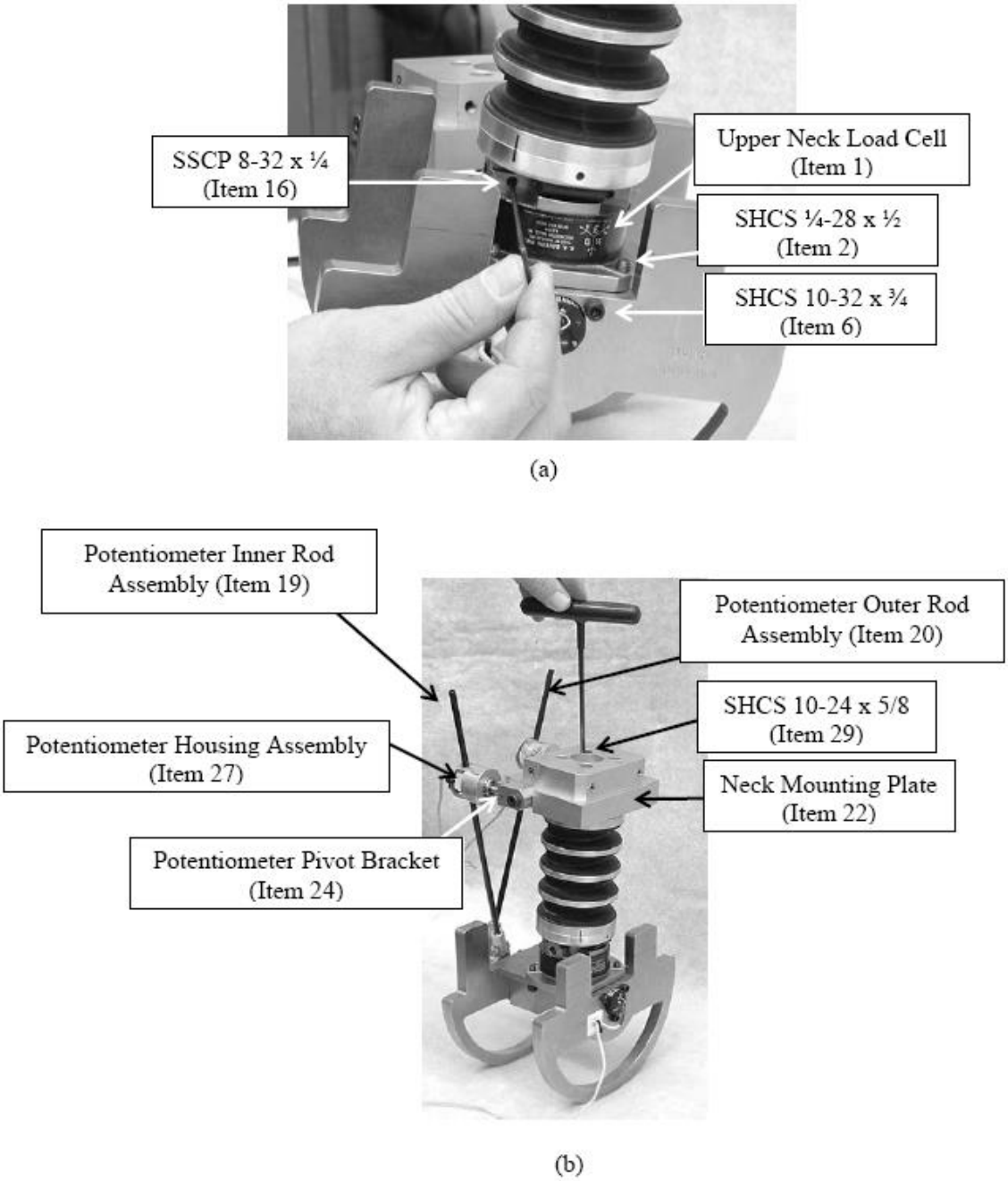

Figure 99. Head Form & Neck Assembly

3.4 Required Instrumentation

- Speed Trap
- Pendulum accelerometer
- Six-axis upper neck load cell
- Three rotational potentiometers (also referred to as “pots”)

3.5 Pretest Preparation

- Soak the neck assembly in a controlled environment at the appropriate temperature and relative humidity for at least four hours prior to a test.
- Inspect the neck for deformation, tears or breaks in the rubber. Replace the neck if deformation or damage is observed.
- Inspect the two nodding blocks for deformation or damage. Deformed nodding blocks can cause the head to rattle and allow improper loading of the nodding joint and should be replaced.
- Insert the bib simulator between the molded neck and the neck mounting plate, and assemble the molded neck to the neck mounting plate with four 10-24 x ⅝ SHCS and four flat washers.
- Remove the hex jam nut (9000018), neck cable (180-2013) and lower neck bushing (180-2005) from the neck assembly (180-2000).
- Insert the lower neck bushing into the neck mounting plate, and reinstall the neck cable and hex jam nut. Torque the nut to 10-12 in·lbs.
- Assemble the head form assembly to the neck assembly with the neck transducer pivot pin, two nodding joint washers and two set screws.
- Insert the neck mounting plate into the pendulum, screw and tighten with four ¼-20 x ⅝ SHCS. Note that the CG of the head form (and head) are not in line with the centerline of the neck, causing the head form to “sag.”
- Carefully slide one of the fiberglass pivot rods into the potentiometer housing. Then slide the clevis onto the Head potentiometer extension shaft (Figure 9, Item 11). This pot/rod assembly is referred to as the Inner Pot. Next, place the aluminum spacer onto the Head pot extension shaft, and place the second fiberglass rod into the potentiometer housing with its clevis onto the Head pot shaft. This pot/rod assembly is referred to as the Outer Pot. Lightly tighten the set screws in the Outer Pot clevis to clamp it to the shaft being careful not to damage the shaft.
- Attach the potentiometers to the neck mounting plate such that the pot rod on the outer portion of the extended Head pot shaft (Outer Pot) is closest to the honeycomb (Figure 100).
- Adjust the head form so that its centerline is parallel to the pendulum strike plate.

3.6 **Opposite Side Test Preparation**

To test the opposite side of the neck, follow these steps:

- Remove the entire assembly from the pendulum, rotate it 180 degrees and reassemble the neck mounting plate to the pendulum.
- Switch the two potentiometer and rod assemblies from the neck mounting plate ***such that the Outer Rod is always closest to the honeycomb***. Lightly tighten the set screws in the clevis of the Outer rod assembly to clamp it to the Head pot shaft

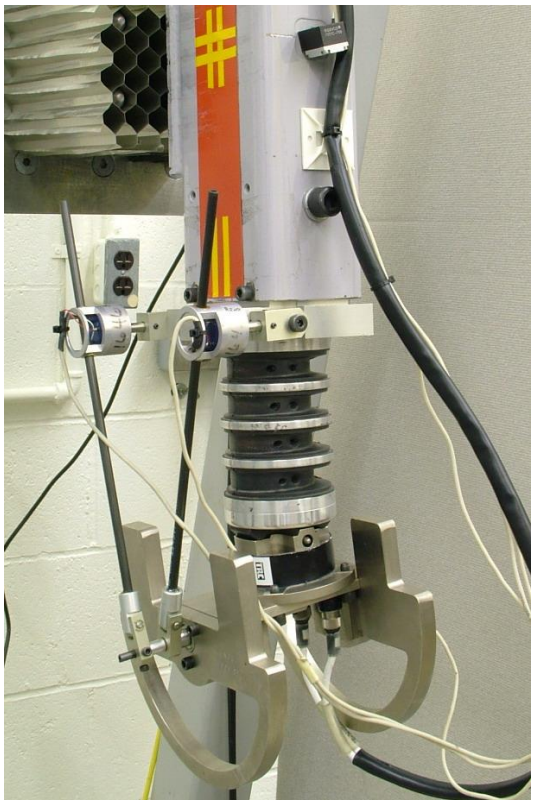

Figure 100. Correct outer and inner pot locations for a left side neck certification test

3.7 Neck Certification Test Procedure

- The neck pendulum has a mass as specified in 49 CFR Part 572 Subpart E.
- Mount an accelerometer on the pendulum with its sensitive axis on the side of the pendulum that impacts the honeycomb at the location specified in 49 CFR Part 572 Subpart E.
- Raise the pendulum and allow it to fall freely such that it achieves an impact velocity between 5.51 – 5.63 m/s at the time of contact with the arresting block at the appropriate temperature and relative humidity specifications.
- The data acquisition system conforms to SAE Recommended Practice J211.
- The pendulum acceleration is filtered using a Channel Class 180 phaseless filter.
- The potentiometers are filtered using a Channel Class 60 phaseless filter.
- The neck lateral shear force is filtered using Channel Class 600 phaseless filter for the purpose of occipital condyle calculation.
- The neck moment about the x-axis is filtered using Channel Class 600 phaseless filter.
- Time zero is defined as the time of contact between the pendulum and the honeycomb. All channels are at the zero level at this point.
- Calculate the moment about the occipital condyle for lateral flexion using the formula:

$$Mx_{oc} = Mx + (0.01778 * Fy)$$

where Mx_{oc} is the moment about the occipital condyle for lateral flexion in Newton-meters,

Mx is the moment about the x axis measured by the upper neck load cell in Newton-meters

and Fy is the lateral shear force measured by the upper neck load cell in Newtons.

- Calculate the D-plane rotation using the formula:

$$\beta_{D\text{-plane}} = \Delta\Theta_{Head} + \Delta\Theta_{Outer}$$

where $\Delta\Theta_{Head}$ and $\Delta\Theta_{Outer}$ are the deviations of the angles Θ_{Head} and Θ_{Outer} (Figure 101).

- Determine the change in pendulum deceleration by integrating the pendulum acceleration beginning at time zero.
- The test parameters must lie within the appropriate specifications.
- Wait at least 30 minutes between consecutive tests on the same neck.

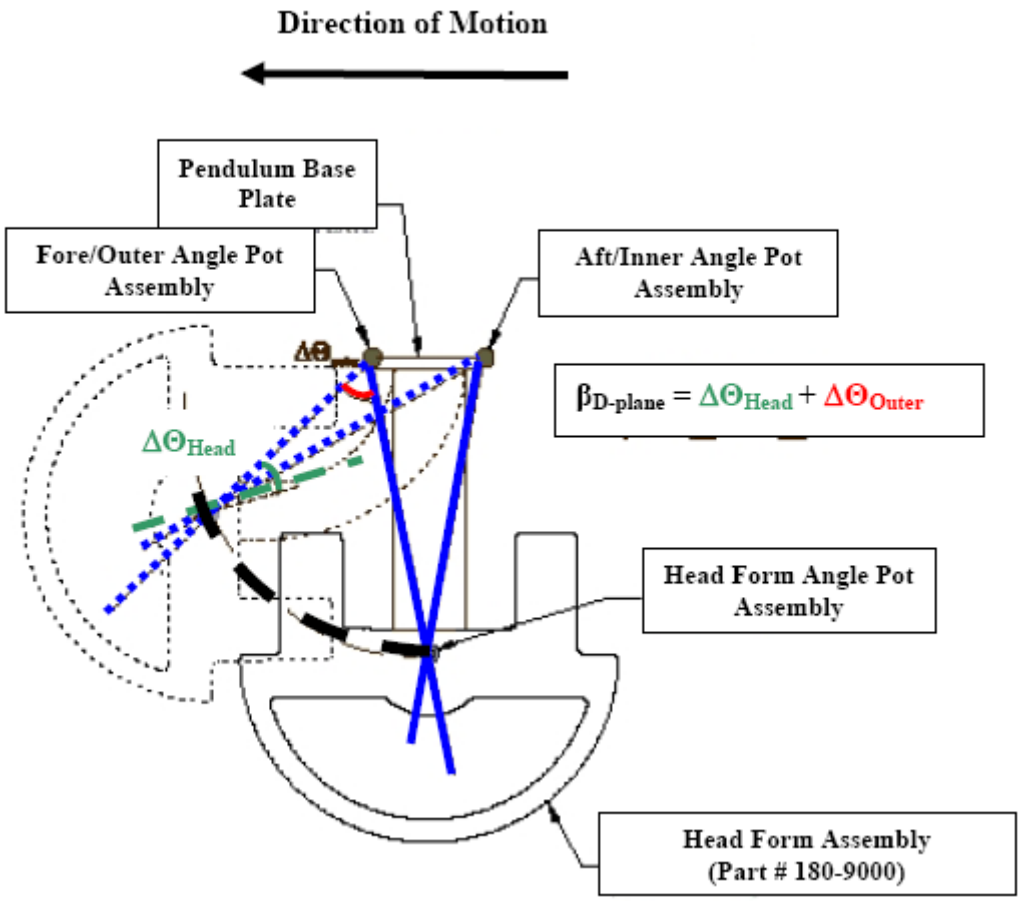

Figure 101. Angle measurements with the head form setup

3.8 Thorax with Arm Certification Procedure

3.8.1 Required Instrumentation

- Shoulder linear potentiometer
- Upper thorax linear potentiometer
- Middle thorax linear potentiometer
- Lower thorax linear potentiometer
- Upper spine (Y) accelerometer (T1)
- Lower spine (Y) accelerometer (T12)[1]
- Test probe accelerometer
- Speed Trap

[1] This is the accelerometer aligned with the first abdominal rib on the non-struck side

3.8.2 Pretest Preparation

- Install the thoracic and abdominal pads using cable ties[2].
- Place the chest jacket on the dummy.
- The dummy wears cotton underwear pants, cut off just above the knees, for this procedure, but no shirt or shoes.
- The dummy is electrically grounded using a cable between a metal component of the dummy and the ground.
- Align the upper and lower neck brackets of the neck load cell replacement so that the top edges are flush with one another[3] (Figure 102).
- Place the certification bench (Figure 104) in the probe's impact area so that the dummy can be impacted in the arm.

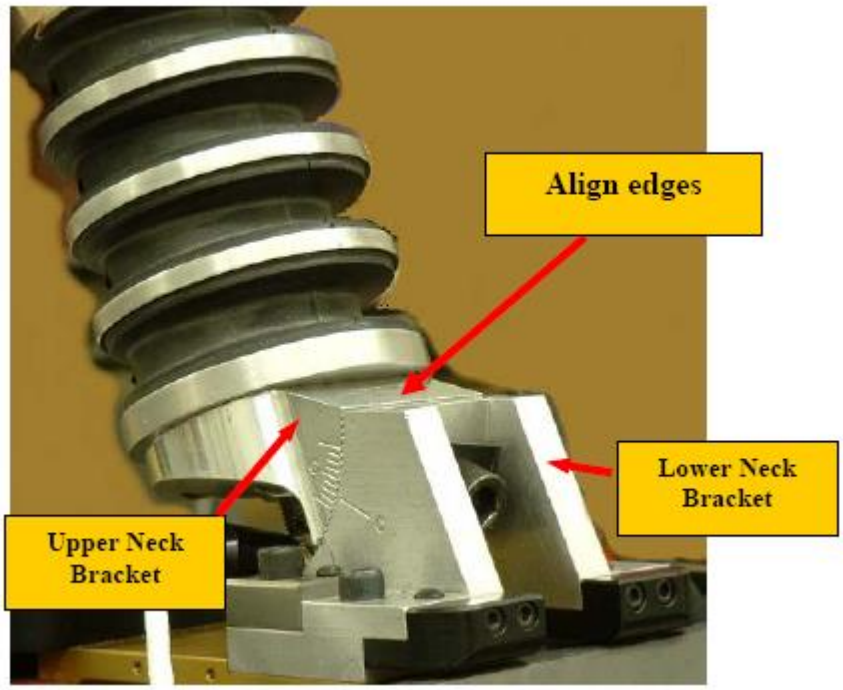

Figure 102. Aligning the upper and lower neck brackets flush for testing

[2] See Appendix A *Attachment of Thoracic and Abdominal Pads in the SID-IIsD*.
[3] The lower neck load cell should not be used since its fixed setting creates a neck angle (of ~14º) which is less than the neck angle (of ~19º) when the upper and lower neck brackets are set flush.

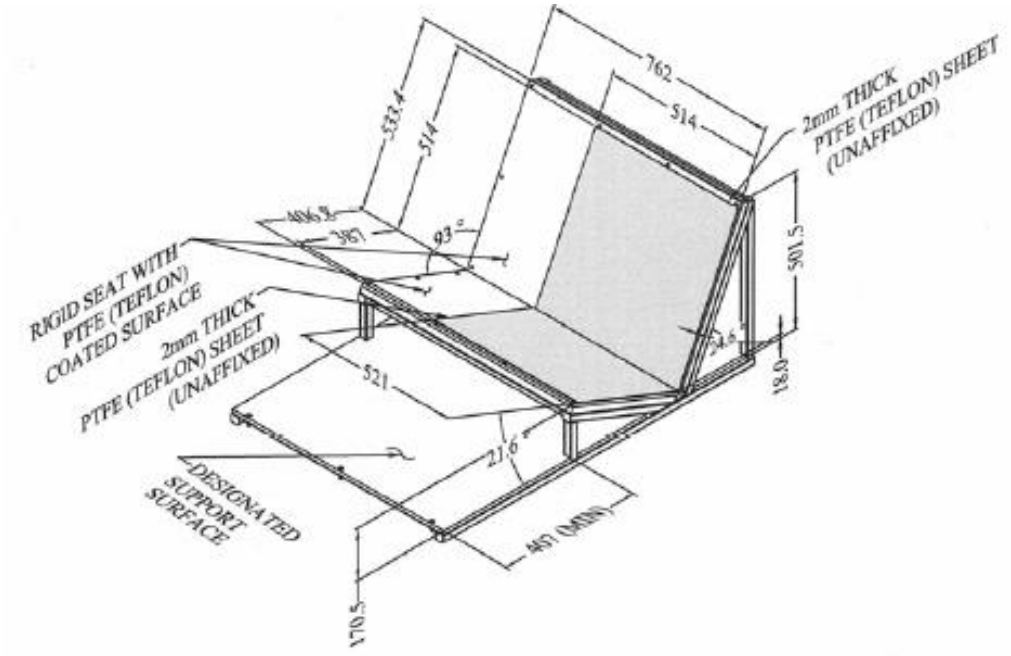

Figure 103. Certification bench seat specifications for SID-IIs D certification tests

- Seat the dummy on a sheet of 387 x 521 mm PTFE (Teflon®) (2-mm thick) on the bench. Position the dummy so that the outermost pelvic flesh is within 10 mm of the edge of the Teflon® sheet; the edge of the sheet must be along the impact side of the bench's seat pan (Figure 104).
- Place a sheet of 514 x 514 mm PTFE (Teflon®) (2-mm thick) between the seatback and the dummy's posterior thorax; the edge of the sheet must be along the impact side of the bench's seatback (Figure 104).
- Position the impact arm to its lowest detent, so that it points downward, parallel to the seatback (Figure 104).

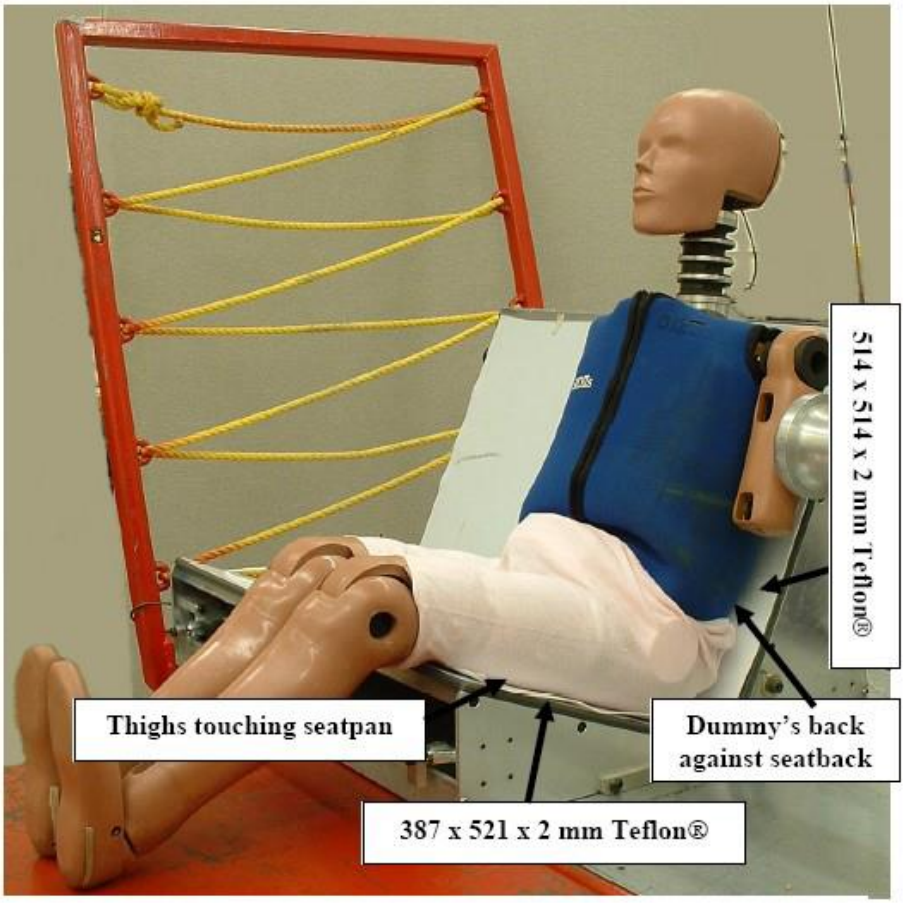

Figure 104. Thorax with arm certification test configuration for SID-IIs D

- Position the dummy so that the centerline of impact probe is centered vertically on the centerline of the middle thoracic rib within 2 mm. This corresponds to a reference measurement of 93 ± 2 mm below the centerline of the shoulder yoke assembly arm pivot when measured along the length of the arm. The center point of the impactor face is aligned horizontally with a line parallel to the seatback incline passing through the center of the shoulder yoke assembly arm rotation pivot. The face of the probe should be parallel to (± 1°), and just touching, the surface of the arm, when the pendulum probe is at its lowest position during travel (Figure 105). (Once the dummy is adjusted in the lateral and fore/aft directions (Figures 108 and 109), the probe positioning with respect to the surface of the arm jacket will be complete).
- Push the dummy's chest toward the seatback, so that the back of the thorax is touching the seatback (Figure 104).

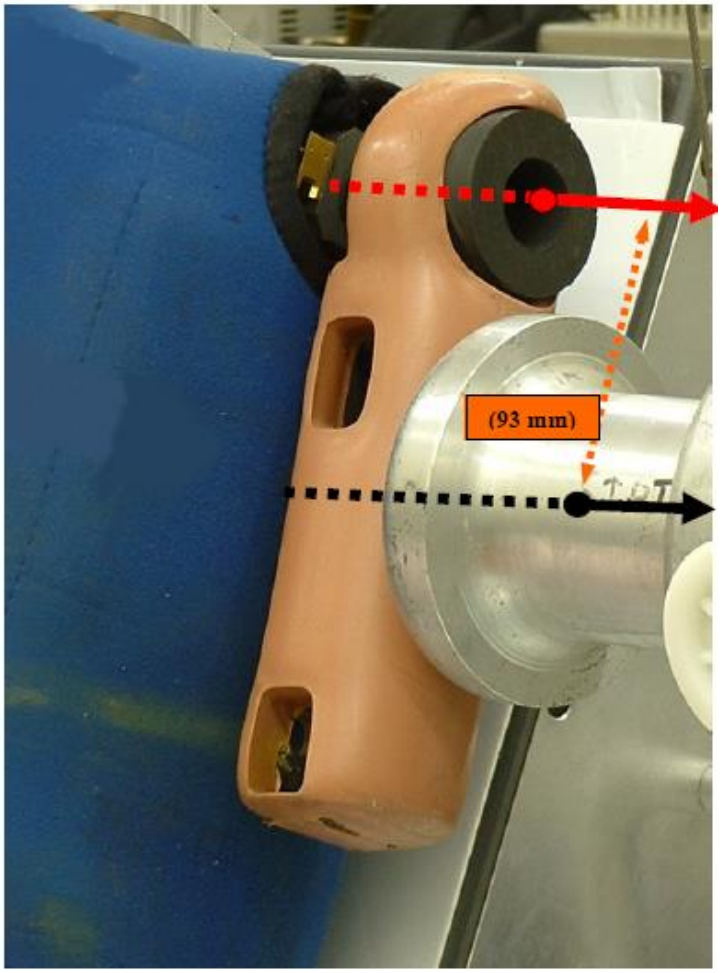

Figure 105. Impact probe position for the SID-IIs D thorax with arm certification test.

- Push the femurs downward toward the seatpan so that the thighs make full contact with the seat (Figures 104 and 106).
- Move the legs together so that the knees are as close together as possible (Figure 106).

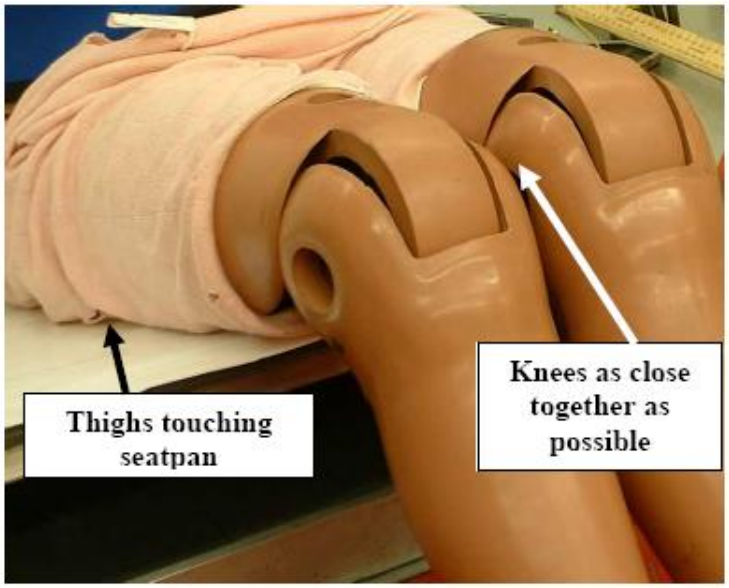

Figure 106. SID-IIs D leg positioning for thorax with arm cerification tests

- Position the feet so that they are vertical and as close together as possible, with the heels touching the surface of the support table (Figure 107).

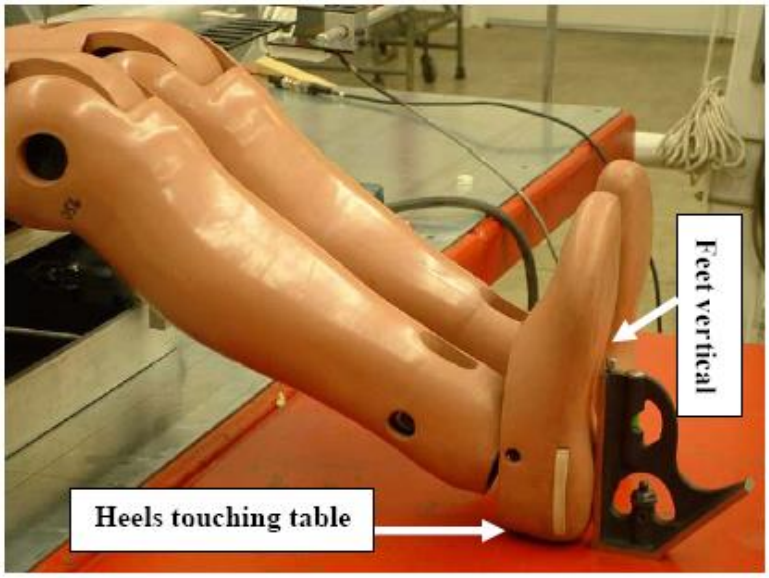

Figure 107. Feet positioning for SID-IIs D thorax with arm certification tests

- Adjust the dummy so that the thoracic lateral plane is 0° ± 1 relative to horizontal as referenced at the top surface of the lower neck bracket (Figure 108).

Figure 108. Adjusting the SID-IIs D dummy in the lateral direction for thorax with arm certification tests

- Adjust the dummy so that the thoracic fore/aft plane measures 24.6 ± 2° relative to horizontal. This measurement can be taken at the top of the shoulder rib mount (Figure 109).

Figure 109. Adjusting the SID-IIs D in the fore/aft plane for thorax with arm certification tests

3.8.3 Thorax with Arm Certification Test Procedure

- The test probe has a mass of 13.97 ± 0.023 kg[4] with a 120.7 ± 0.25 mm face diameter, and a 12.7 mm edge radius.
- Mount an accelerometer on the test probe with its sensitive axis in line with the longitudinal centerline of the test probe.
- Release the test probe within the appropriate temperature and humidity specifications so that it achieves a velocity between 6.6 – 6.8 m/s at the instant of contact with the dummy.
- At the instant of contact, the probe should be horizontal ± 1º, and the centerline of the probe should be within 2 mm of the centerline of the middle rib.
- he data acquisition system conforms to SAE Recommended Practice J211.
- The probe and spine accelerations are collected and filtered using a Channel Class 180 phaseless filter.

[4] Mass includes probe mass and all rigidly attached hardware, plus 1/3 of supporting cable weight.

- The shoulder and thoracic deflections are collected and filtered using a Channel Class 600 phaseless filter.
- Time zero is defined as the time of contact between the impact probe and the arm. All channels are at a zero level at this point.
- The maximum probe acceleration, peak rib deflections and maximum spine accelerations must lie within the proper specifications.
- Wait at least 30 minutes between successive thorax impact tests on the same thorax assembly.

3.9 Thorax without Arm Certification Procedure

3.9.1 Required Instrumentation

- Upper thorax linear potentiometer
- Middle thorax linear potentiometer
- Lower thorax linear potentiometer
- Upper spine Y accelerometer (T1)
- Lower spine Y accelerometer (T12)[5]
- Test probe accelerometer
- Speed Trap

3.9.2 Pretest Preparation

- Remove the arm on the impact side.
- Install the thoracic and abdominal pads using cable ties[6].
- Place the chest jacket on the dummy.
- The dummy wears cotton underwear pants, cut off just above the knees, for this procedure, but no shirt or shoes.
- The dummy is electrically grounded using a cable between a metal component of the dummy and the ground.
- Align the upper and lower neck brackets of the neck load cell replacement so that the top edges are flush with one another[7] (Figure 102).
- Place the certification bench (Figure 103) in the probe's impact area so that the dummy can be impacted in the thorax.
- Seat the dummy on a sheet of 387 x 521 mm PTFE (Teflon®) (2-mm thick) on the bench. Position the dummy so that the outermost pelvic flesh is within 10 mm of the edge of the Teflon® sheet; the edge of the sheet must be along the impact side of the bench's seat pan (Figure 110).
- Place a sheet of 514 x 514 mm PTFE (Teflon®) (2-mm thick) between the seatback and the dummy's posterior thorax; the edge of the sheet must be along the impact side of the bench's seatback (Figure 110).

[5] This is the accelerometer aligned with the first abdominal rib on the non-struck side.
[6] See Appendix A Attachment of Thoracic and Abdominal Pads in the SID-IIsD.
[7] The lower neck load cell should not be used since its fixed setting creates a neck angle (of ~14º) which is less than the neck angle (of ~19º) when the upper and lower neck brackets are set flush.

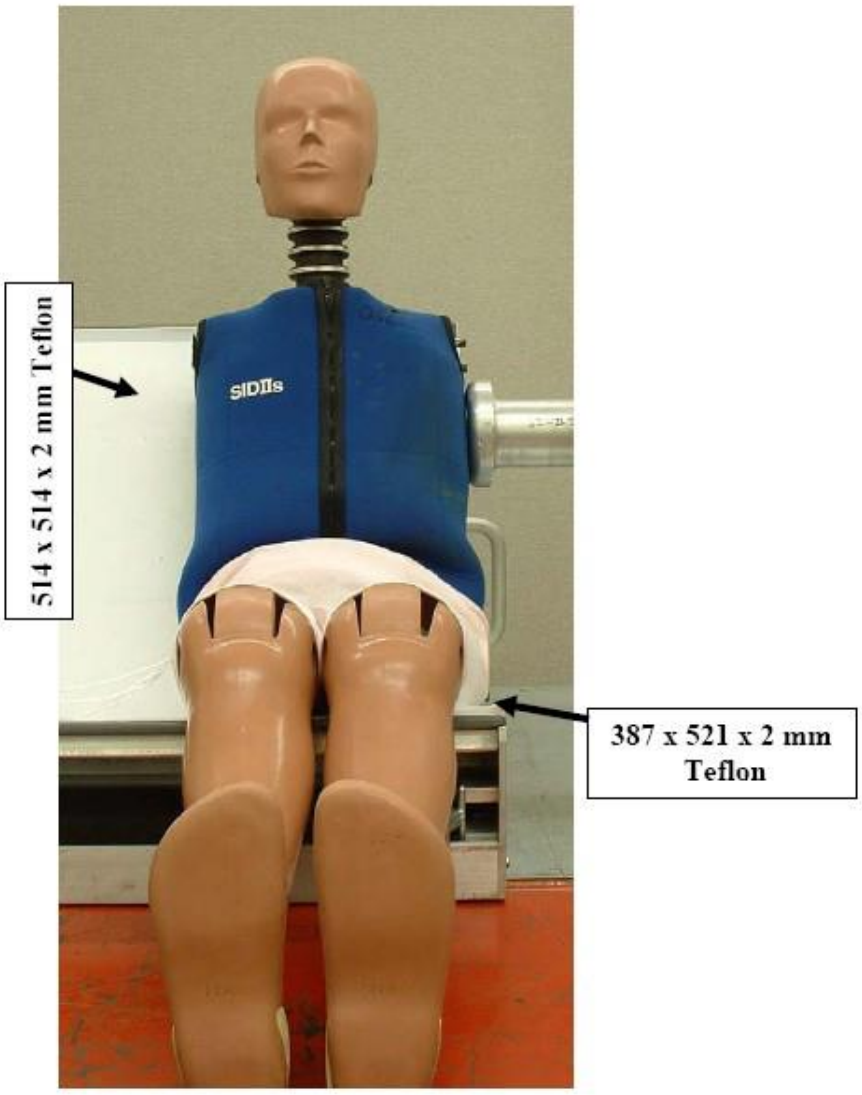

Figure 110. Thorax without arm certification test configuration for SID-IIs D

- Position the dummy so that the centerline of impact probe is vertically centered on the centerline of the middle thoracic rib within 2 mm. This corresponds to a reference measurement of 93 ± 2 mm below the centerline of the shoulder yoke assembly arm pivot when measured along a line parallel to the seatback (Figure 111). The center point of the impactor face is aligned horizontally with a line parallel to the seatback incline passing through the center of the shoulder yoke assembly arm pivot. The face of the probe should be approximately parallel to, and just touching, the surface of the thorax, when the pendulum probe is at its lowest position during travel. (Once the dummy is adjusted in the lateral and fore/aft directions (Figures 114 and 115), the probe positioning with respect to the surface of the thorax jacket will be complete).
- Push the dummy's chest toward the seatback, so that the back of the thorax is touching the seatback (Figure 111).

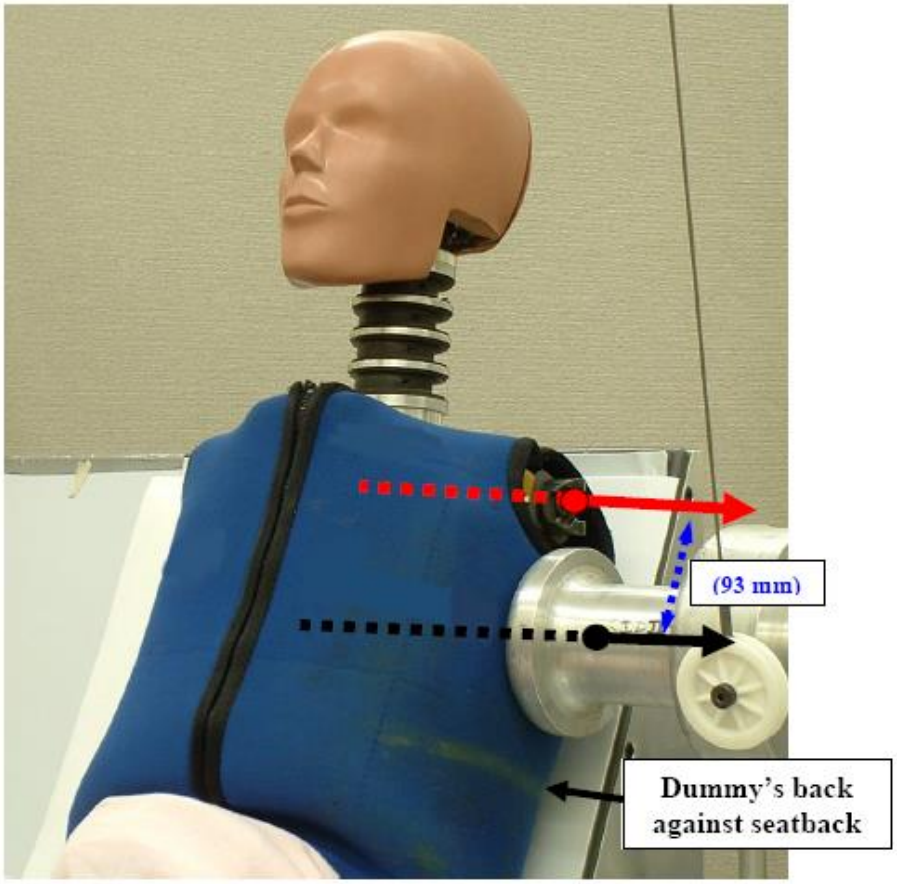

Figure 111. Impact probe position for the SID-IIs D thorax without arm certification test

- Push the femurs downward toward the seatpan so that the thighs make full contact with the seat (Figure 112).
- Move the legs together so that the knees are as close together as possible (Figure 112).

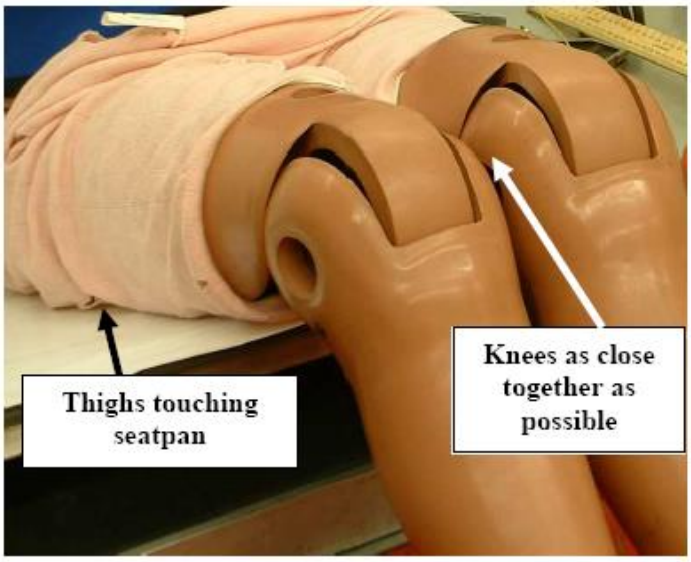

Figure 112. SID-IIs D leg positioning for thorax without arm certification tests

- Position the feet so that they are vertical and as close together as possible, with the heels touching the surface of the support table (Figure 113).

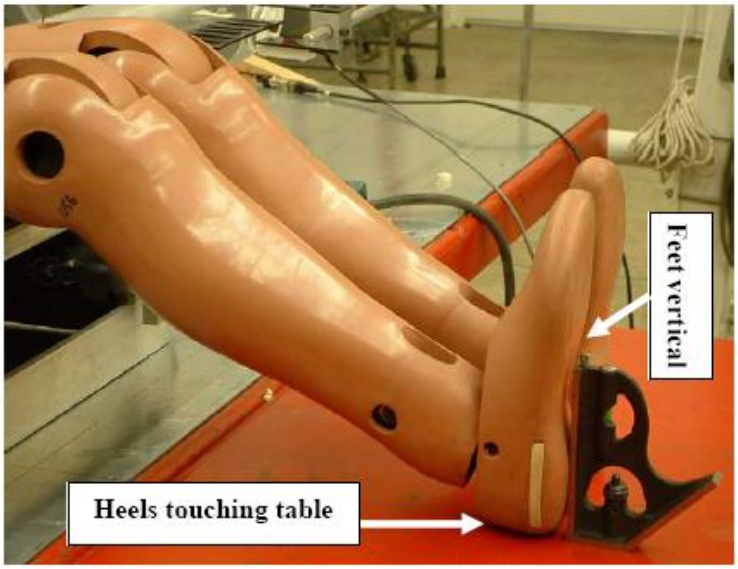

Figure 113. Feet positioning for SID-IIs D thorax without arm certification tests

- Adjust the dummy so that the thoracic lateral plane is 0° ± 1 relative to horizontal as referenced at the top surface of the lower neck bracket (Figure 114).
- Once this positioning is complete, the face of the probe should be approximately parallel to (± 1°), and just touching, the surface of the thorax, when the pendulum probe is at its lowest position during travel.

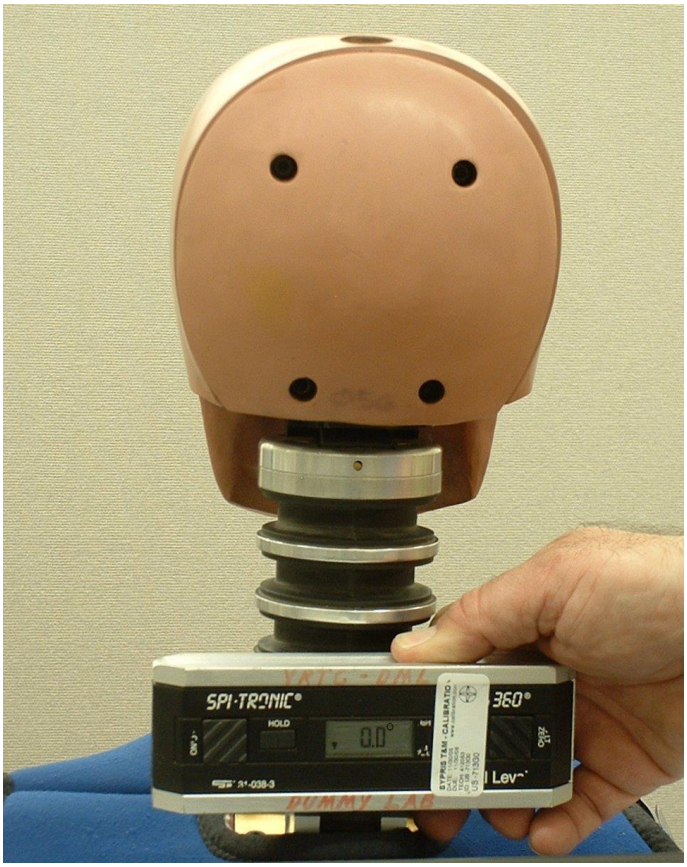

Figure 114. Adjusting the SID-IIs D dummy in the lateral direction for thorax without arm certification tests

- Adjust the dummy so that the thoracic fore/aft plane measures 24.6 ± 2° relative to horizontal. This measurement can be taken at the top of the shoulder rib mount (Figure 115).

Figure 115. Adjusting the SID-IIs D dummy in the fore/aft plane for thorax without arm certification tests

3.10 **Thorax without Arm Certification Test Procedure**

- The test probe has a mass of 13.97 ± 0.023 kg[8] with a 120.7 ± 0.25 mm face diameter, and a 12.7 mm edge radius.
- Mount an accelerometer on the test probe with its sensitive axis in line with the longitudinal centerline of the test probe.
- Release the test probe within the appropriate temperature and humidity specifications so that it achieves a velocity between 4.2 – 4.4 m/s at the instant of contact with the dummy.
- At the instant of contact, the probe should be horizontal ± 1º, and the centerline of the probe should be within 2 mm of the centerline of the middle rib.
- The data acquisition system conforms to SAE Recommended Practice J211.
- The probe and spine accelerations are collected and filtered using a Channel Class 180 phaseless filter.

[8] Mass includes probe mass and all rigidly attached hardware, plus 1/3 of supporting cable weight

- The rib deflections are collected and filtered using a Channel Class 600 phaseless filter.
- Time zero is defined as the time of contact between the impact probe and the thorax. All channels are at a zero level at this point.
- The maximum probe acceleration, peak rib deflections and maximum spine accelerations must lie within the proper specifications.
- Wait at least 30 minutes between successive thorax impact tests on the same thorax assembly.

3.11 Abdomen Certification Procedure

3.11.1 Required Instrumentation

- Upper abdominal linear potentiometer
- Lower abdominal linear potentiometer
- Lower spine (Y) accelerometer (T12)[9]
- Test probe accelerometer
- Speed Trap

3.11.2 Pretest Preparation

- Remove the arm on the impact side.
- Install the thoracic and abdominal pads using cable ties[10].
- Place the chest jacket on the dummy.
- The dummy wears cotton underwear pants, cut off just above the knees, for this procedure, but no shirt or shoes.
- The dummy is electrically grounded using a cable between a metal component of the dummy and the ground.
- Align the upper and lower neck brackets of the neck load cell replacement so that the top edges are flush with one another[11] (Figure 102).
- Place the certification bench (Figure 103) in the probe's impact area so that the dummy can be impacted in the abdomen.
- Seat the dummy on a sheet of 387 x 521 mm PTFE (Teflon®) (2-mm thick) on the bench. Position the dummy so that the outermost pelvic flesh is within 10 mm of the edge of the Teflon® sheet; the edge of the sheet must be along the impact side of the bench's seat pan (Figure 116).
- Place a sheet of 514 x 514 mm PTFE (Teflon®) (2-mm thick) between the seatback and the dummy's posterior thorax; the edge of the sheet must be along the impact side of the bench's seatback (Figure 116).

[9] This is the accelerometer aligned with the first abdominal rib on the non-struck side.
[10] See Appendix A *Attachment of Thoracic and Abdominal Pads in the SID-IIsD*.
[11] The lower neck load cell should not be used since its fixed setting creates a neck angle (of ~14º) which is less than the neck angle (of ~19º) when the upper and lower neck brackets are set flush.

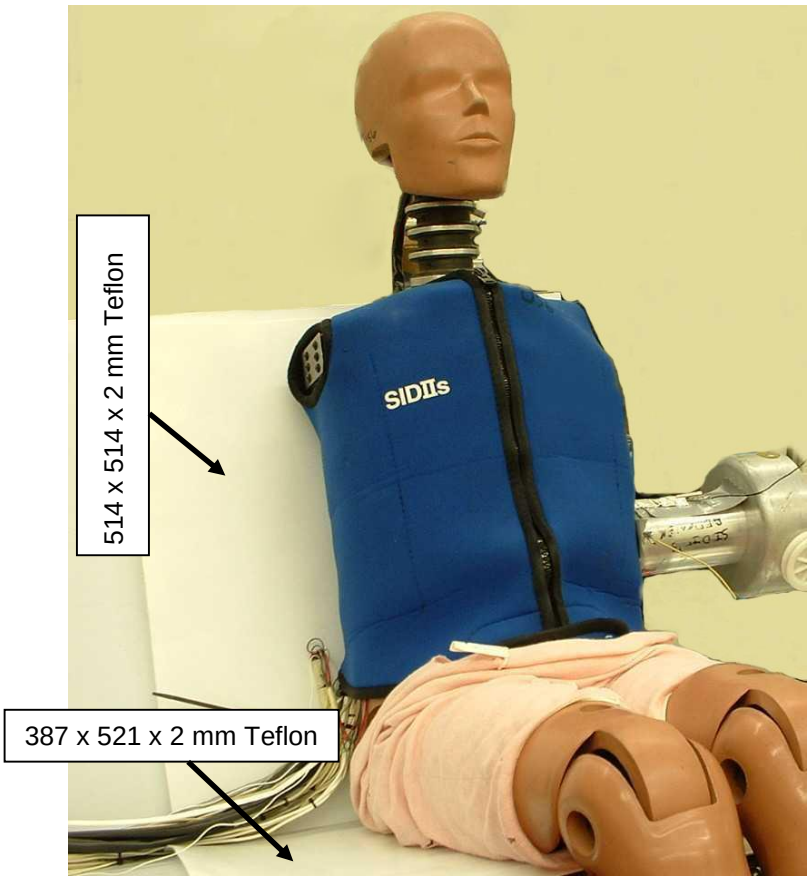

Figure 116. Abdomen certification test configuration for SID-IIsD

- Position the dummy so that the centerline of impact probe is centered vertically on the midpoint between the two abdominal ribs within 2 mm. This corresponds to a reference measurement of 208 ± 2 mm below the centerline of the shoulder yoke assembly arm pivot when measured along a line parallel to the seatback (Figure 117). The center point of the impactor face is aligned horizontally with a line parallel to the seatback incline passing through the center of the shoulder yoke assembly arm rotation pivot. The face of the probe should be approximately parallel to, and just touching, the surface of the abdomen, when the pendulum probe is at its lowest position during travel. (Once the dummy is adjusted in the lateral and fore/aft directions (Figures 120 and 121), the probe positioning with respect to the surface of the jacket at the abdomen will be complete).
- Push the dummy's chest toward the seatback, so that the back of the thorax is touching the seatback (Figure 117).

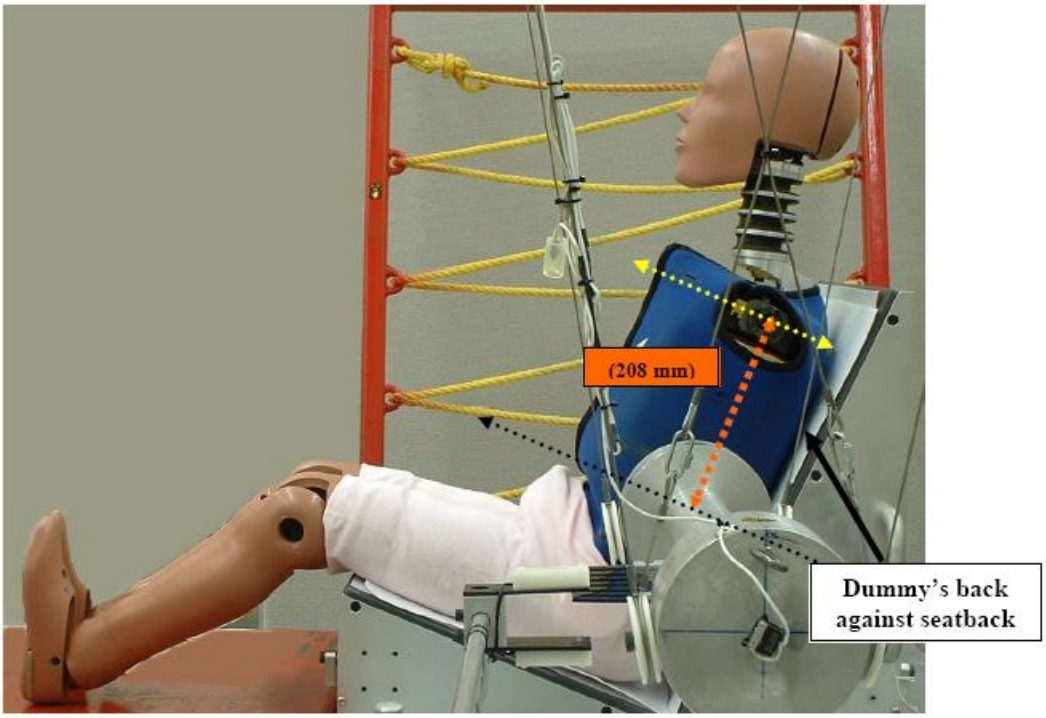

Figure 117. Impact probe position for the SID-IIs D abdomen certification test

- Push the femurs downward toward the seatpan so that the thighs make full contact with the seat (Figure 118).
- Move the legs together so that the knees are as close together as possible (Figure 118).

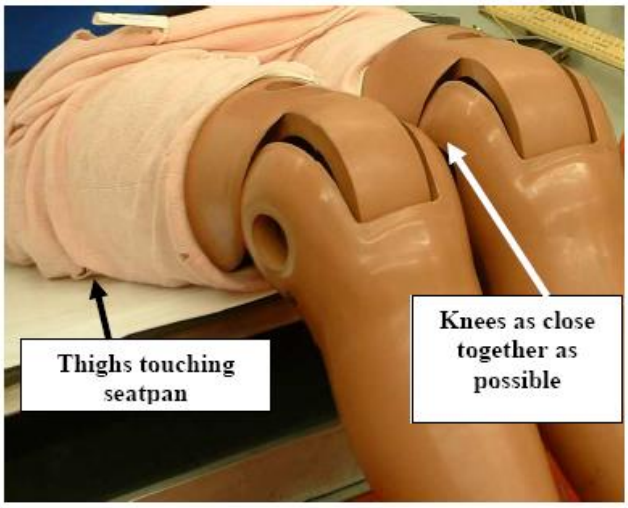

Figure 118. SID-IIs D leg positioning for abdomen certification tests

- Position the feet so that they are vertical and as close together as possible, with the heels touching the surface of the support table (Figure 119).

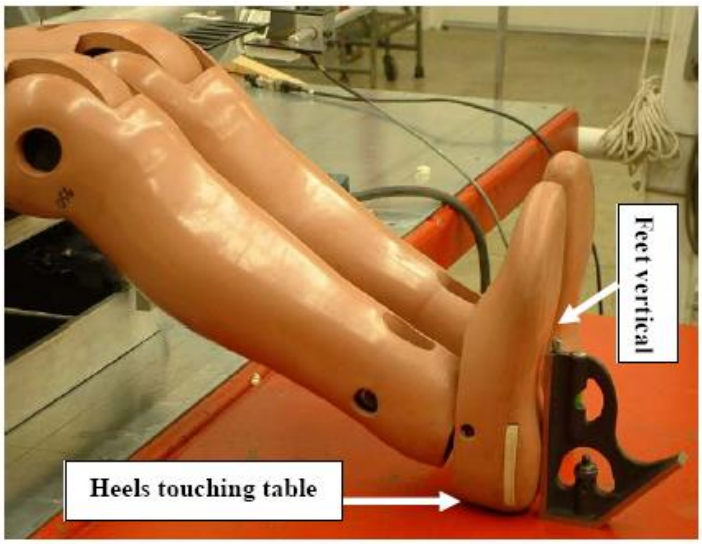

Figure 119. Feet positioning for SID-IIs D abdomen certification tests

- Adjust the dummy so that the thoracic lateral plane is 0° ± 1 relative to horizontal as referenced at the top surface of the lower neck bracket (Figure 120).
- Once this positioning is complete, the face of the probe should be approximately parallel to (± 1°), and just touching, the surface of the abdomen, when the pendulum probe is at its lowest position during travel.

Figure 120. Adjusting the SID-IIs D dummy in the lateral direction for abdomen certification tests

- Adjust the dummy so that the thoracic fore/aft plane measures 24.6 ± 2° relative to horizontal. This measurement can be taken at the top of the shoulder rib mount (Figure 121).

Figure 121. Adjusting the SID-IIs D in the fore/aft plane for abdomen certification tests

3.11.3 Abdomen Certification Test Procedure

- The test probe has a mass of 13.97 ± 0.023 kg[12]. The probe tip[13] has a 76.2 ± 0.25 mm face diameter and a 12.7 mm edge radius.
- Mount an accelerometer on the test probe with its sensitive axis in line with the longitudinal centerline of the test probe.
- Release the test probe within the appropriate temperature and humidity specifications so that it achieves a velocity between 4.2 – 4.4 m/s at the instant of contact with the dummy.

[12] Mass includes probe mass and all rigidly attached hardware, plus 1/3 of supporting cable weight.
[13] Note that this probe tip differs from the probe tip used in the other certification tests.

- At the instant of contact, the probe should be horizontal ± 1º, and the centerline of the probe should be within 2 mm of the centerline between the abdominal ribs.
- The data acquisition system conforms to SAE Recommended Practice J211.
- The probe and spine accelerations are collected and filtered using a Channel Class 180 phaseless filter.
- The abdominal deflections are collected and filtered using a Channel Class 600 phaseless filter.
- Time zero is defined as the time of contact between the impact probe and the abdomen. All channels are at a zero level at this point.
- The maximum probe acceleration, peak rib deflections and maximum lower spine acceleration must lie within the proper specifications.
- Wait at least 30 minutes between successive abdomen impact tests on the same abdomen assembly.

3.12 Pelvis Certification Procedure

3.12.1 PART I: Pelvis Plug Quasi-Static Certification Procedure

3.12.1.1 Required Instrumentation

- Compression head displacement
- Compression head force

3.12.1.2 Pretest Preparation

- The compression device utilized for this test must be capable of:
- achieving a quasi-static compression rate between 12.7 mm/min (0.5”/min) and 50.8 mm/min (2”/min)
- sampling data at an acquisition rate minimum of 20 Hz
- measuring force
- measuring displacement
- halting at a specified displacement level
-
- Both the support and compression head surfaces have length and width dimensions greater than the diameter of the pelvis plug (7.4 cm) so that the top and bottom surfaces of the plug are fully engaged with the contact surfaces (Figure 122).

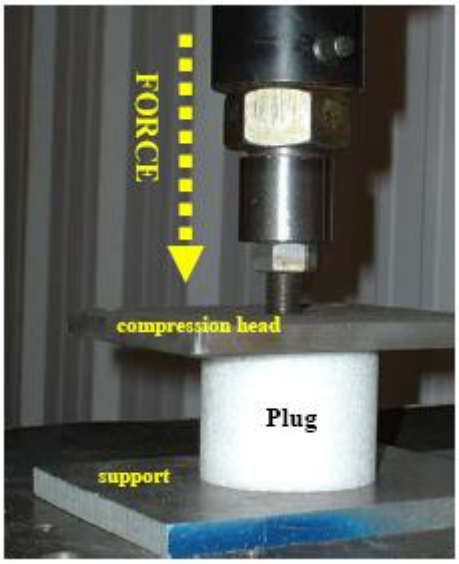

Figure 122. Pelvis plug certification test setup

- The contact surfaces are clean, dry, solid, flat, and free of surface abnormalities.
- Assure that the compression head surface and support surfaces are parallel.
- Place the pelvis plug on the support surface and center it under the compression head surface, assuring that the top and bottom of the plug are in full contact with the surfaces.
- Select a maximum displacement located within the specification box (see Pelvis Plug drawing 180-4450-3) as a halting point for the compression head.
- Configure the compression system to halt (and return) at the specified displacement.

3.12.1.3 Pelvis Plug Certification Test Procedures

- The force and displacement measurements are collected at a minimum sample rate of 20 Hz.
- Pre-load the pelvis plug to 22.2N (5lb) and zero both the force and displacement measurement channels. Time zero is defined at this point and all channels are at a zero level.
- With the channels at zero level, compress the plug at a quasi-static rate, nominally 12.7 mm/min (0.5”/min), but no greater than 50.8 mm/min (2”/min).
- When the displacement reaches the selected value from the specification box indicated, the compression head is halted and immediately reversed until the load is completely alleviated from the plug.
- The force-displacement characteristics of the plug must be measured within the corridors (see Pelvis Plug drawing 180-4450-3).
- Wait at least 4 hours before utilizing the pelvis plug in any dummy test (including acetabulum certification).

3.12.2 PART II: Acetabulum Pendulum Certification Procedure

3.12.2.1 Required Instrumentation

- Pelvis (Y) accelerometer
- Test probe accelerometer
- Acetabulum load cell
- Speed Trap

3.12.2.2 Pretest Preparation

- Remove the chest jacket from the dummy.
- Be sure the thoracic and abdominal pads are installed using cable ties[14].
- Install a certified pelvis plug (see ***PART I: Pelvis Plug Quasi-Static Certification Procedures***). Be certain that the plug is fully seated in the cavity by pushing on the end of the plug until it fully contacts the acetabulum load cell surface.
- Position the arm on the impact side downwards (lowest detent) and perpendicular to the seating surface.
- The dummy wears no clothing or shoes for this procedure.
- The dummy is electrically grounded using a cable between a metal component of the dummy and the ground.
- Align the upper and lower neck brackets of the neck load cell replacement so that the top edges are flush with one another[15] (Figure 102).
- Place the certification bench (Figure 103) in the probe's impact area so that the dummy can be impacted in the pelvis.
- Seat the dummy on a sheet of 387 x 521 mm PTFE (Teflon®) (2-mm thick) on the bench. Position the dummy so that the outermost pelvic flesh is within 10 mm of the edge of the Teflon® sheet; the edge of the sheet must be along the impact side of the bench's seat pan (Figure 123).
- Place a sheet of 514 x 514 mm PTFE (Teflon®) (2-mm thick) between the seatback and the dummy's posterior thorax; the edge of the sheet must be along the impact side of the bench's seatback (Figure 123).
- Position the dummy so that the centerline of impact probe is centered on the centerline of the acetabulum load cell within 2 mm. The face of the probe should be parallel to (± 1°), and just touching, the surface of the pelvis plug, when the pendulum probe is at its lowest position during travel (Figure 124).

[14] See Appendix A *Attachment of Thoracic and Abdominal Pads in the SID-IIsD*.

[15] The lower neck load cell should not be used since its fixed setting creates a neck angle (of ~14º) which is less than the neck angle (of ~19º) when the upper and lower neck brackets are set flush.

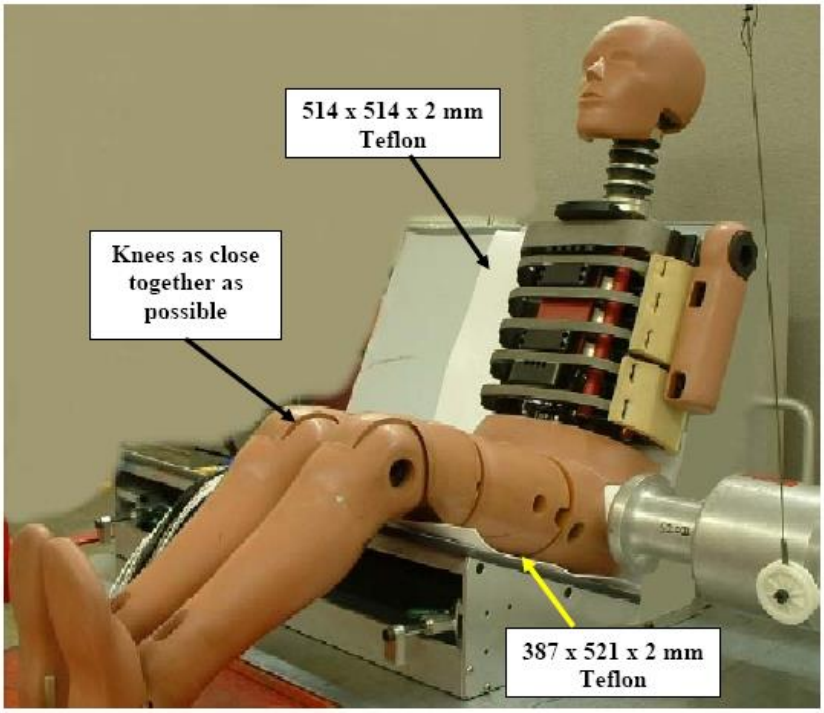

Figure 123. Acetabulum certification test for SID-IIs D

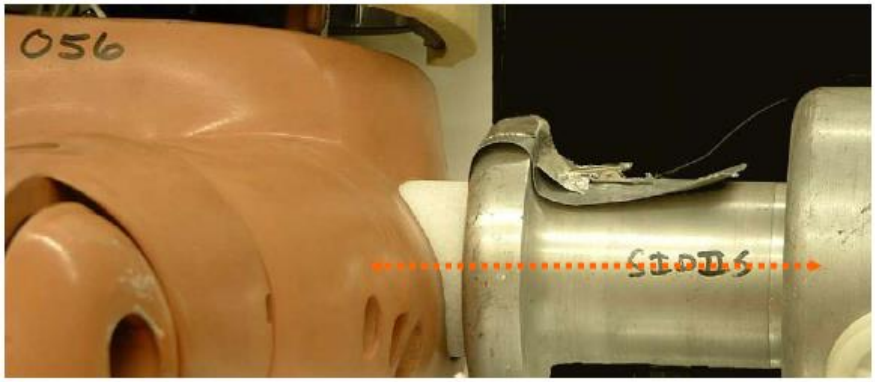

Figure 124. Impact probe position for the SID-IIs D acetabulum certification test

- Push the dummy's chest toward the seatback, so that the back of the thorax is touching the seatback (Figure 125).
- Push the femurs downward toward the seatpan so that the thighs make full contact with the seat (Figure 125).
- Move the legs together so that the knees are as close together as possible (Figure 123).

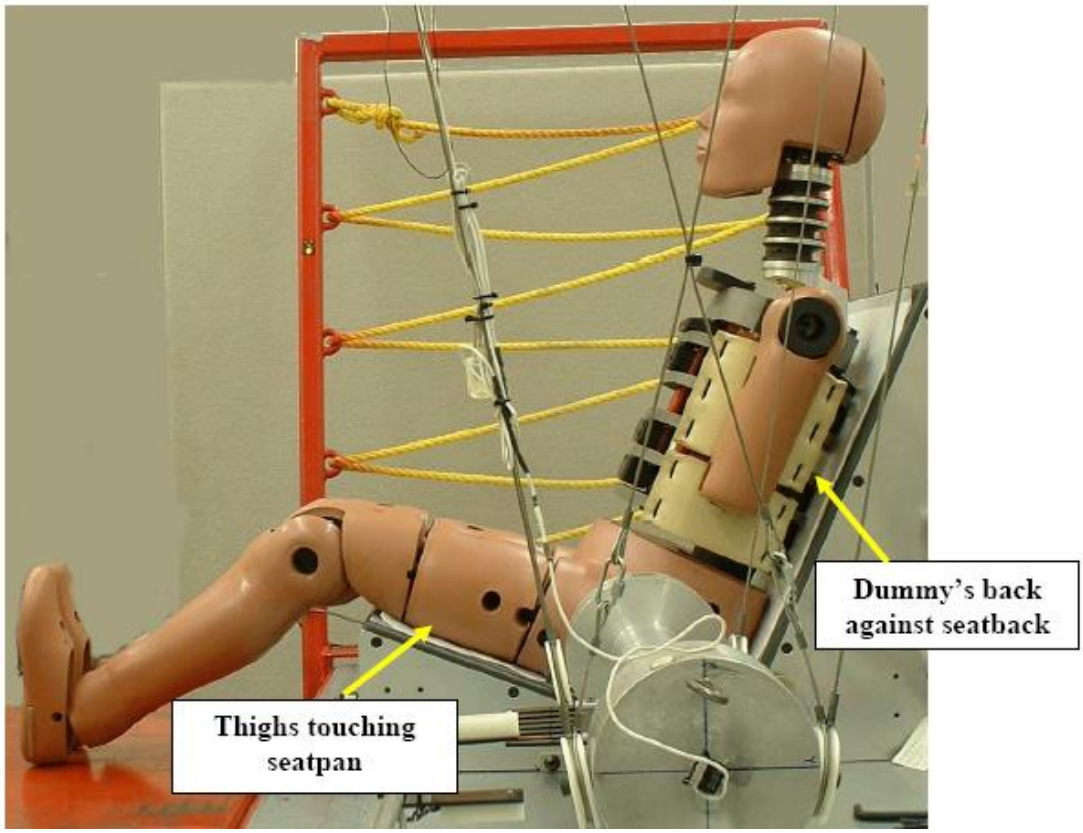

Figure 125. SID-IIs D leg and back positioning for acetabulum certification tests

- Position the feet so that they are vertical and as close together as possible, with the heels touching the surface of the support table (Figure 126).

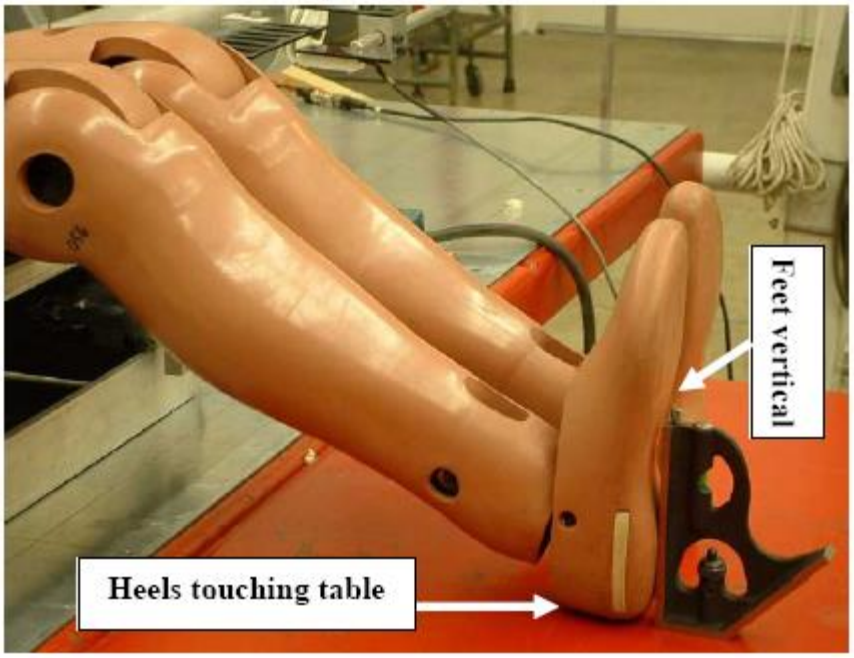

Figure 126. Feet positioning for SID-IIs D acetabulum certification tests

• Adjust the dummy so that the thoracic lateral plane is 0° ± 1 relative to horizontal as referenced at the top surface of the lower neck bracket (Figure 127).

Figure 127. Adjusting the SID-IIs D dummy in the lateral direction for acetabulum certification tests

- Adjust the dummy so that the thoracic fore/aft plane measures 24.6 ± 2° relative to horizontal. This measurement can be taken at the top of the shoulder rib mount (Figure 128).

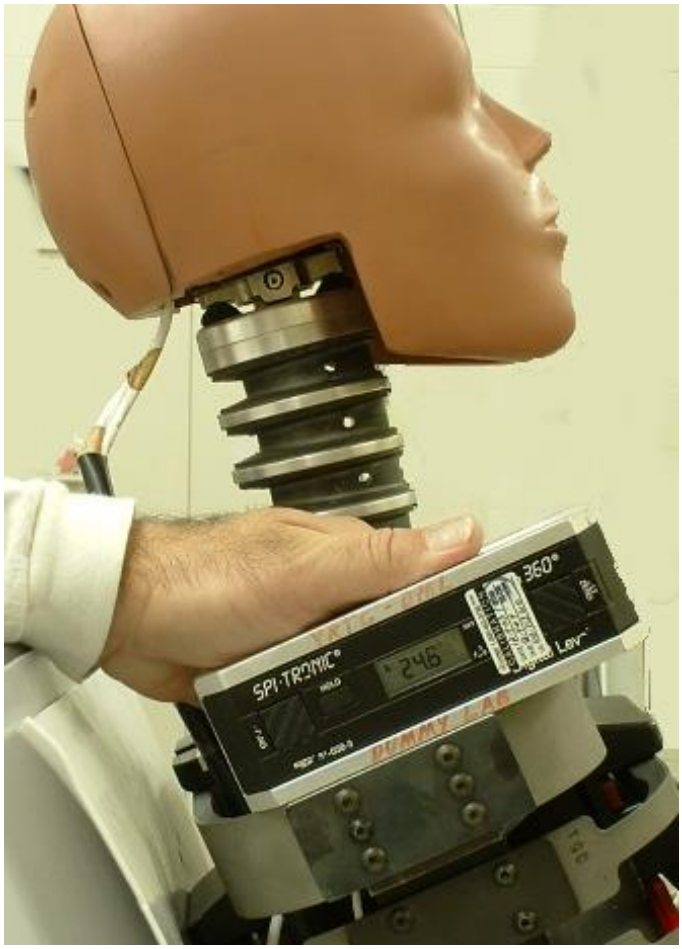

Figure 128. Adjusting the SID-IIs D in the fore/aft plane for acetabulum certification tests

3.12.2.3 Acetabulum Certification Test Procedure

- The test probe has a mass of 13.97 ± 0.023 kg[16]. The probe tip has a 120.7 ± 0.25 mm face diameter and a 12.7 mm edge radius.
- Mount an accelerometer on the test probe with its sensitive axis in line with the longitudinal centerline of the test probe.

[16] Mass includes probe mass and all rigidly attached hardware, plus 1/3 of supporting cable weight.

- Release the test probe within the appropriate temperature and humidity specifications so that it achieves a velocity between 6.6 – 6.8 m/s at the instant of contact with the dummy.
- At the instant of contact, the probe should be horizontal ± 1º, and the centerline of the probe should be within 2 mm of the centerline of the acetabulum load cell.
- The data acquisition system conforms to SAE Recommended Practice J211.
- The probe and pelvis accelerations are collected and filtered using a Channel Class 180 phaseless filter.
- The acetabulum force is collected and filtered using a Channel Class 600 phaseless filter.
- Time zero is defined as the time of contact between the impact probe and the pelvis plug. All channels are at a zero level at this point.
- The maximum probe acceleration, peak pelvic acceleration, and peak acetabulum force must lie within the proper specifications.
- Discard the impacted pelvis plug and replace it with another certified plug. An impacted plug must not be used for another impact test (or any other full scale test).
- Wait at least 120 minutes between successive pelvis impact tests on the same pelvis.

3.12.3 PART III: Iliac Pendulum Certification Procedure

3.12.3.1 Required Instrumentation

- Pelvis (Y) accelerometer
- Test probe accelerometer
- Iliac load cell
- Speed Trap

3.12.3.2 Pretest Preparation

- Remove the chest jacket from the dummy.
- Be sure the thoracic and abdominal pads are installed using cable ties[17].
- Install a certified pelvis plug (see ***PART I: Pelvis Plug Quasi-Static Certification Procedures***). Be certain that the plug is fully seated in the cavity by pushing on the end of the plug until it fully contacts the acetabulum load cell surface.
- Position the arm on the impact side downwards (lowest detent) and perpendicular to the seating surface. No bench is used in this procedure.
- The dummy wears no clothing or shoes for this procedure.
- The dummy is electrically grounded using a cable between a metal component of the dummy and the ground.
- Align the upper and lower neck brackets of the neck load cell replacement so that the top edges are flush with one another[18] (Figure 102).

[17] See Appendix A Attachment of Thoracic and Abdominal Pads in the SID-IIsD.

[18] The lower neck load cell should not be used since its fixed setting creates a neck angle (of ~14º) which is less than the neck angle (of ~19º) when the upper and lower neck brackets are set flush.

- Place two sheets of 2-mm thick Teflon® on top of one another on the seating surface. The sheets should be large enough to fit completely under the dummy's pelvis, legs, and feet.
- Position the dummy on the Teflon® (Figure 129) in the probe's impact area so that the dummy can be impacted in the iliac area, with the centerline of the probe aligned with the centerline of the iliac load cell access hole in the pelvis flesh.
- The probe tip has a 50.5 mm x 88.9 mm face, with an alignment tool access hole in the center. Appendix B includes dimensions for a possible iliac probe face. Care should be taken to adjust probe depth dimensions as needed to maintain the proper 13.97 ± 0.23 kg weight of the probe assembly according to the needs of each test lab.
- The probe tip should be positioned vertically (0 ± 1º).
- Position the dummy so that the centerline of impact probe is centered on the centerline of the iliac load cell access hole. When the pendulum probe is at its lowest position during travel, it should be just touching the pelvis.
- Push the femurs downward so that the thighs make full contact with the test surface.
- Move the legs together so that the knees are as close together as possible (Figure 129).
- Position the feet so that they are in dorsiflexion with toes angled towards the dummy's head.

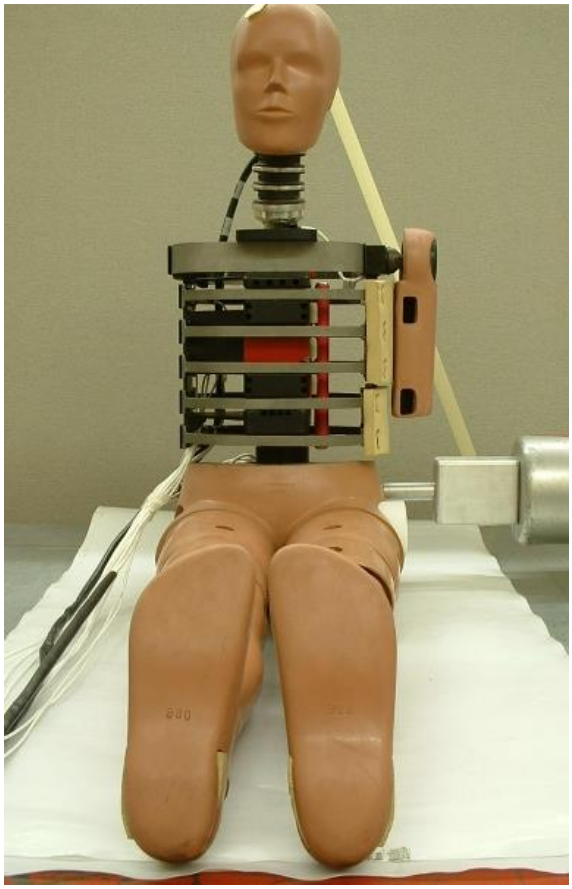

Figure 129. Setup of the dummy for iliac certification tests

- Using masking tape from the top of the dummy's head to the seating surface (Figure 130), level the shoulder rib so that the fore/aft plane is 0°± 1 relative to horizontal. This measurement can be taken at the top of the shoulder rib mount. Adjust the masking tape as necessary to achieve these results (Figure 131)

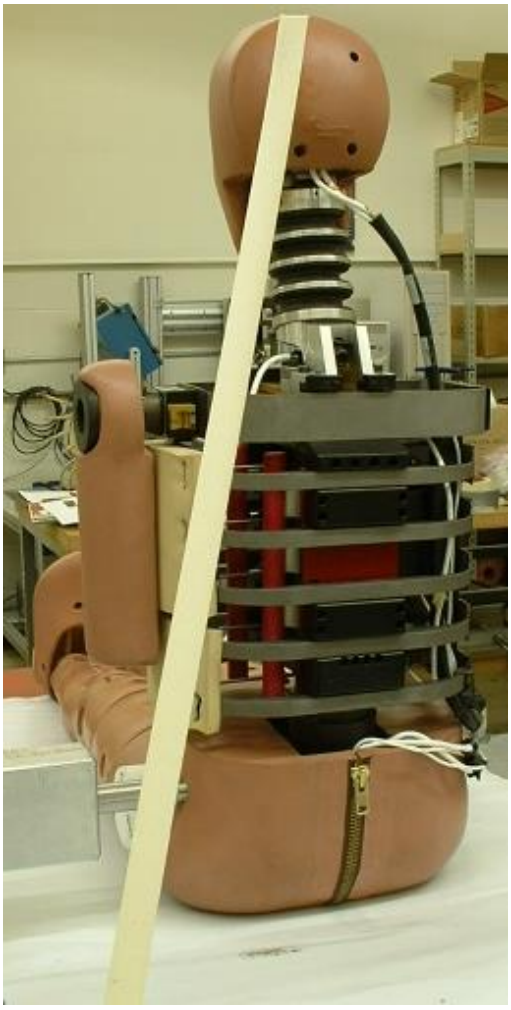

Figure 130. Using masking tape to sit the dummy upright

Figure 131. Adjusting the SID-IIs D in the fore/aft plane for iliac certification tests

- Adjust the dummy so that the thoracic lateral plane is 0° ± 1 relative to horizontal as referenced at the top surface of the lower neck bracket (Figure 132).
- Adjust the masking tape as necessary to achieve these results, taking care to maintain level in the fore/aft direction as well.

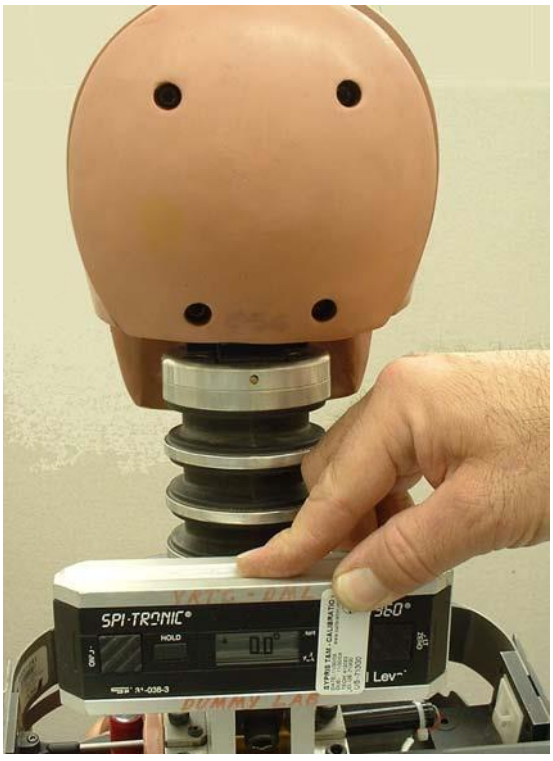

Figure 132. Adjusting the SID-IIs D dummy in the lateral direction for iliac certification tests

- To correctly position the probe face to the iliac, an iliac alignment tool should be used (Figure 133; Appendix C includes dimensions for a possible iliac alignment tool). An air channel should be included along the length of the shaft to minimize vacuum effects when inserting the tool into the probe face.

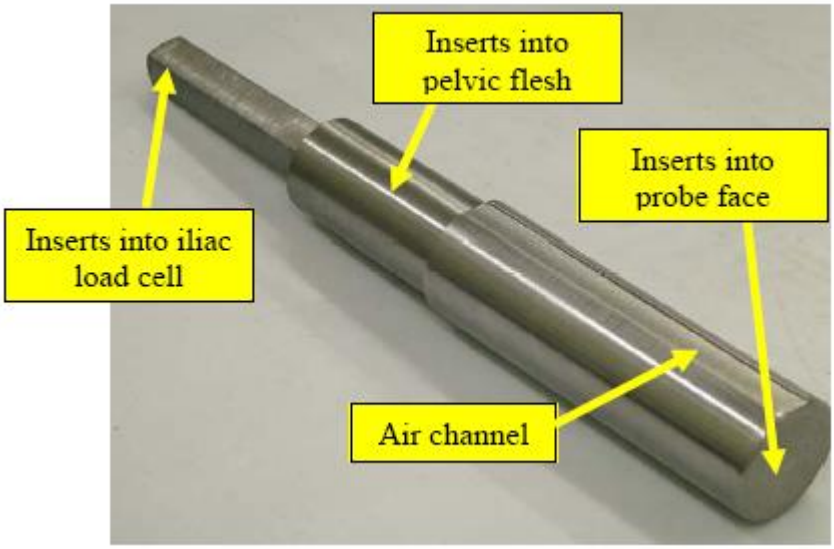

Figure 133. Iliac alignment tool

- The access hole in the center of the probe face should mate with the iliac alignment tool such that there is a good fit (with minimal play) when the shaft of the tool is inserted into the probe access hole (Figure 134).

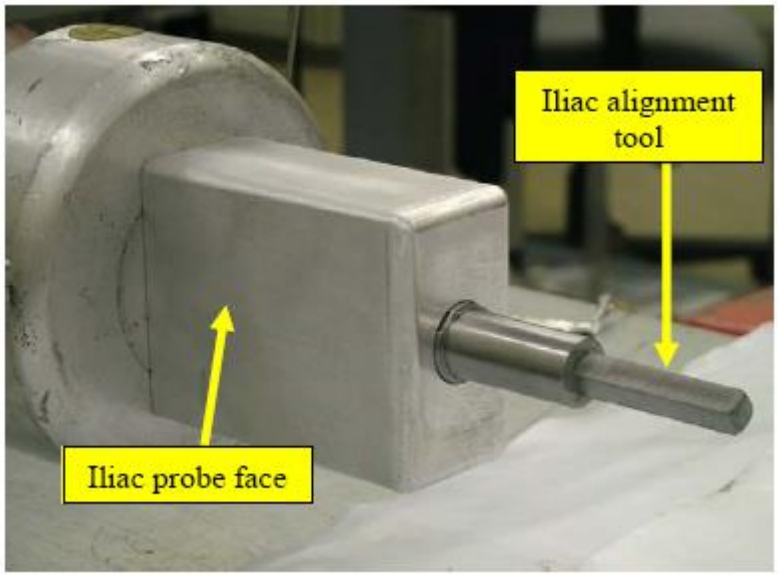

Figure 134. Iliac probe with alignment tool inserted

- The opposite end of the alignment tool is designed to fit into the center of the iliac load cell (Figure 135).

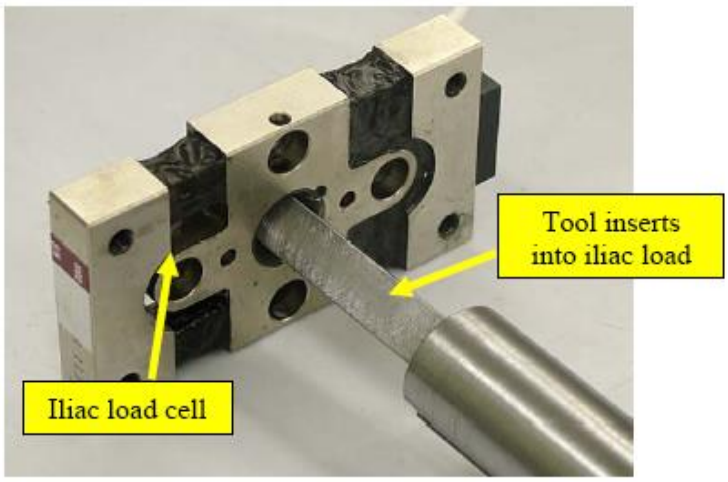

Figure 135. Iliac alignment tool inserted into iliac load cell (shown outside of dummy for clarity)

- To properly align the impact probe for an iliac impact, the square end of the alignment tool is inserted into the center of the iliac load cell through the iliac load cell access hole in the pelvis flesh (Figure 136).
- The dummy's position is then adjusted so that moving the pendulum towards contact with the iliac allows for smooth motion (minimal resistance) of the alignment tool within the probe face (Figures 136 and 137).
- Once this position has been achieved, a check of the fore/aft level and right/left level should be conducted and adjusted as necessary (Figures 131 and 132).

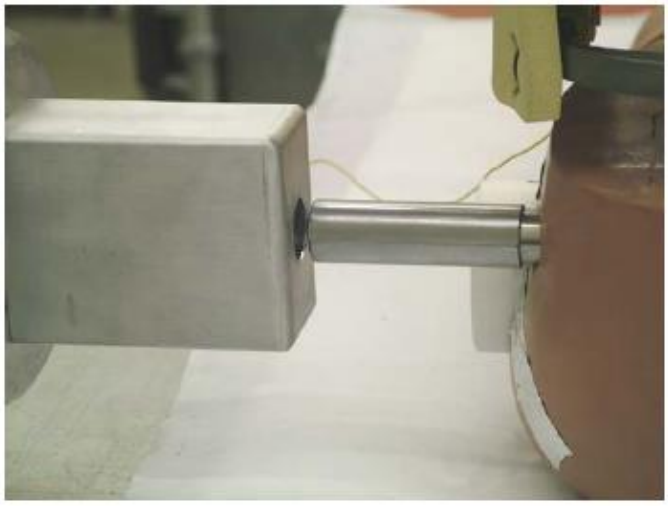

Figure 136. Adjusting the pelvic position so that the alignment tool can be inserted into the probe face

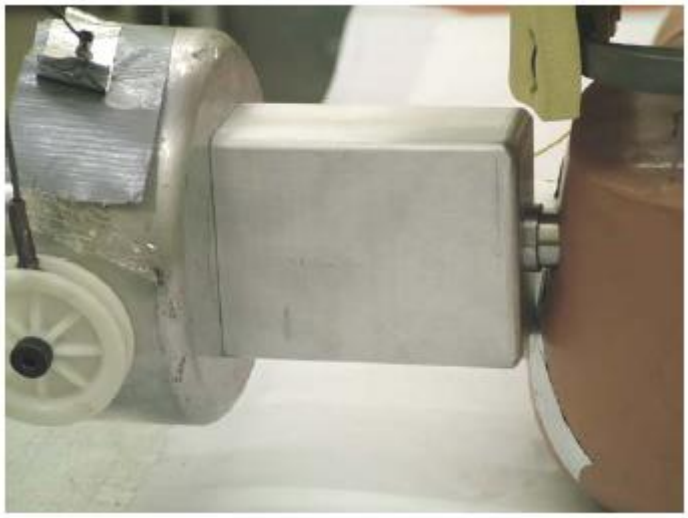

Figure 137. Assuring smooth motion of the alignment tool shaft within the probe indicates proper setup has been achieved

- Once probe alignment has been achieved, and assuring that the dummy is level, pull back the pendulum probe and carefully remove the alignment tool while maintaining dummy position.

3.12.4 Iliac Certification Test Procedure

- The test probe has a mass of 13.97 ± 0.23 kg[19]. The probe tip has a 50.5 mm x 88.9 mm face, (with a minimum depth of 76 mm) and a 6.4 mm edge radius. In addition, the probe face should contain an access hole such that an alignment tool can be inserted for proper impact positioning.
- Mount an accelerometer on the test probe with its sensitive axis in line with the longitudinal centerline of the test probe.
- Release the test probe within the appropriate temperature and humidity specifications so that it achieves a velocity between 4.2 – 4.4 m/s at the instant of contact with the dummy.
- At the instant of contact, the probe should be horizontal ± 1º, and the centerline of the probe should be within 2 mm of the centerline of the iliac load cell access hole.
- The data acquisition system conforms to SAE Recommended Practice J211.
- The probe and pelvis accelerations are collected and filtered using a Channel Class 180 phaseless filter.
- The iliac force is collected and filtered using a Channel Class 600 phaseless filter.
- Time zero is defined as the time of contact between the impact probe and the pelvis. All channels are at a zero level at this point.
- The maximum probe acceleration, peak pelvic acceleration, and peak iliac force must lie within the proper specifications.
- The pelvis plug must be used in this procedure. However, since it is not impacted in this test, it remains certified and still usable after the iliac certification test.
- Wait at least 120 minutes between successive iliac impact tests on the same pelvis.

[19] Mass includes probe mass and all rigidly attached hardware, plus 1/3 of supporting cable weight.

3.13 Shoulder Certification Procedure

3.13.1 Required Instrumentation

- Shoulder linear potentiometer
- Upper spine (Y) accelerometer (T1)
- Test probe accelerometer
- Speed Trap

3.13.2 Pretest Preparation

- Install the thoracic and abdominal pads using cable ties[20].
- Place the chest jacket on the dummy.
- The dummy wears cotton underwear pants, cut off just above the knees, for this procedure, but no shirt or shoes.
- The dummy is electrically grounded using a cable between a metal component of the dummy and the ground.
- Align the upper and lower neck brackets of the neck load cell replacement so that the top edges are flush with one another[21] (Figure 102).
- Place the certification bench (Figure 103) in the probe's impact area so that the dummy can be impacted in the shoulder.
- Seat the dummy on a sheet of 387 x 521 mm PTFE (Teflon®) (2-mm thick) on the bench. Position the dummy so that the outermost pelvic flesh is within 10 mm of the edge of the Teflon® sheet; the edge of the sheet must be along the impact side of the bench's seat pan (Figure 138).
- Place a sheet of 514 x 514 mm PTFE (Teflon®) (2-mm thick) between the seatback and the dummy's posterior thorax; the edge of the sheet must be along the impact side of the bench's seatback (Figure 138).
- Be sure that the molded arm assembly plug (drawing 180-6019) is completely inserted into the arm and secured to the arm bone with screws.
- Position the impact arm so that it points forward at 90° relative to the inferior-superior orientation of the upper torso (spine box) (Figure 138).

[20] See Appendix A *Attachment of Thoracic and Abdominal Pads in the SID-IIsD*

[21] The lower neck load cell should not be used since its fixed setting creates a neck angle (of ~14º) which is less than the neck angle (of ~19º) when the upper and lower neck brackets are set flush.

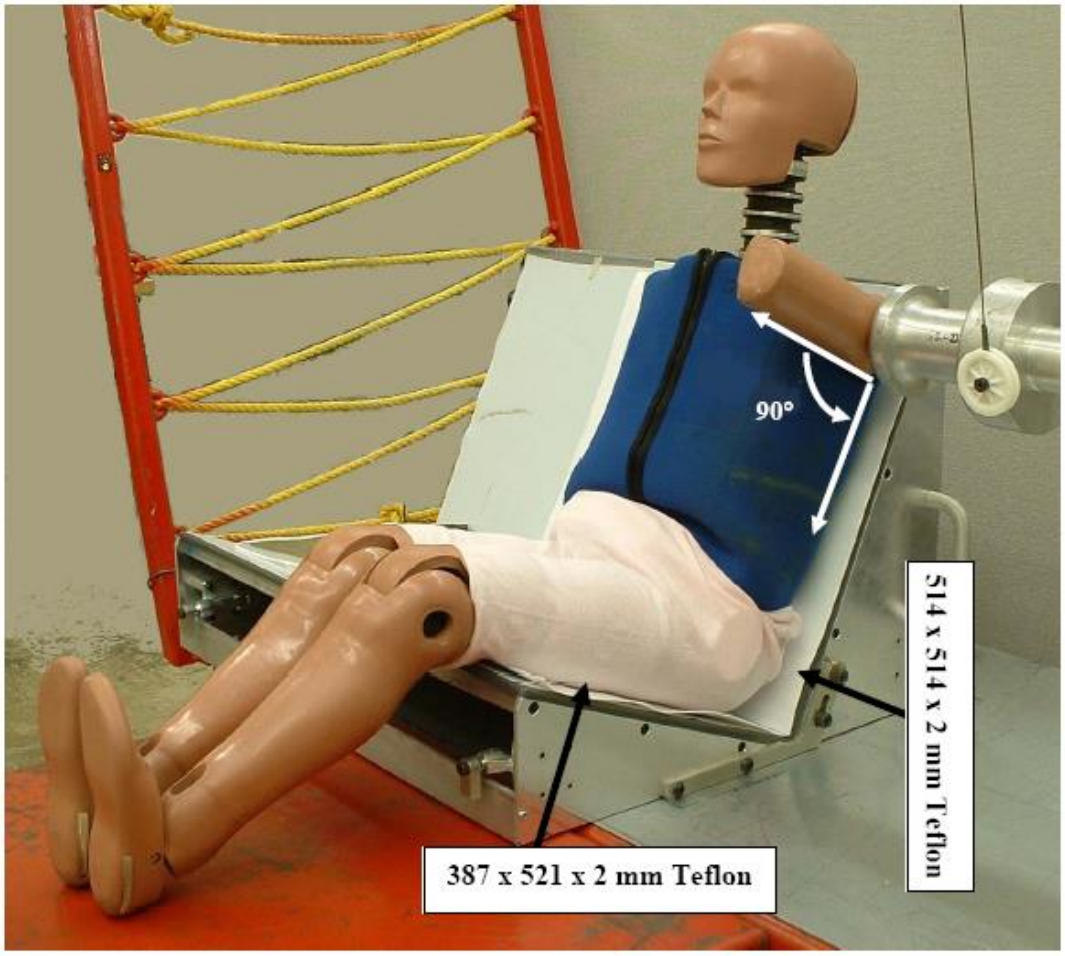

Figure 138. Shoulder impact test configuration for SID-IIs D

- Position the dummy so that the centerline of the arm bolt (ref. item 23 in drawing 180-3000) is centered on the centerline of the impact probe within 2 mm. The face of the pendulum should be parallel to, and just touching, the surface of the molded arm assembly plug when the pendulum probe is at its lowest position during travel (Figures 138 and 139).
- Push the dummy's chest towards the seatback, so that the back of the thorax is touching the seatback (Figure 139).

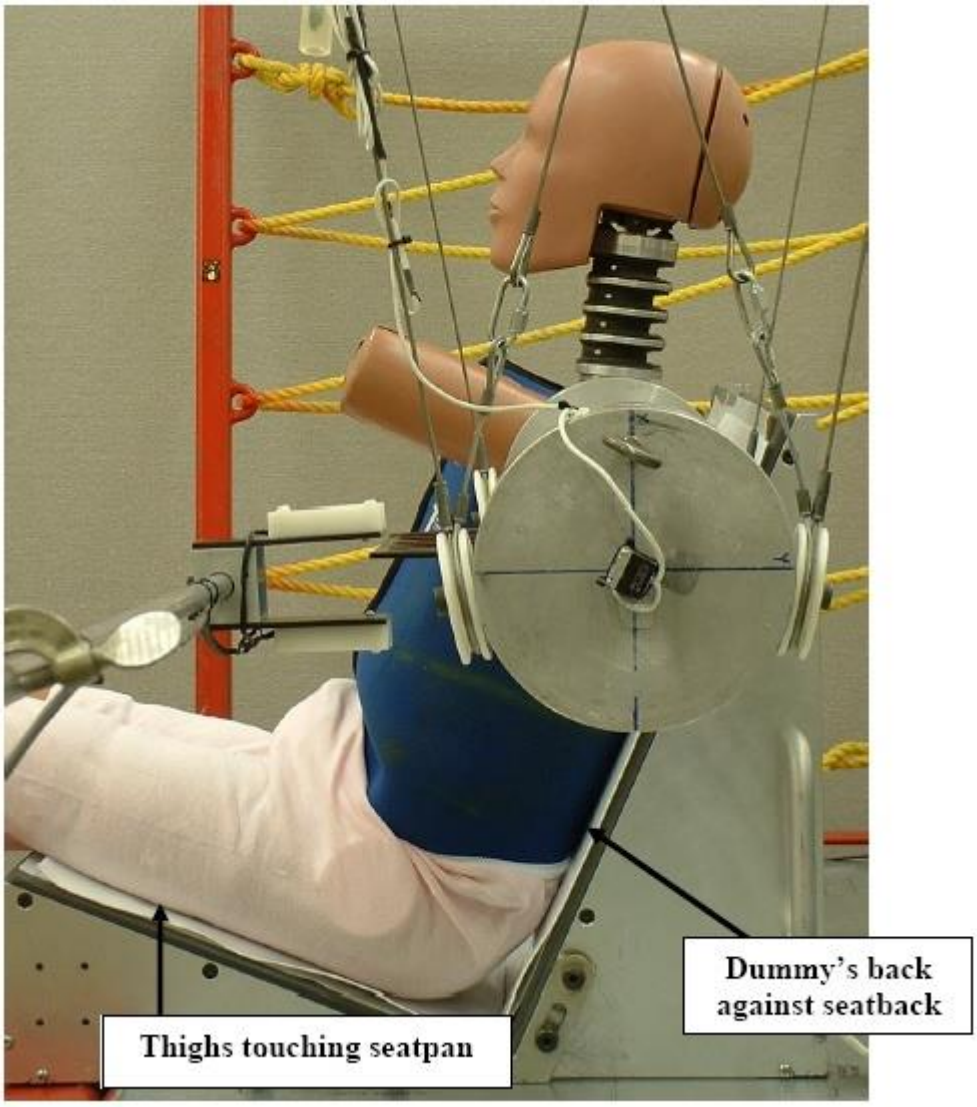

Figure 139. Impact probe and dummy seating position for the SID-IIs D shoulder certification test

- Push the femurs towards the seatpan so that the thighs are in contact with the seat (Figures 140 and 141).
- Move the legs together so that the knees are as close together as possible (Figure 140).

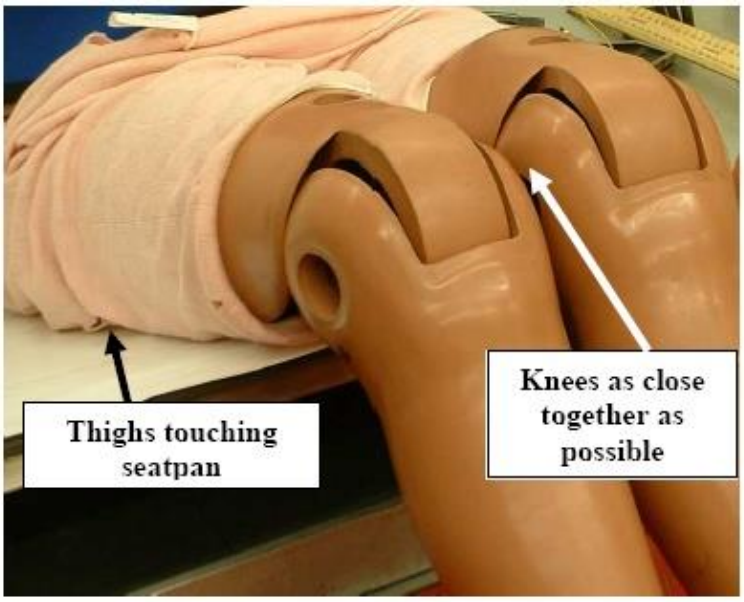

Figure 140. SID-IIs D leg positioning for shoulder certification tests

- Position the feet so that they are vertical and as close together as possible, with the heels touching the surface of the support table (Figure 141).

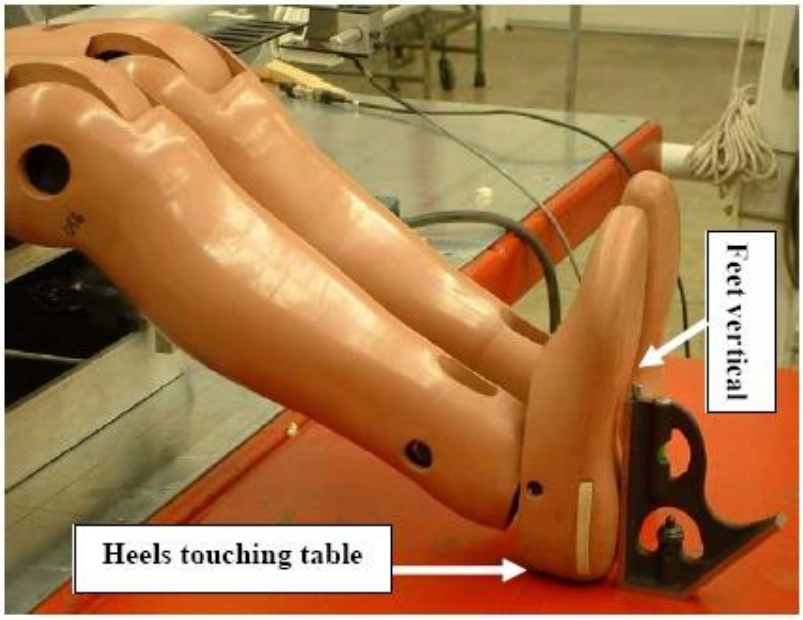

Figure 141. Feet positioning for SID-IIs D shoulder certification tests

- Adjust the dummy so that the thoracic lateral plane is 0° ± 1 relative to horizontal as referenced at the top surface of the lower neck bracket (Figure 142).

Figure 142. Adjusting the SID-IIs D dummy in the lateral direction for shoulder certification tests

- Adjust the dummy so that the thoracic fore/aft plane measures 24.6 ± 2° relative to horizontal. This measurement can be taken at the top of the shoulder rib mount (Figure 143).

Figure 143. Adjusting the SID-IIs D in the fore/aft plane for shoulder certification tests

3.13.3 Shoulder Certification Test Procedure

- The test probe should have a mass of 13.97 ± 0.023 kg[22] with a 120.7 ± 0.25 mm face diameter, and a 12.7 mm radius.
- Mount an accelerometer on the test probe with its sensitive axis in line with the longitudinal centerline of the test probe.
- Release the test probe within the appropriate temperature and humidity specifications so that it achieves a velocity between 4.2 – 4.4 m/s at the instant of contact with the dummy.
- At the instant of contact, the probe should be horizontal ± 1º, and the centerline of the probe should be within 2 mm of the dummy's arm rotation centerline (ref. item 23 in drawing 180-3000).
- The data acquisition system should conform to SAE Recommended Practice J211.
- The probe and spine accelerations are collected and filtered using a Channel Class 180 phaseless filter.
- The shoulder deflection is collected and filtered using a Channel Class 600 phaseless filter.

[22] Mass includes probe mass and all rigidly attached hardware, plus 1/3 of supporting cable weight.

- Time zero is defined as the time of contact between the impact probe and the shoulder. All channels should be at a zero level at this point.
- The peak shoulder deflection and maximum T1 and probe accelerations should lie within the proper specifications.
- Wait at least 30 minutes between successive shoulder impact tests on the same shoulder.

3.14 **External Dimensions**

These measurements shall be taken prior to testing with the dummy in order to verify key external dimensions and identify possible deficiencies in the dummy molded parts or problems with the internal structural configuration. These dimensions shall be checked without any instrumentation cabling coming from the rear of the dummy as this bundle may affect the measurements. Figure 144 and Table 14 illustrate the external dimension details for the SID-IIsD dummy. Table 15 indicates the specifications for each of the SID-IIsD external dimensions.

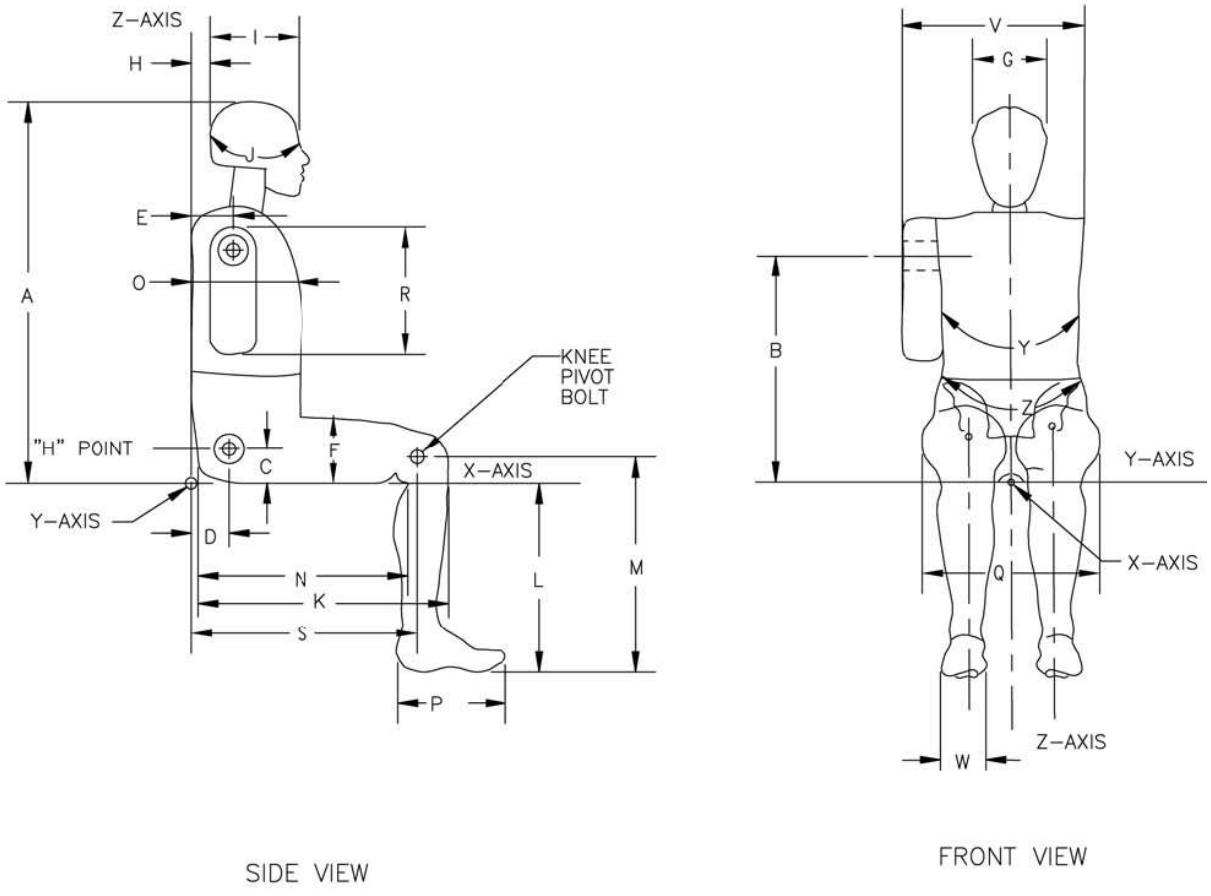

Figure 144. External dimensions

Table 14. Definitions of External Dimensions

ID	Description	Details
A	Sitting Height	seat surface to highest point on top of head
B	Shoulder Pivot Height	centerline of shoulder pivot bolt to seat surface
C	H-point Height	Reference
D	H-point from Seat Back	Reference
E	Shoulder Pivot from Backline	center of shoulder yoke assembly to rear vertical surface
F	Thigh Clearance	seat surface to highest point on the upper femur segment
G	Head Breadth	widest part of the head
H	Head Back from Backline	Reference - back of skull cap to vertical surface
I	Head Depth	back of the head to the forehead
J	Head Circumference	measured at the point as in dimension “I”
K	Buttock to Knee Length	most forward surface of the knee flesh to the rear surface of the buttock, in line with the knee pivot and hip pivot
L	Popliteal Height	bottom surface of knee flesh to the horizontal plane of the bottom of the feet
M	Knee Pivot to Floor Height	knee pivot bolt to horizontal plane of the bottom of the feet
N	Buttock Popliteal Height	(anterior) edge of ½” diameter rod nearest the knee joint to the rear surface of buttock
O	Chest Depth w/o Jacket	from the rib guide between the first and second ribs (measured 381 mm (15”) above seat surface) to the seat back
P	Foot Length	tip of toe to rear of heel
Q	Hip Breadth	The widest part of the hip with both pelvic plugs installed
R	Arm Length	top of shoulder to bottom of elbow
S	Knee Joint to Seat Back	seat back to the knee pivot bolt
V	Shoulder Width	outside surface of the shoulder plug and the rib mounting bracket with only one arm (left or right) installed
W	Foot Width	the widest part of the foot
Y	Chest Circumference with Jacket	measured 114 mm (4.5”) below top surface of non-struck side shoulder
Z	Waist Circumference	measured within 6 mm (0.25”) from top of pelvis flesh (no chest jacket)

Table 15. External Dimensions Specifications

ID	Description	English (in)		SI (mm)	
		Spec.	± Tolerance	Spec.	± Tolerance
A	Sitting Height	30.70	0.30	780	8
B	Shoulder Pivot Height	17.50	0.30	445	8
C	H-point Height	3.30	0.20	84	5
D	H-point Forward	5.75	0.20	146	5
E	Shoulder Pivot from back line	4.00	0.20	102	5
F	Thigh Clearance	5.00	0.30	127	8
G	Head Breadth	5.65	0.15	144	4
H	Head Back from Backline	1.70	0.10	43	3
I	Head Depth	7.20	0.20	183	5
J	Head Circumference	21.25	0.20	546	5
K	Buttock to Knee Length	20.75	0.50	527	13
L	Popliteal Height	14.00	0.50	356	13
M	Knee Pivot to floor Height	15.80	0.30	401	8
N	Buttock Popliteal Length	16.90	0.50	429	13
O	Chest Depth w/o Jacket	8.00	0.30	203	8
P	Foot Length	8.80	0.30	224	8
Q	Hip Breadth	12.50	0.20	318	5
R	Arm Length	10.00	0.20	254	5
S	Knee Joint to Seat Back	19.10	0.30	485	8
V	Shoulder Width (only one arm installed, Left or Right)	13.75	0.30	349	8
W	Foot Width	3.40	0.30	86	8
Y	Chest Circumference with Jacket	34.10	0.60	866	15
Z	Waist Circumference	30.30	0.60	776	15

1. Assemble the dummy according to the procedures defined in the PADI. Assure that the neck and lumbar cables are set at a torque of 1.13 - 1.35 Nm (10-12 in-lbs).

2. With the dummy's jacket in place, seat the dummy on a flat, rigid, smooth, clean, dry, horizontal surface. The seating surface must be at least 406-mm (16-in) wide and 406-mm (16-in) deep, with a vertical section at least 406-mm (16 in) wide and 914-mm (36 in) high attached to the rear of the seating fixture. The dummy's midsagittal plane is vertical and centered on the test surface.

3. Seat the dummy in the test fixture so that the torso is against the vertical surface of the fixture.

4. Chest Circumference (Y): With the jacket on, using a tape measure positioned 114 mm (4.5") below the top surface of the non-struck side shoulder, measure the chest circumference.

5. Remove the chest jacket. Position the dummy against the vertical back plate so that dummy is in contact with the surface. Level the top surface of the top rib guide laterally.

Extend the dummy's neck so that the base of the skull is level side-to-side, within 0.5 degrees. The rear surface of the skull cap should be 43 +/- 3 mm (1.70 +/- 0.10 in) from the vertical surface of the test fixture (parameter H). A 43-mm wide block mounted to the vertical surface of the seat behind the head will aid in this process. In addition, a strap or bungee cord may be placed around the forehead of the dummy to stabilize the head in this position.

6. Position the dummy's H-point (both left and right sides) so it is 84 +/- 5 mm (3.30 +/- 0.20 in) above the horizontal seating surface and 146 +/- 5 mm (5.75 +/- 0.20 in) forward of the rear vertical surface of the fixture (parameters C and D, respectively). A threaded cylindrical tool, as illustrated in Figure 145, which can be screwed into the acetabulum load cell replacement (Figure 146) in place of the ¼-20 x 5/8" FHCS, will aid this process.

Figure 145. H-Point Tool used to assist in measuring external dimensions

Figure 146. H-Point Tool installed at acetabulum

7. **Sitting Height (A)**: With the head positioned as indicated in step 5, measure the distance from the seat horizontal surface to a level placed on top of the head.

8. **Shoulder Pivot Height (B)**: Level the shoulder load cell structural replacement. Measure from the centerline of the shoulder yoke assembly to the seat horizontal surface. For ease of measurement, it is recommended to measure from the top of the load cell replacement to the horizontal seat surface and adjust this value by ½ the height of the structural load cell replacement.

9. **Shoulder Pivot From Backline (E)**: Level the shoulder load cell structural replacement. Measure from the centerline of the shoulder yoke assembly to the seat vertical surface (seat back). For ease of measurement, it is recommended to measure from the front of the load cell replacement to the seat back and adjust this value by ½ the width of the structural load cell replacement.

10. **Thigh Clearance (F)**: Measure from the horizontal seat surface to the highest point on the thigh flesh. A level placed laterally across both thighs at the highest point will aid in this process

11. **Head Breadth (G)** Measure the widest part of the head.

12. **Head Depth (I)** Measure from the back of the head to the forehead.

13. **Head Circumference (J)** Measure at the point used for dimension “I”.

14. **Buttock to Knee Length (K)**: Measure from the rear surface of the buttock to the front edge of the knee in line with the knee pivot and hip pivot. Use of a vertically positioned level will aid in this measurement.

15. **Popliteal Height (L)**: Position the front edge of the lower leg vertically. Level the bottom of the feet. Measure from the bottom of the feet to the seat horizontal surface.

16. **Knee Pivot to Floor Height (M)**: Position the front edge of the lower leg vertically. Level the bottom of the feet. Measure from the bottom of the feet to the knee pivot.

17. **Buttock Popliteal Length (N)**: Place a ½” diameter rod behind the knee and pull it forward against the back of the knee joint. Measure from the (anterior) edge of the rod nearest the knee joint to the rear surface of buttock.

18. **Foot Length (P)**: Measure the maximum foot length from heel to toe.

19. **Hip Breadth (Q)** Measure the widest part of the hip with both pelvic plugs installed.

20. **Arm Length (R)** Measure from the top of the shoulder to the bottom of the elbow.

21. **Knee Joint to Seat Back (S)** Measure from the center of the knee joint to the seat back. Use of a horizontally positioned level will aid in this measurement.

22. **Foot Width (W)**: Measure the maximum foot width from left to right.

23. **Chest Depth (O)**: Push the thorax against the seat back. At a distance of 381 mm (15”) above the seat surface (on the rib guide between the first and second ribs), measure the horizontal distance from this point to the seat back.

24. **Shoulder Width (V)**: With only one arm installed (left or right), measure the distance between the outside surface of the shoulder plug and the rib mounting bracket on the nonstruck side.

25. **Waist Circumference (Z)**: Use a tape measure to measure the circumference of the waist within 6 mm (0.25”) of the topmost portion of the pelvis flesh, avoiding the zipper closure.

3.15 **Mass Measurements**

The masses of each segment should be measured and checked against the specifications in Table 16. Table 17 through 24 define which components are included in each segment.

Table 16. Mass Specifications

Segment	English (lb)		SI (kg)	
	Value	± Tolerance	Value	± Tolerance
Head	8.16	0.10	3.70	0.05
Neck	2.00	0.20	0.91	0.09
Upper Torso w/o Jacket	24.50	0.45	11.11	0.20
Lower Torso	27.60	0.40	12.52	0.18
Arm, Left or Right	2.00	0.10	0.91	0.05
Upper Leg, Left or Right	6.90	0.20	3.13	0.09
Lower Leg, Left or Right	7.20	0.20	3.27	0.09
Foot, Left or Right	1.75	0.10	0.79	0.05
Chest Jacket	1.30	0.15	0.59	0.07
Total Dummy Mass	**97.26**	**2.40**	**44.12**	**1.09**

Table 17. Head Segment Components

Description	Part Number	Quantity
Head Assembly	180-1000	1
Head Accel Assembly with Accels and Mounts		

Table 18. Neck Segment Components

Description	Part Number	Quantity
Neck Assembly	180-2000	1
Upper Neck Bracket	180-2006	1
SHCS, 3/8-16 x 1	9000021	1
Clamping Washer	180-3005	1

Table 19. Arm Segment Components (Left or Right)

Description	Part Number	Quantity (each left or right)
Upper Arm Assembly, Molded	180-6000-1/-2	1
Arm Accels with Mounts and Screws		

Table 20. Upper Torso Segment Components

Description	Part Number	Quantity
Upper Torso Assembly	180-3000	1
Accels with Mounts and Screws		
Potentiometer Assembly	183-3881	5

Table 21. Lower Torso Segment Components

Description	Part Number	Quantity
Lower Torso Assembly	180-4000	1
Pelvic Accel Assembly with Accels with Mounts		
Potentiometer Assembly	183-3881	1

Table 22. Foot Segment Components (Left and Right)

Description	Part Number	Quantity (each left or right)
Foot Assembly	180-5900-1/-2	1
SHSS 1/4 x 5/8	9000619	1

Table 23. Upper Leg Segment Components (Left and Right)

Description	Part Number	Quantity (each left and right)
Upper Leg Structural Assembly	180-5140-1/-2	1
Upper Leg Flesh	180-5120-1/-2	1
SHCS 3/8-16 x 1 ½	9000479	1
Load Cell Simulator	180-4701	1
SHCS 3/8-16 x 1-3/4	9000449	1
Rotation Stop Cover	180-5302	1
Knee Insert	180-5340	1
Knee Skin	180-5320	1
Machined Knee Cap	180-5360	1

Table 24. Lower Leg Segment Components (Left and Right)

Description	Part Number	Quantity (each left and right)
Lower Leg Flesh	180-5520	1
Ankle Assembly	180-5700	1
Ankle Bumper	180-5705	1
Lower Leg Structural Replacement	180-5505	1
Inboard Structural Replacement	180-5304	1
Outboard Structural Replacement	180-5305	1
FHCS #10-32 x 3/8	9000249	8
Knee Washer	180-5381	1
Compression Washer	180-5303	2
Knee Shoulder Bolt	180-5382	1
BHCS #8-32 x 1/2	9000076	2
Rotation Stop Arm	180-5301	1

4 Appendices

4.1 Flesh Repair Procedures

Minor flesh damage to the dummy can be repaired with a standard electric soldering iron. A flat paddle tip is used (Figure 147) with the iron set to 60 to 90 Watts. For best results, use a variable power supply to control the amount of heat.

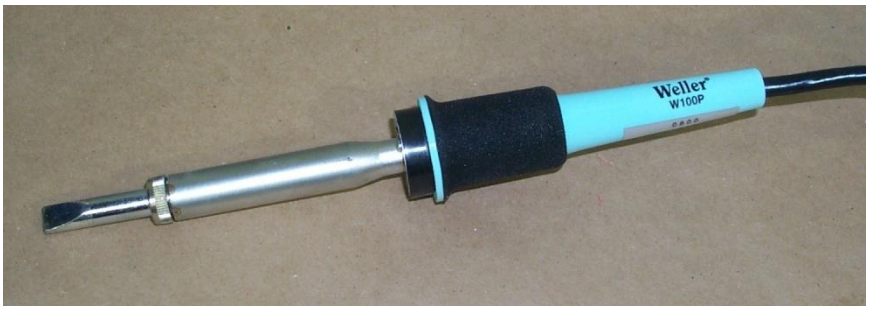

Figure 147. Soldering iron with a flat paddle tip to repair flesh.

Work in a ventilated area. Clean the flesh with isopropyl alcohol and let the flesh dry completely since it is flammable. Remove all loose material from the damaged areas. When repairing the flesh, clean the iron tip frequently by quickly tapping it on a buffing wheel or rubbing it with a wire brush.

Repair scrapes and abrasions by rubbing the iron over the affected area. If black flakes of burnt flesh start to appear on the iron tip, the iron is either too hot or has been in the same spot too long.

Larger damaged areas may require a patch. Cut the patch to be 10 mm (0.4 in) wider than the damaged area on all sides. Position the iron between the patch and the damaged flesh. When the patch and flesh start to look like a gel, move the iron to a new point while holding the patch in place until the melted area is cool. For larger areas, it may be desirable to tack it in several places around the patch, then fill in the untacked areas. Move the iron in a circular motion to eliminate rough uneven areas.

4.2 **Joint Adjustment Procedures**

The joints in this dummy are adjusted to a “1 g” torque setting. This is defined as the joint torque required to support the weight of the specified segment, but also allows the segment to move when a small force is applied to the unsupported end of the segment. For example, when the lower leg is extended to be parallel to the upper leg on a seated dummy, the knee bolt should be tight enough to support the weight of the lower leg and foot, but loose enough so the lower leg will fall slowly when tapped near the ankle.

Begin by removing the chest jacket. Extend the arm laterally outward to a horizontal position. Position the lower arm so the elbow cannot rotate downward. Tighten the shoulder yoke clevis bolt until the torque on the shoulder joint will support the weight of the arm. Tap the lower arm near the wrist vertically. The arm should slowly fall back down towards the dummy’s side. If it does not fall, loosen the shoulder yoke clevis bolt. Repeat the procedure until the 1 g torque setting is achieved.

Figure 148. Adjusting the torque for shoulder joint movement.

Figure 149. Position for checking torque on the shoulder.

Extend the entire leg assembly so it is horizontal (Figure150). Adjust the knee pivot bolt until the joint torque is sufficient to support the weight of the lower leg and foot. Tap the lower leg near the ankle vertically. The lower leg should fall down slowly. If it does not, loosen the knee pivot bolt. Repeat the procedure of tapping at the ankle and adjusting the knee pivot bolt until the 1 g torque setting is achieved.

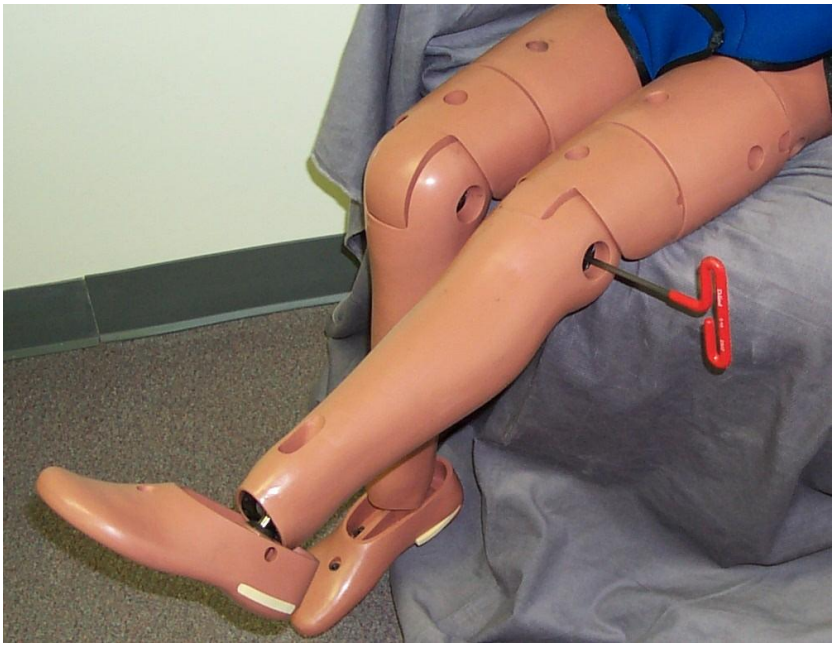

Figure 150. Adjusting the knee torque.

Position the lower leg perpendicular to the upper leg (Figure 151). Adjust the ankle ball set screw, accessed through the lower leg skin, until the joint torque is sufficient to support the weight of the foot. Tap the foot near the toes vertically. The foot should slowly fall down. If it does not fall, loosen the ankle ball set screw. Repeat the procedure until the 1 g torque setting is achieved.

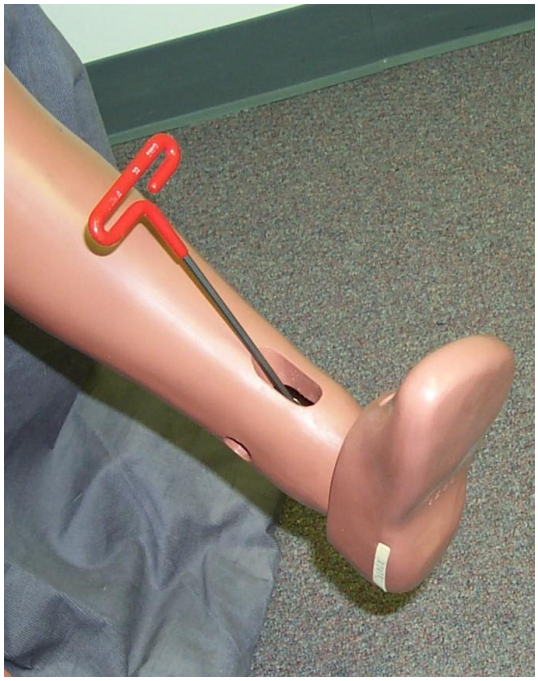

Figure 151. Adjustment of the ankle torque.

Repeat these procedures for the other leg and foot.

4.3 **Attachment of Thoracic and Abdominal Pad in the SID-IIs D**

Use approximately 185-mm (7.31”) long, 4.67-mm (0.184”) wide, 1.33-mm thick cable ties to attach the pads to the ribs. The cable ties are used at each rib on both the left and right edges of the pad. Route the cable ties through the holes punched into the pad and around the rib making certain that the cable tie locking apparatus is at the back side of the rib. Be sure not to wrap over rib damping material or over the larger flared out portion of the ribs near the red urethane. Tighten the cable tie so that pad is pulled against the rib and the pad becomes compressed by the cable tie. Once the cable tie is tightened, the cable “tail” (excess which was pulled through the locking mechanism) should be approximately 125-mm long. About 55 mm of the tie will be utilized on the loop around the ribs (*Note: about 5 mm of the tie remains inside the locking mechanism*). An indication of the proper “tightness” can be identified in Figure 152 below. After tightening the cable tie the proper amount, cut off the excess “tail” so that no further tightening will occur and to reduce interference.

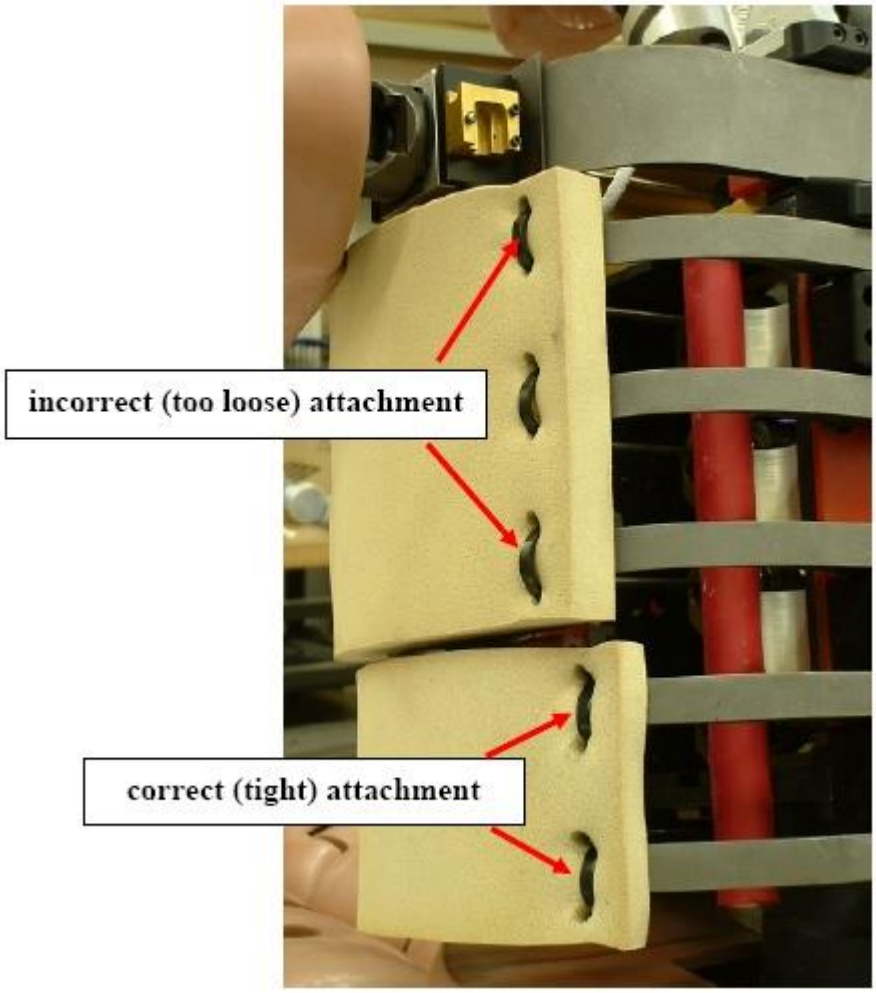

Figure 152. Cable tie attachment to hold the pads for the SID-IIs D

4.4 **Iliac Probe Face**

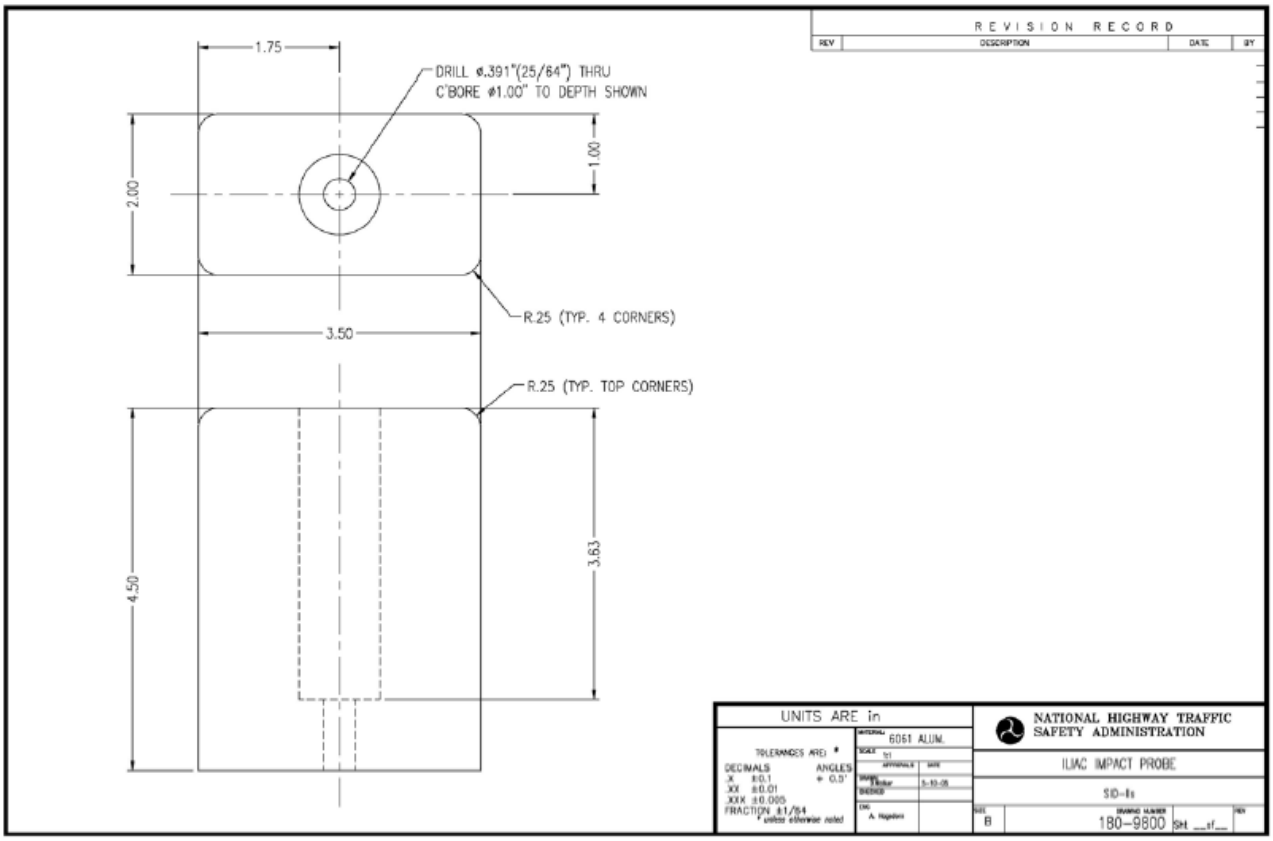

Figure 153. Iliac Probe Drawing

4.5 **Iliac Alignment Tool Example**

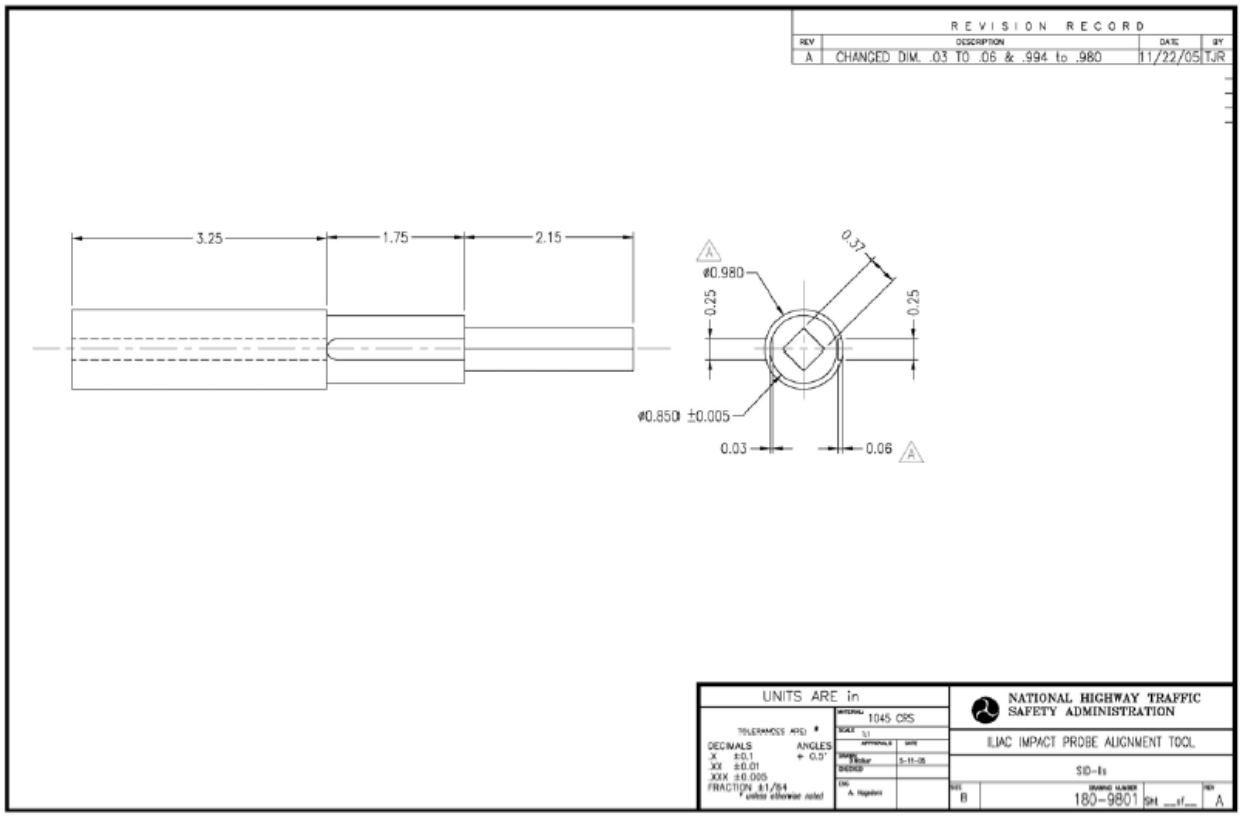

Figure 154. Iliac Alignment Tool Drawing

Manual Update Log

Rev. 2003-Nov-10

1. Page 115, 3.7.2, line 1, should read “the entire dummy (180-0000), excluding chest jacket”

2. Page 117, line 4, add “ … Make sure the probe end surface is parallel to the pelvis plug flat surface.”

Rev. 2003-Dec-04

1. Page 35, 36, Replaced figures 31 and 32 to show correct head accelerometer orientation.

Rev. B.1 2006-July-25

1. Page 117, add Warning: SID-IIs pelvic plug can be used only once for testing.

Rev. C 2007-August

1. Updated manual to show SBL D dummy.

Rev. C 2007-September

1. Change Test probe mass 13.97±0.23 kg to 13.97±0.023 kg on pages 106, 112, 118, 125, 132 & 138.

Rev. D 2008-February

1. Page 19. Change Upper and Lower tibia load cell Denton number to FTSS number. Add Knee Clevis load cell.

Rev. E 2009-July

1. Page 38, 180-3628 was 180-3623. Page 62, 180-4322-1/-2 was 180-4320-1/-2. Page 68 added iliac wing backer plates (Item 4). Page 116, 4.2-4.4 was 4.3-4.5. Page 118, 180-4450-3 was 180-4450 Rev. D. Page 136 4.2-4.4 was 4.3-4.5. Page 143, Mass Measurements section was updated. Page 138, External Dimension section was updated.

Rev. F 2011-June

Manual changed from FTSS to Humanetics

Rev. G 2014-December

Change wait time in 3.12.2.3 Acetabulum cert. procedure & 3.12.4 iliac cert. procedure. Wait was 30/60 mins. Now it is 120 mins.

Rev. H, Jul. 2015

Page 2: Added lead material statement