TEGID-23

Procedures for Assembly, Disassembly, and Inspection (PADI) of the BioRID II Rear Impact Crash Test Dummy

November 2010

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1.0 INTRODUCTION

1.1 Forward

The Biofidelic Rear Impact Dummy, or BioRID, was developed to meet the need for a testing tool to measure automotive seat and head restraint performance in rear end collision testing. It simulates human response in the seated posture during low velocity rear impact.

In the mid-1980's through the 1990's researchers found that the Hybrid III neck was too stiff to properly simulate human response in the sagittal plane. Based on this research the BioRID has been developed through consecutive prototypes starting with the Rear Impact Dummy neck (RID-neck), then the TNO RID-neck and on to the BioRID P1 through P3 until the BioRID II. Each of these steps have served to bring increased knowledge both in scientific data and manufacturing procedures to bring this testing device to a place where it is superior to any available tool for measuring rear-impact response.

1.2 Part Numbers

All part numbers in this document refer to the drawing package. Electronic files of the drawings for this dummy may be downloaded from (TBD – Need website information). Paper copies of the drawings may be obtained from (TBD).

1.3 General Design

The core component of the BioRID II is the spine assembly. The spine consists of seven (7) cervical (C1-C7), twelve (12) thoracic (T1-T12) and five (5) lumbar (L1-L5) vertebrae, the same number as the human spine. The head assembly and the top cervical vertebra (C1) are connected using an occipital interface plate. This interface is mounted to the upper neck load cell, or a load cell structural replacement. The superior thoracic vertebra (T1) is designed to mate the cervical and thoracic vertebrae. It is contoured as a cervical vertebra on the upper side and a thoracic vertebra on the lower side. The superior lumbar vertebra (L1) is similar to the top thoracic in its design to mate the two sections. The upper surface of the vertebra is shaped like the thoracic vertebrae and the bottom is like the lumbar vertebrae. The lowest lumbar vertebra (L5) connects the spine to the pelvis through a sacrum lumbar and pelvis interface plate.

The vertebrae, except for T1, for the BioRID II are made of durable plastic and are connected with pins at each joint that allow for angular motion in the sagittal plane only. The interfaces, T1, occipital and pelvis are made of aluminum. There are elastomer blocks glued to the top of each vertebra to simulate the compression resistance of the muscles and discs between each human vertebra.

For improved neck motion response, tensioning cables have been designed into the neck region of the spine. There are three cables that originate at the top of the neck with threaded adjustments for controlling cable tension. One cable goes through the cervical vertebrae and around a damper assembly at the T4 vertebra, then back through the vertebrae to the top of the neck. The two other cables also start at the top of the neck but terminate at two spring-loaded cable-tensioning devices mounted on the right side of the torso.

The upper torso flesh is made of molded silicone. Included in the flesh mold are: the left and right arm attachment yokes with reinforcement plates, abdomen interface attachment, abdomen cavity, abdomen valve, spine-torso interface and upper jacket pin interface plates.

The arms and legs are standard Hybrid III 50$_{th}$ percentile dummy assemblies and the head and pelvis are modified Hybrid III 50$_{th}$ percentile assemblies.

1.4 Abbreviations

The following of abbreviations are used for screw types throughout this manual:

Table 1 - Screw Abbreviations

Screw Type	Abbreviation
Socket Head Cap Screw	SHCS
Button Head Cap Screw	BHCS
Flat Head Cap Screw	FHCS
Socket Set Cup Point	SSCP
Socket Head Shoulder Screw	SHSS

1.5 Required Tools

The following special tools will allow assembly, disassembly and calibration of the BioRID II Rear Impact Dummy. For information concerning tool availability, contact the dummy manufacturers.

Hex wrenches, Ball end (0.05" – 3/8" and 1.5 mm – 10 mm)
Hex wrenches, 'T'-handle (3/32" - 3/8" and 2 mm – 10 mm)
Screwdriver, standard tip (2.5 mm tip width)
Pin punch (6 mm (0.25") dia.)
Brass mallet
Loctite® Adhesive: 401
Open-end wrench (13 mm)
Meropa® 680 gear oil (Texaco, Inc.)*

*a Syringe filled with Meropa® oil is included with the dummy

2.0 CLOTHING

2.1 Shirt and Shorts

The BioRID II Clothing is comprised of two pairs of pants (one is blue color, one is black color) and two shirts (one is blue color, one is black color) made of a nylon fabric. The design of the fabric has a different texture on the outside as it does on the inside. The blue material has a shiny side out, where as the black material is opposite and has the matte side out.

The test requirements call out for the shiny sides of the materials to come face to face with each other, the orientation (blue vs. black) is up to the user and can be chosen individually.

Figure 1- BioRID II Clothing

2.2 Shoes

The BioRID II Shoes are Men's dress oxford type, size 11 extra wide that meets military specifications MIL-S-13192P. Each shoe weighs .613 +/- 0.2 lb and should have an overall length of 320-325mm.

Figure 2- BioRID II Shoe

3.0 STORAGE AND HANDLING

3.1 BioRID II Dummy Transportation Chair

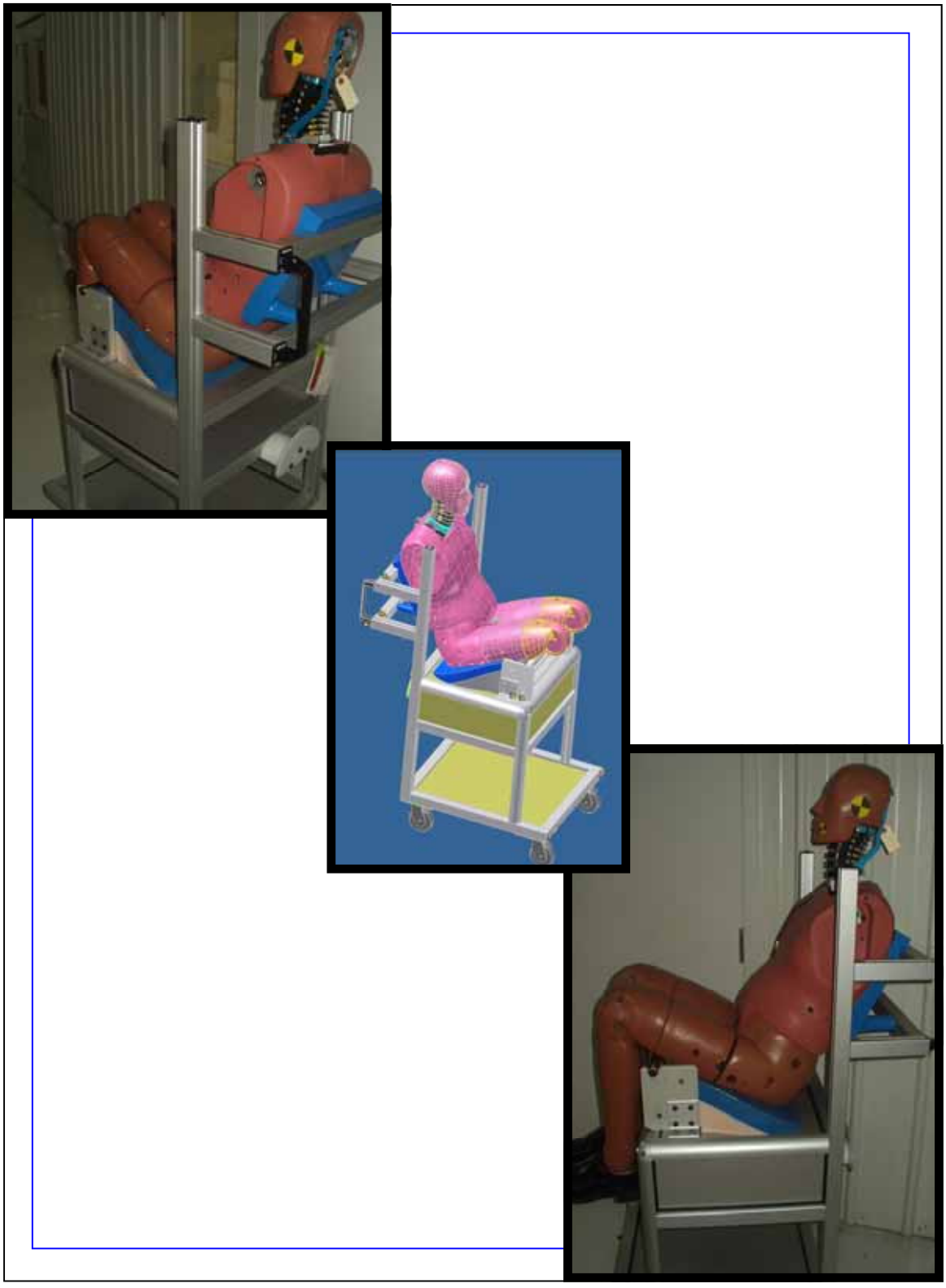


Figure 3- BioRID II Dummy Storage

3.2 Dummy Lifting Procedure

To lift the dummy, the pelvis position indicator attachment is used as a point for lift cable attachment. The dummy is shipped with the attachment and the lift cable in place. An upper cable bracket is mounted at T-1 with a M8 wingnut on each side.
After the dummy is moved and positioned for testing, remove the upper bracket and wingnuts and store them for future use. If the pelvis position indicator attachment interferes with the seatbelt it needs to be removed and replaced with the two M6 X 25 mm SHCS provided.

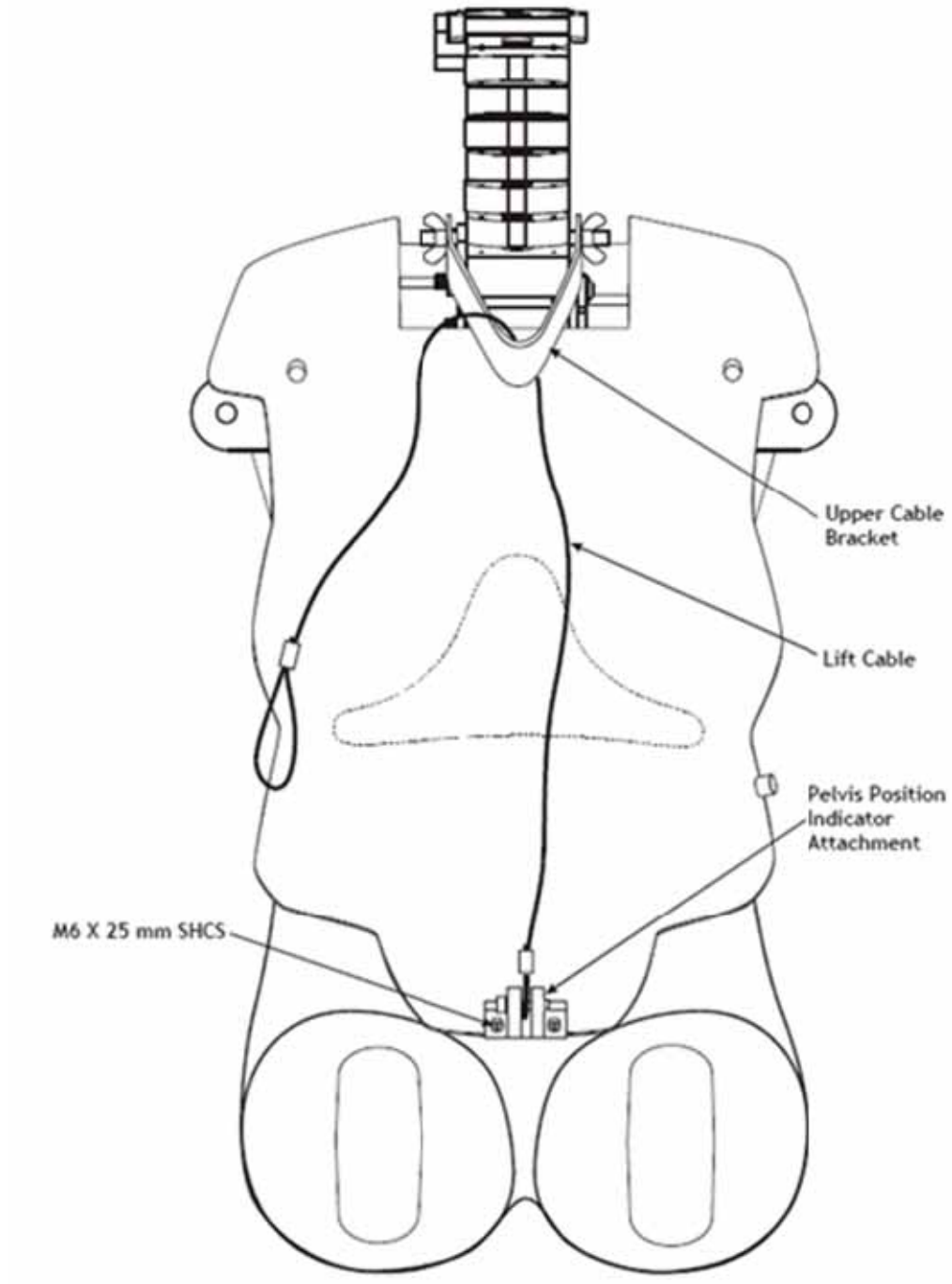


Figure 4 - BioRID II Lifting Cable

4.0 INSTRUMENTATION

4.1 Available Instrumentation

When ordering a new dummy, inform the dummy manufacturer of the type and model of accelerometer you intend to use. This will ensure that you obtain the correct accelerometer mounts for the head, neck, thorax and pelvis.

Table 2 lists the available instrumentation for the BioRID II Dummy.

Table 2 - BioRID II Instrumentation

BioRID II Dummy Instrumentation			
Location	Type	Measurement	Number of Channels
Head	Accelerometer	AX, AY, AZ	3
Head	Gyro	AVX, AVY, AVZ	1 - 3
Head	Skull Cap Load Cell	FX, FZ, MY	3
Head	Skull Cap Contact Switch	Event	1
Head	Tilt Sensor	Angle	1
Upper Neck	Load Cell	FX, FY, FZ, MX, MY, MZ	6
Neck (C4)*	Accelerometer	AX, AZ	2
Thorax (T1)	Load Cell	FX, FZ, MY	3
Thorax (T1)*	Accelerometer	AX, AZ	2
Thorax (T1)*	Gyro	AVX, AVY, AVZ	1 - 3
Thorax (T1)	Tilt Sensor	Angle	1
Thorax (T8)*	Accelerometer	AX, AZ	2
Thorax (T8)*	Gyro	AVX, AVY, AVZ	1 - 3
Lumbar (L1)*	Accelerometer	AX, AZ	2
Lumbar (L1)*	Gyro	Angular	1 - 3
Lumbar	Load Cell	FX, FY, FZ, MX, MY, MZ	6
Muscle Tension (2)	Load Cell	Force	2
Pelvis	Accelerometer	AX, AY, AZ	3
Pelivs	Gyro	AVX, AVY, AVZ	1 - 3
Pelivs	Tilt Sensor	Angle	1
Femur (Left and Right)	Load Cell	FX, FY, FZ, MX, MY, MZ	12

* Can be mounted on left or right side of dummy

Electrical noise on the accelerometer and load cell data channels may be reduced by following the grounding concepts shown in Figure 22 below. Care should be taken to ensure not to introduce electrical ground loops in to the system.

4.2 Instrumentation Location

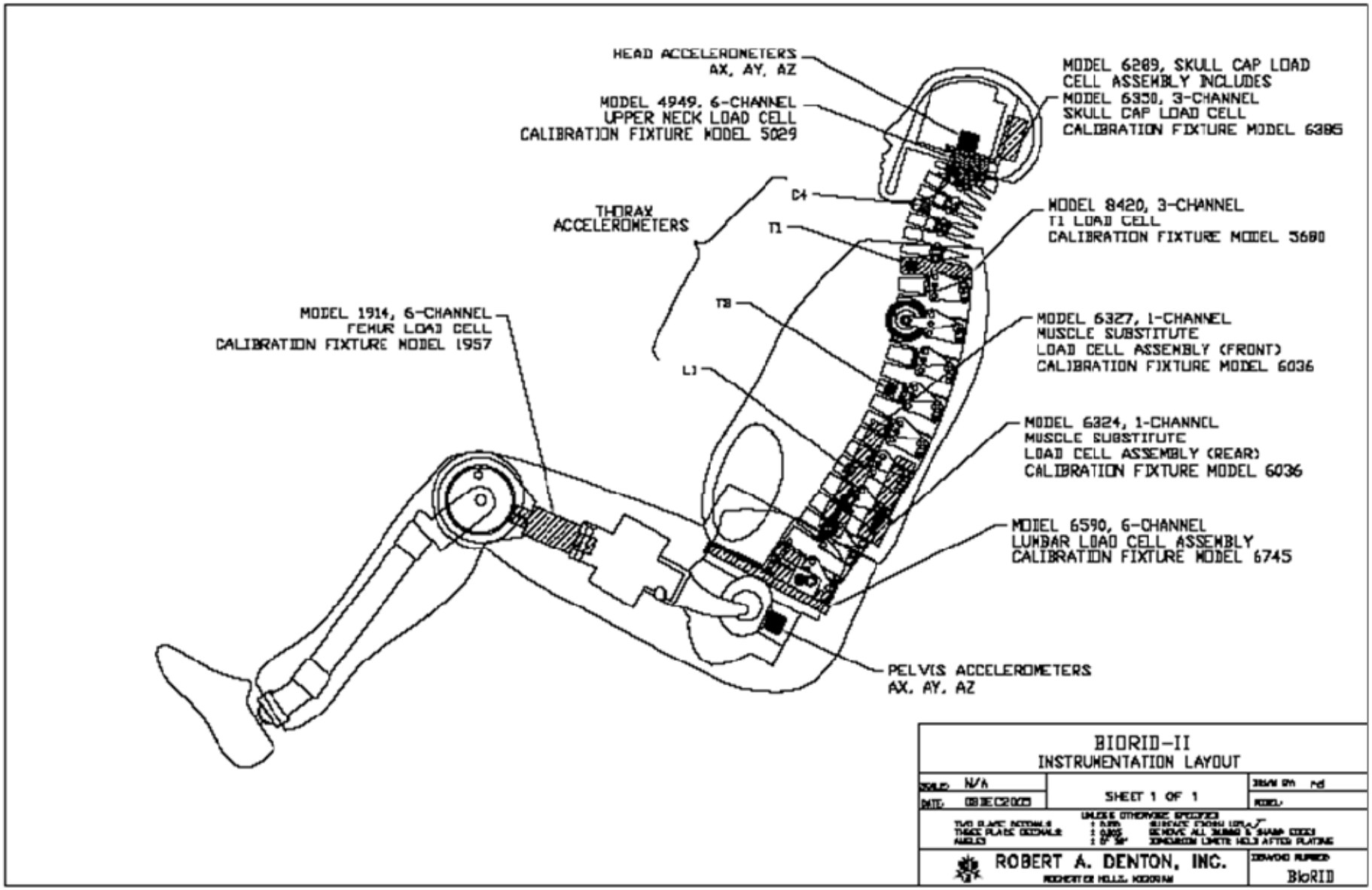


Figure 5 - BioRID II Instrumentation Layout

5.0 PROCEDURES FOR ASSEMBLY, DISASSEMBLY AND INSPECTION

The complete BioRID II dummy consists of six major assembly groups as shown in Figure 6.

Table 3 - Dummy Assembly Groups

Assembly Group	Part Number
Head Assembly	ARA-103
Arms (Left and Right)	78051-123 / 124
Spinal Column	ARA-200
Torso Flesh (without pins)	ARA-395
Lower Torso	ARA-500
Leg Assemblies (Left and Right)	86-5001BR / 002BR

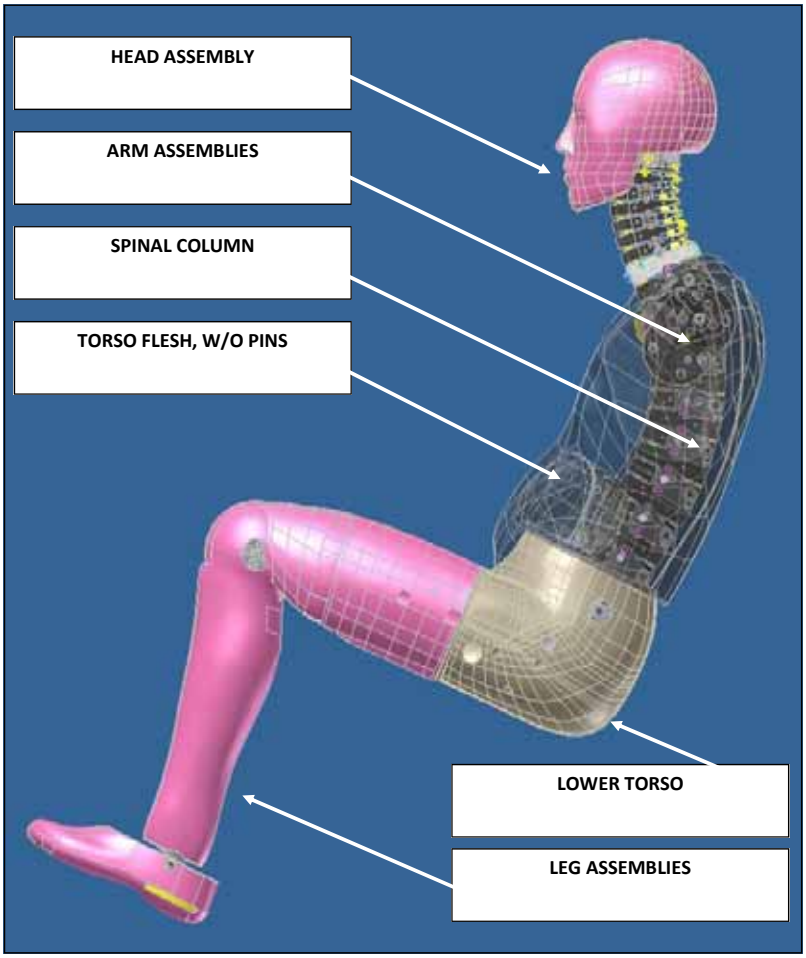


Figure 6 - BioRID II Major Assemblies

5.1 Head Assembly Components

The BioRID head assembly is a modified Hybrid III 50th percentile head assembly. The skull base and ballast are modified to accommodate the upper neck load cell and the tensioning cables that extend out of the neck section. The components in Table 4 list the parts that are included in the Head Assembly. Figure 7 shows a breakdown of all components.

Table 4 – ARA 103 Head Assembly Components

Part Description	QTY
ARA-104 Skull	1
ARA-106 Skull Cap	1
9000005 1/4-20 x 5/8 SHCS	2
4956 Upper Neck Structural Replacement	1
9000126 1/4-28 x 5/8 SHCS	4
ARA-110 Cap Skin	1
ARA-108 Head Skin	1
4947 Ring Ballast	1
9000824 8-32 x 1/2 FHCS	3

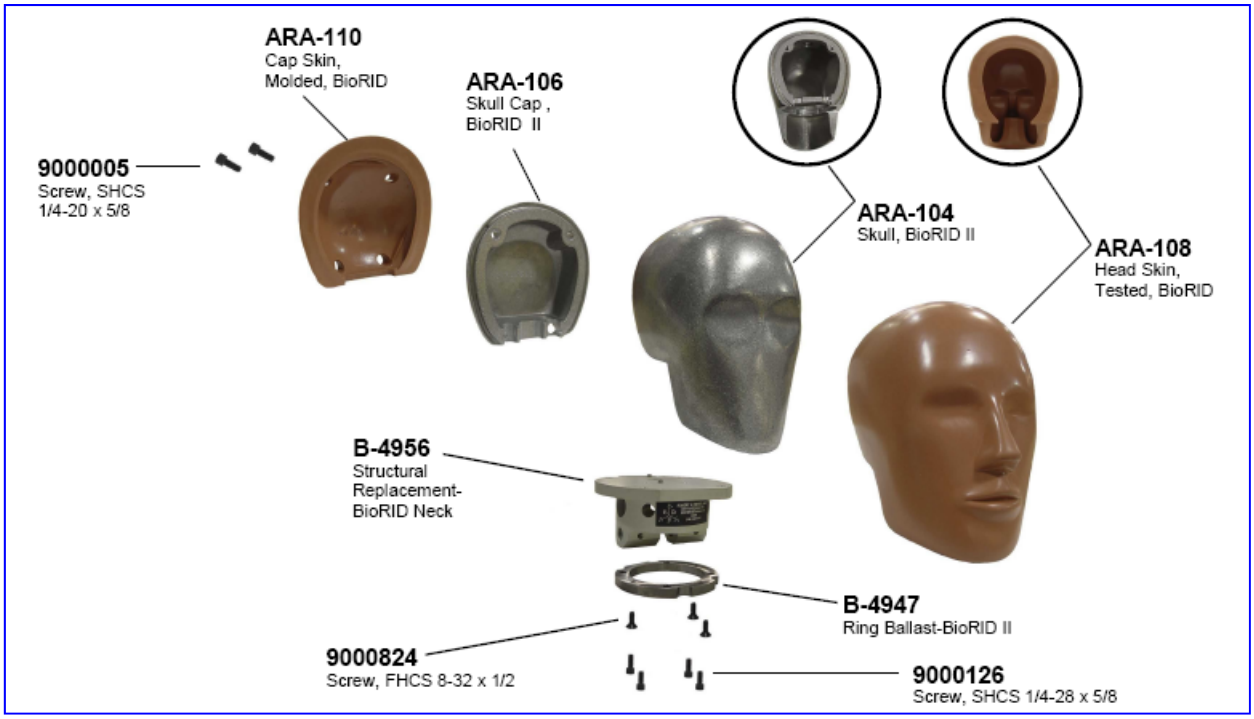


Figure 7 - Head Assembly Components

5.1.1 Head Removal

1. To remove the head from the neck assembly, loosen the two M4 nylon tipped set screws clamping the condyle pin to the O.C Plate, firmly press down on the top of the head assembly to compress the elastomer bumpers on the Occipital Condyle.

2. While the bumpers are compressed, push the condyle pin out of the head-neck joint using a 1/4" 'T'-handle wrench toward the dummy's right side. If the pin does not move easily there probably is not

enough force applied. Use caution while removing the condyle pin to avoid damaging the joint or the upper neck load cell. Once the pin is removed the head should easily pull away from the neck assembly.

5.1.2 Head Disassembly

1. To disassemble the head assembly take out the two (2) 1/4-20 x 5/8" SHCS securing the skull cap assembly to the skull.
2. Disconnect the two (2) connector plugs at the top surface of the load cell, inside the head, by sliding the outer sleeve of the connector away from the load cell.
3. Then, the four (4) 1/4-28 x 7/8" SHCS at the base of the skull can be removed to take out the upper neck load cell.
4. Take out the load cell by pushing it into the inside of the skull and then rotate the load cell 90º so that the occipital condyle hole is vertical.
5. Then the load cell can be pulled out through the back of the skull where the skull cap attaches.
6. Accelerometers can be mounted on the top surface of the neck load cell. To remove them from the load cell take out the four (4) #10-24 x 1/4" SHCS that secure the mounting plate in place.
   NOTE: Accelerometers are very susceptible to damage from direct impact. Hold on to all instrumentation until it can be properly insulated or stored.
7. Remove the head skin from the assembly by lifting the rear flaps from the skull and peeling the skin away while holding the skull.
8. With the skin removed, check the skull and skin for damage (cracks, tears or dents).

5.2 Spinal Column Assembly Components

The upper torso is the foundational section of BioRID. It is also the most complicated section of the dummy containing the torso flesh, spinal column, and muscle substitute assemblies.

5.2.1 Torso Flesh Assembly Components (Upper Torso)

The components in Table 5 list the torso flesh and lifting bracket assemblies. Figure 8 shows a breakdown of the jacket and lifting cable assemblies.

Table 5 - Jacket Flesh and Lifting Components

Part Description	QTY
ARA-395 Torso Flesh, Molded	1
ARA-364 Spine Back Plate	1
ARA-908 Pelvis Lift Bracket	1
9004036 M6 x 25mm FHCS	2
ARA-253 Shoulder Yoke	2
ARA-912 Head Locking Device	1
ARA-610 Lift Bracket	1
ARA-611 Lift Cable	1

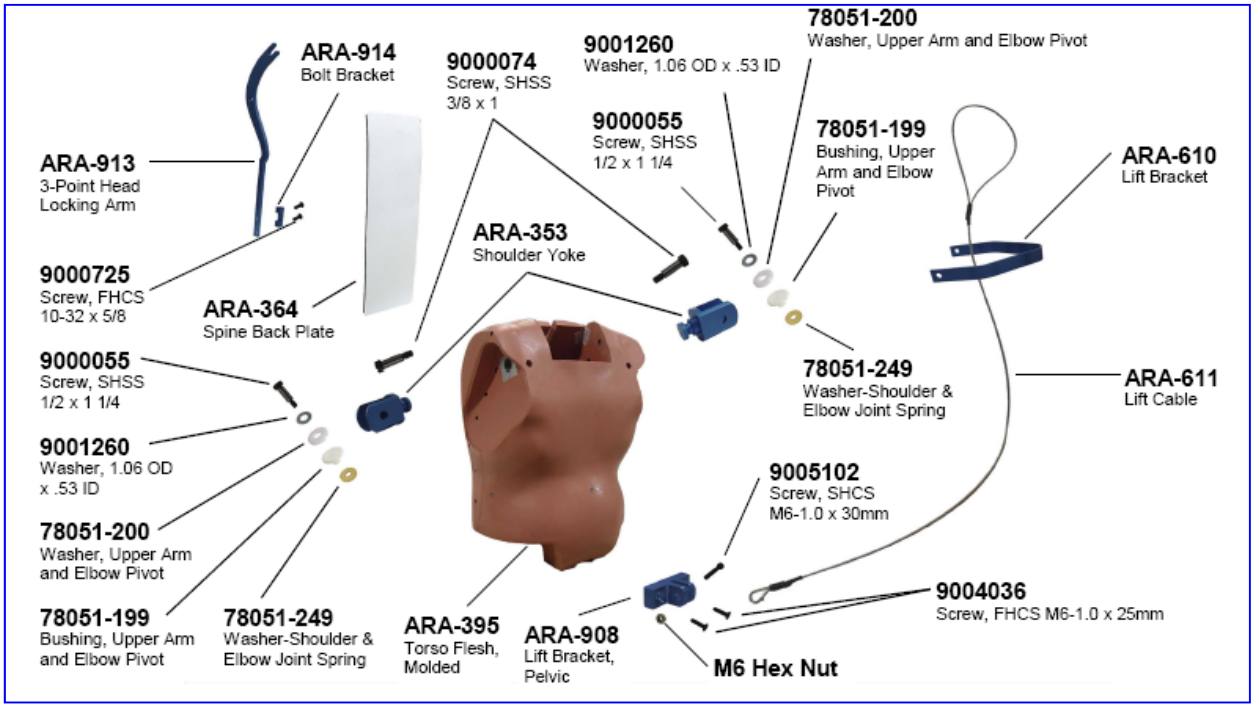


Figure 8 - Torso Flesh Assembly Components

5.2.1.1 Torso Flesh Removal

CAUTION: The abdomen is filled with fluid. Be careful not to puncture or tear the flesh.

1. To detach the upper torso from the dummy assembly remove the two (2) M10 X 1.5 X 40 mm SHCS located at the rear of the modified Hybrid III pelvis structure and the M10 X 1.5 X 40 mm SHCS, located at the front and accessed through the bottom of the pelvis.
2. With these M10 screws removed the pelvis and legs can be removed.

3. To start the disassembly of the upper torso section the arms must be taken off.
4. To do this, take out the 3/8 x 1-1/2" SHSS located at the front of the torso at the shoulder pivot.
5. When this screw is removed the shoulder yoke and arm assembly can be pulled away from the upper torso as one unit.
6. Disassembly of the arm assembly will be discussed later in this manual.
7. After both arms are removed from the upper torso the torso flesh can be removed.
8. First, take out the Teflon® back plate from the rear of the torso flesh.
9. Then, remove the two (2) M6 X 1 X 12 SHCS located at the base of the upper torso flesh in the front of the dummy.
10. Next, take out the interface pins along each side of the torso. These fifteen (15) pins increase spine–torso flesh interaction.
11. Lay the upper torso on a clean, flat surface with the chest down and loosen the upper four screws (2 on each side) with an M6 wrench, the remainder are removed with an M4 hex wrench.
12. Once the interface pins are detached from the spine, the spring loaded muscle substitute assemblies (2 pieces) can be slipped from their holder in the torso flesh and the flesh can be pulled from the spine assembly.

5.2.2 Muscle Substitute System Assembly

The muscle substitute assembly is a system of springs and cables running through each cervical vertebra to the T3 vertebrae connecting the head assembly to the thoracic assembly. The components in Table 6 list the components of the muscle substitute assemblies. Figure 9show a breakdown of the assembly.

Table 6 - Muscle Substitute Assembly Components

Part Description	QTY
ARA-404 Anterior Spring Tube	1
ARA-401 Anterior Spring	1
ARA-405 Muscle Substitute Piston	2
ARA-403 Posterior Spring Tube	1
ARA-402 Posterior Spring	1
ARA-410 Cable Sleeve	2
ARA-411 Cable Terminal	2
ARA-505 Spring Tube Retainer	1

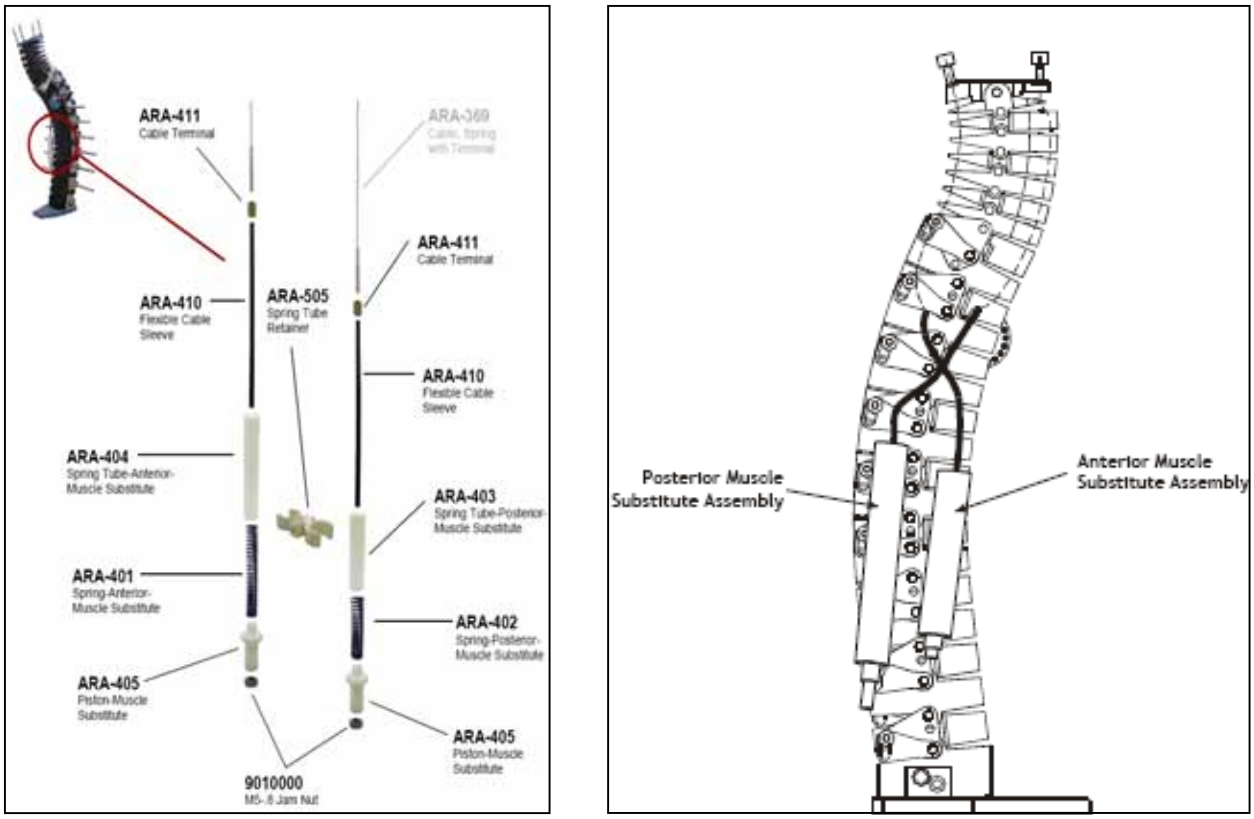


Figure 9 - Muscle Substitute Assembly Components

5.2.2.1 Muscle Substitute Removal

Prior to disassembly of the spine, the muscle substitute cables must be loosened or removed.

1. To disassemble the spine first relieve the tension on the muscle substitute system (damper and spring loaded muscle substitutes) and remove the cables threaded through the vertebrae.
2. This is done by first loosening and removing the two M5 nuts and lower spring cable adjusters at the base of each spring assembly.
3. After which, the springs will slide out of the tubes.
4. Then, pull the cable through the adjustment screw at the top of the torso so that the cable crimp is accessible.
5. Cut the cable below the crimp, between the crimp and the adjustment screw.
6. Pull the cable down and out through the vertebrae and spring tubes.
7. To remove the damper loaded muscle substitute assembly loosen the cable adjustment screws and posts at the top of the torso, on the dummy's left side and adjust the posts all the way down.
8. Compress cervical vertebrae toward the rear and pull the cable out of the rear adjustment screw.
9. Cut the cable between the cable crimp and the adjustment screw.
10. Repeat this procedure for the front adjustment screw.
11. Next, remove the damper mounting screw (M8 X 1.25 X 12 SHCS) located at T4 and pull the damper unit from the spine assembly.
12. Loosen the two M3 SHSS that clamp the damper to the damper cable and remove the cable from the damper slot.
13. Discard the cable and clean the slot of any glue residue.
14. During reassembly the damper mounting screw is to be torqued to 5 ft lbs.

5.2.3 Spinal Column (Cervical Portion)

The cervical, or neck, section of the spine assembly is the upper most section of the spine extending from T1 vertebrae to Occipital interface plate. The components in Table 7 list the components of the spinal column (cervical portion) assembly. Figure 10 shows a breakdown of all the spinal column (cervical portion) components.

Table 7 - Spinal Column (Cervical Portion)

Part Description	QTY
ARA-100 Occipital Interface	1
9010112 M4 x 6mm SSFP	2
ARA-231 Bumper Occipital	2
ARA-221 Rear Cervical stop	9
ARA-220 Front / Rear Cervical Bumper	12
ARA-227 Rear Cervical Bumper	6
ARA-201 Cervical Vertebra C1	1
ARA-225 Front Cervical stop	9
ARA-206 Cervical Vertebra C4	1
ARA-207 Cervical Vertebra C2, C6	2
ARA-203 Cervical Vertebra C3, C5	2
ARA-208 Cervical Vertebra C7	1
ARA-209 Neck Pins C1, C2	1
9002030 Nut, Hex M8	2
ARA-210 Neck Pin Occipital C1	1
ARA-213 Neck Pin w/ flats C7, T1	1
ARA-212 Neck Pin C2, C7	5
ARA-369 Spring Cable	2
9005132 O Ring	2
9005133 Cable Ferrule	4
ARA-356 Cable Adjustment	4
ARA-406 Cable Adjuster	4
ARA-711 Cable Post Sleeve	2
ARA-409 Damper Cable	1
ARA-413 Cable Boot	4
9009091 Cable Adjuster	4
9010113 M2.5 x 8mm SHCS	2
ARA-302 T1 Structural Replacement	1
8417 Split Bushing	4
8418 Split Bushing	4

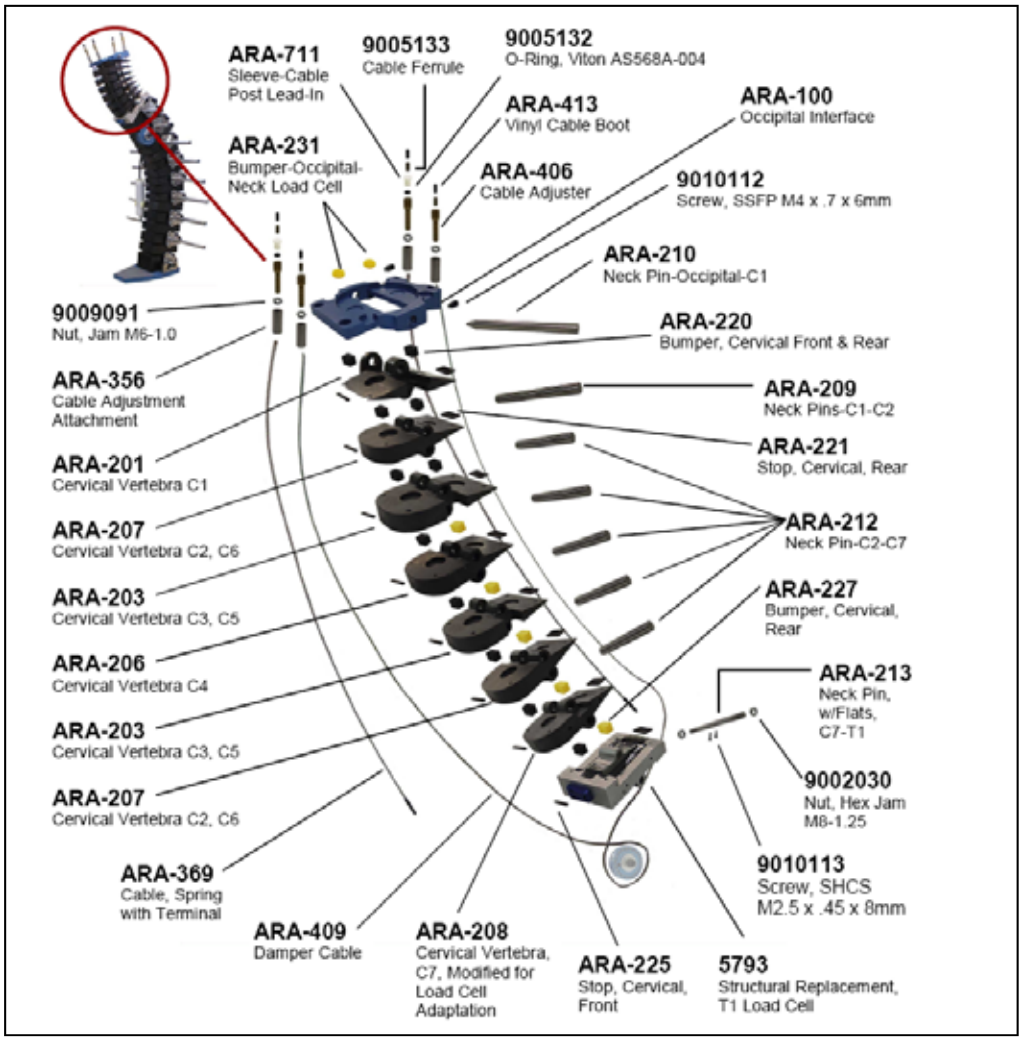


Figure 10 - Spinal Column (Cervical Portion)

5.2.3.1 Spinal Column (Cervical Portion) Removal

1. Taking off the M8 jam nuts on each side of the spine at the C7–T1 joint and loosen or remove the (2) M2.5 SHCS used to lock the T1 pin to the vertebrae.
2. The pin can then be pushed out of the assembly. Do not hammer or directly impact the joint. The vertebrae are plastic and can be damaged if excessive force is used.
   NOTE: Be careful not to damage the pin threads or the through hole.
3. To remove the remaining cervical spine pins, use a 6 mm punch and tap lightly to slide the pins out, until the cervical spine is completely disassembled.
4. Check the bumpers as discussed in the Thorax–Lumbar Spine section.
5. Reassembly the Cervical Spine by reversing the disassembly instructions.

5.2.4 Spinal Column (Thoracic Portion)

The spinal column is further broken down into two addition subassemblies (Part 1 and Part 2). The components in Table 8 and Table 9 list the parts that are included in the thoracic section of the spinal column assembly. These components are further illustrated in Figure 11and Figure 12.

Table 8 - Spinal Column Components – Part 1

Part Description	QTY

Part Description	QTY
ARA-381-37 Thoracic Bumper	12
ARA-381-30 Thoracic Bumper	12
ARA-312 Thoracic Vertebra T2	1
ARA-327 Thoracic Vertebra T3	1
ARA-328 Thoracic Vertebra T4	1
ARA-329 Thoracic Vertebra T5	1
ARA-330 Thoracic Vertebra T6, T7, T-9	6
ARA-331 Thoracic Vertebra T8	1
ARA-375 Damper Assembly	1
ARA-501 Lumbar Vertebra L1	1
ARA-521 Front Lumbar Bumper	5
ARA-520 Rear Lumbar Bumper	5
ARA-502 Lumbar Vertebra L2, L5	4
ARA-563 Pelvis / Spine Interface Plate	1
ARA-933 H-Point Left	1
ARA-934 H-Point Right	1
ARA-343 Cable Guide Wheel	1
9005108 M8 x 25mm SHCS	1
ARA-510 Pelvic Interface Abd. Attach.	1
9004036 M6 x 25mm FHCS	4
4000076 5/16 x 3/4 Washer	2
8703 S1 Structural Replacement	1

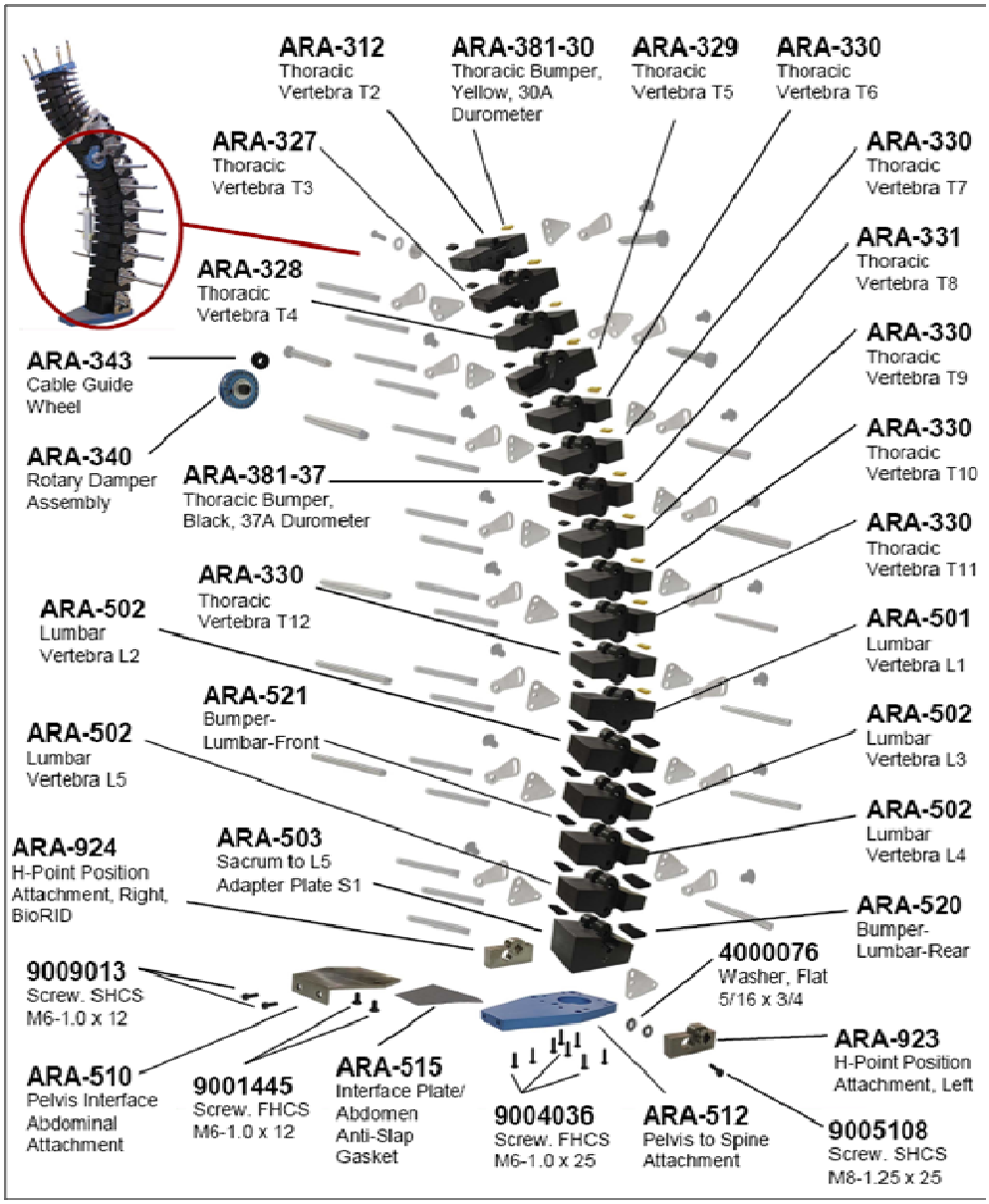


Figure 11 - Spinal Column - Part 1

Table 9 - Spinal Column Components - Part 2

Part Description	QTY
9005125 M8 x 12mm SHCS	16
9010000 M5 Hex Nut	2
9001447 M6 x 25mm SHCS	1
9000776 9/32 x 5/8 Washer	1
9010293 Cable Cap	4
9009285 5/16 x 3/4 Washer	16
9010443 Tension Washer	1
9010454 M6 Low Head SHCS	6
6588 Adaptor S1 LC	1
9010051 M4 x 10mm SHCS	6
9005170 M2.5 x 12mm SHCS	10
ARA-354-LR12 Spine-Torso Interface Pin	4
ARA-354-LR3 Spine-Torso Interface Pin	2
ARA-354-LR4 Spine-Torso Interface Pin	2

Part Description	QTY
ARA-354-L5 Spine-Torso Interface Pin	1
ARA-354-R5 Spine-Torso Interface Pin	1
ARA-354-LR67 Spine-Torso Interface Pin	4
ARA-354-L8 Spine-Torso Interface Pin	1
9001445 M6 x 12mm FHCS	2
ARA-320 Torsion Adjustment Washer	17
ARA-321 Torsion Bar	17
ARA-332 Torsion Washer	1
ARA-373 Torsion Washer T4	1
ARA-324 Torsion Thoracic Washer	10
ARA-325 Torsion Lumbar Washer	6

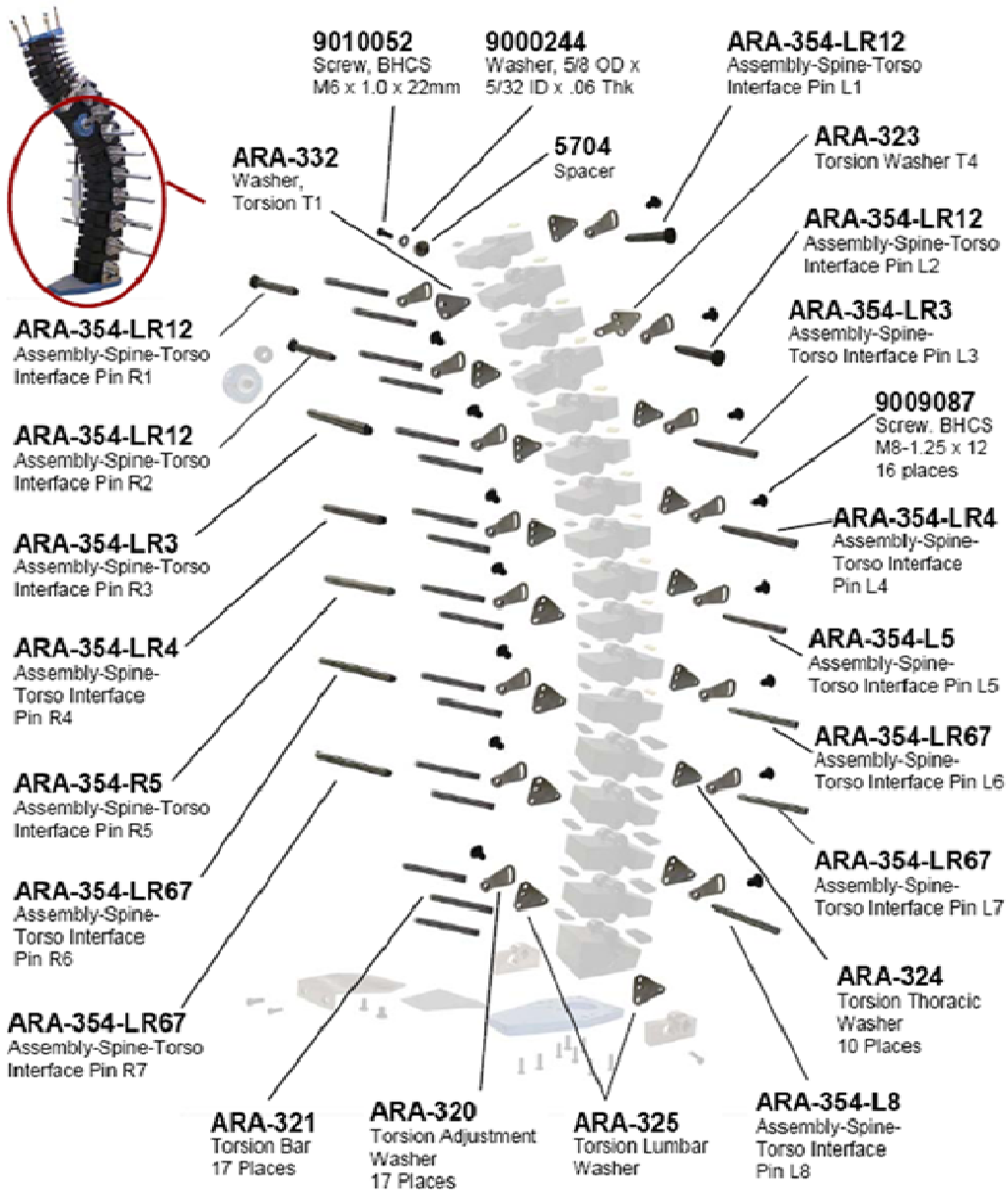


Figure 12 - Spinal Column - Part 2

5.2.4.1 Spinal Column (Thoracic Portion) Assembly Removal

1. Before starting to take off each vertebra, it is recommended that the operator mark each position with tape or paint so that it can be more easily reassembled. The best numbering method would be to mark each vertebra with its standard designation: C1, . . . T1, . . . L1, etc. Also, the torsion adjustment washer position at each vertebral junction can be marked with a paint marker to show its position relative to the torsion washer.
2. Start disassembling the spine vertebrae by removing the pelvis interface plate at the base of the spine.
3. Do this by taking out the four (4) M6 X 1 X 20 FHCS (8 FHCS for dummies with rev. E) at the underside of the interface plate.
4. The pelvis interface plate can now be pulled away from the spine.
5. Remove the M8 x 1.25 x 10 BHCS that lock the adjustment washers in place on the torsion washer.
6. The best method to remove these pins is to lay the spine assembly on a firm, flat work surface with the pins vertical.
7. Use two wooden blocks to provide clearance under the spine for the pins to move downward.
8. Then, starting with the pin joining S1 and L5, tap the pin out of the torsion washer on the dummy's left side using a 6 mm pin punch and a brass mallet.

   NOTE: Be careful not to damage the pin or the splined hole in the washer. The vertebrae are plastic and can be damaged if excessive force is used.

9. Continue working along the spine assembly breaking loose the torsion pins from the torsion washers. After all the pins on one side are loose, turn the spine over and repeat the process on the opposite side until all the pins are free from the torsion washers.
10. Now, the pins and torsion washers can be pulled from the spine assembly.
11. For easier re-assembly, take out the pin–adjustment washer assemblies one at a time starting at the S1–L5 joint. bottom to top set aside each part as it is taken off so it can be re-assembled in the same sequence.
    NOTE: Pay attention to the parts at each vertebral section. At S1 there are shim or spacer washers between the torsion washer and the vertebra. At T4 there is a cable pulley wheel inside. There are also rubber bumper pads on each vertebra. These must be reinstalled. If any are loose or have fallen off they can be re-glued to the vertebra using the following procedure:
    1. Remove old glue from the bumper and the vertebra.
    2. Scrub area of vertebra to be glued with acetone or MEK.
    3. Draw a line on the vertebra 2 mm from the anterior (front) when replacing the front bumper for positioning the bumpers. The posterior (rear) bumper will be glued flush with the rear edge of the vertebra when being replaced.
    4. Apply a thin coat of glue (Loctite® 401) to the bumper and gently press the bumper onto the vertebra centered from sides of vertebra. Hold for approximately 30 seconds.
    5. Remove excess glue with a cotton swab (or equivalent) and acetone (or equivalent).

5.3 Pelvic Assembly

The pelvis assembly is a modified Hybrid III 50th Percentile (HIII-50th). The assembly consists of the molded pelvis structure, the femur assemblies (left and right) and two (2) femur friction plungers used to apply force to the femur ball and provide resistance to leg motion.

5.3.1 Pelvis Assembly Components

The components in Table 10 list the parts that are included in the pelvis assembly. Figure 13 shows a breakdown of the components in the pelvis assembly.

Table 10 - Pelvis Assembly Components

Part Description	QTY
ARA-514 Pelvis, Molded	1
78051-110 Femur Assembly, Left	1
78051-111 Femur Assembly, Right	1
9000009 1/4-20 x 3/4 SHCS	6
9000063 5/8 x 1 3/4 SHSS	2
78051-13 Pelvic Cover	1
9000624 10-24 x 1/2 SHCS	4
78051-259 Set Screw Assembly	2
78051-123 Arm Assembly, Left	1
9005218 M10 x 40mm SHCS	3

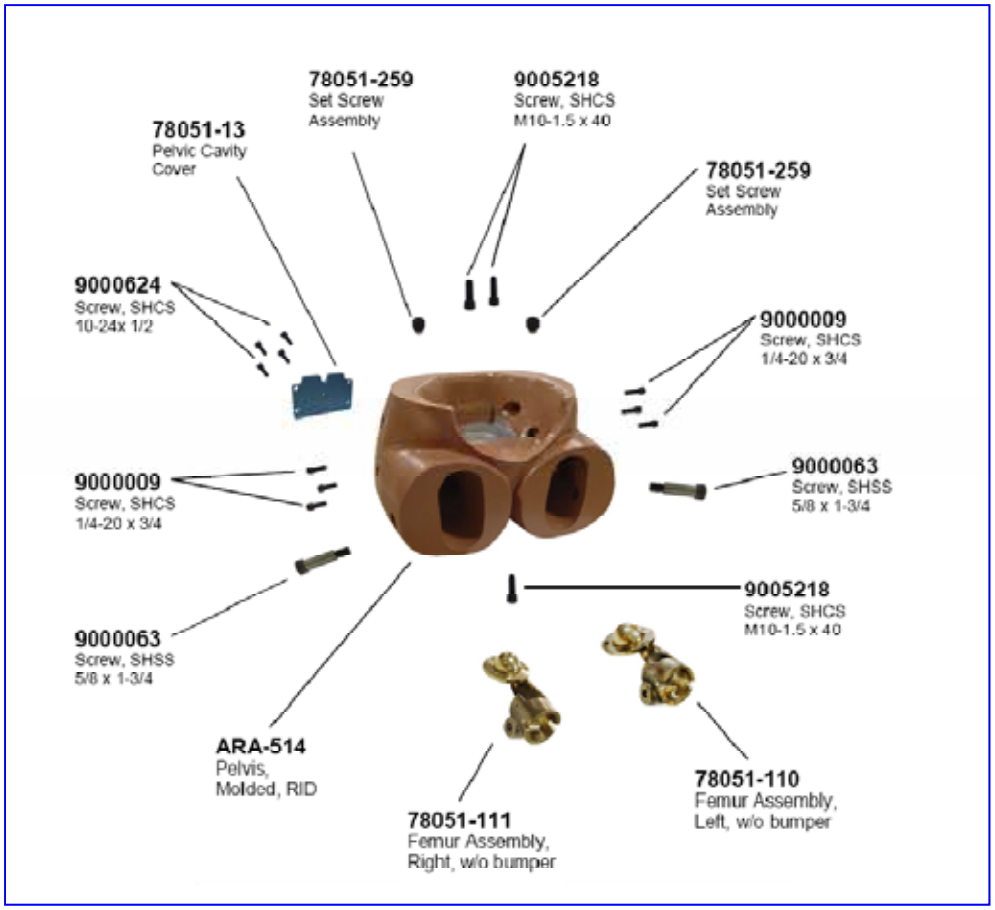


Figure 13 - Pelvis Assembly Components

5.3.1.1 Pelvis Assembly Removal

1. To begin disassembly, first remove the legs.
2. This is done by removing the 5/8 X 1-3/4" SHSS in the pelvis securing the leg in the femur.
3. Next, take out the femur assemblies.
4. This is done by taking out the three (3) 1/4-20 x 3/4" SHCS that secure each femur flange to the pelvis bone.
5. After removing the femur assembly from the pelvis, check the femur ball for damage or metal deposit build-up.

5.4 Arm Assembly

The BioRID II dummy uses the arms from the Hybrid III 50th Male Dummy as specified in CFR 49 Part 572 Subpart E.

5.4.1 Arm Assembly Components

The components in Table 11 list the parts that are included in the arm assembly. Figure 14show a breakdown of the components in a left arm assembly.

Table 11 - Arm Assembly Components

Part Description	QTY
78051-199 Bushing, Upper Arm and Elbow	2
78051-200 Washer, Upper Arm and Elbow	2
78051-249 Washer, Joint Spring	2
9010283 M10 x 45mm SHCS	3
78051-174 Upper Arm	1
9006003 3/8 x 1 1/2 SHSS	1
78051-191 Upper Arm, Lower Part	1
9000055 1/2 x 1 1/4 SHSS	1
78051-200 Washer, Upper Arm and Elbow	1
9001260 1.06 x .53 Washer	1
78051-199 Bushing, Upper Arm and Elbow	1
78051-249 Washer, Joint Spring	1
78051-202 Elbow Pivot Nut	1
78051-194 Lower Arm	1
9000074 3/8 x 1 SHSS	1
78051-204 Wrist Rotation	1
78051-214 Wrist Pivot Screw	1
78051-208 Hand, Left	1
78051-124 Arm Assembly, Right	1
78051-174 Upper Arm	1
9006003 3/8 x 1 1/2 SHSS	1
78051-191 Upper Arm, Lower Part	1
9000055 1/2 x 1 1/4 SHSS	1
78051-200 Washer, Upper Arm and Elbow	1
9001260 1.06 x .53 Washer	1
78051-199 Bushing, Upper Arm and Elbow	1
78051-249 Washer, Joint Spring	1
78051-202 Elbow Pivot Nut	1
78051-194 Lower Arm	1
9000074 3/8 x 1 SHSS	1
78051-204 Wrist Rotation	1
78051-214 Wrist Pivot Screw	1
78051-208 Hand, Right	1

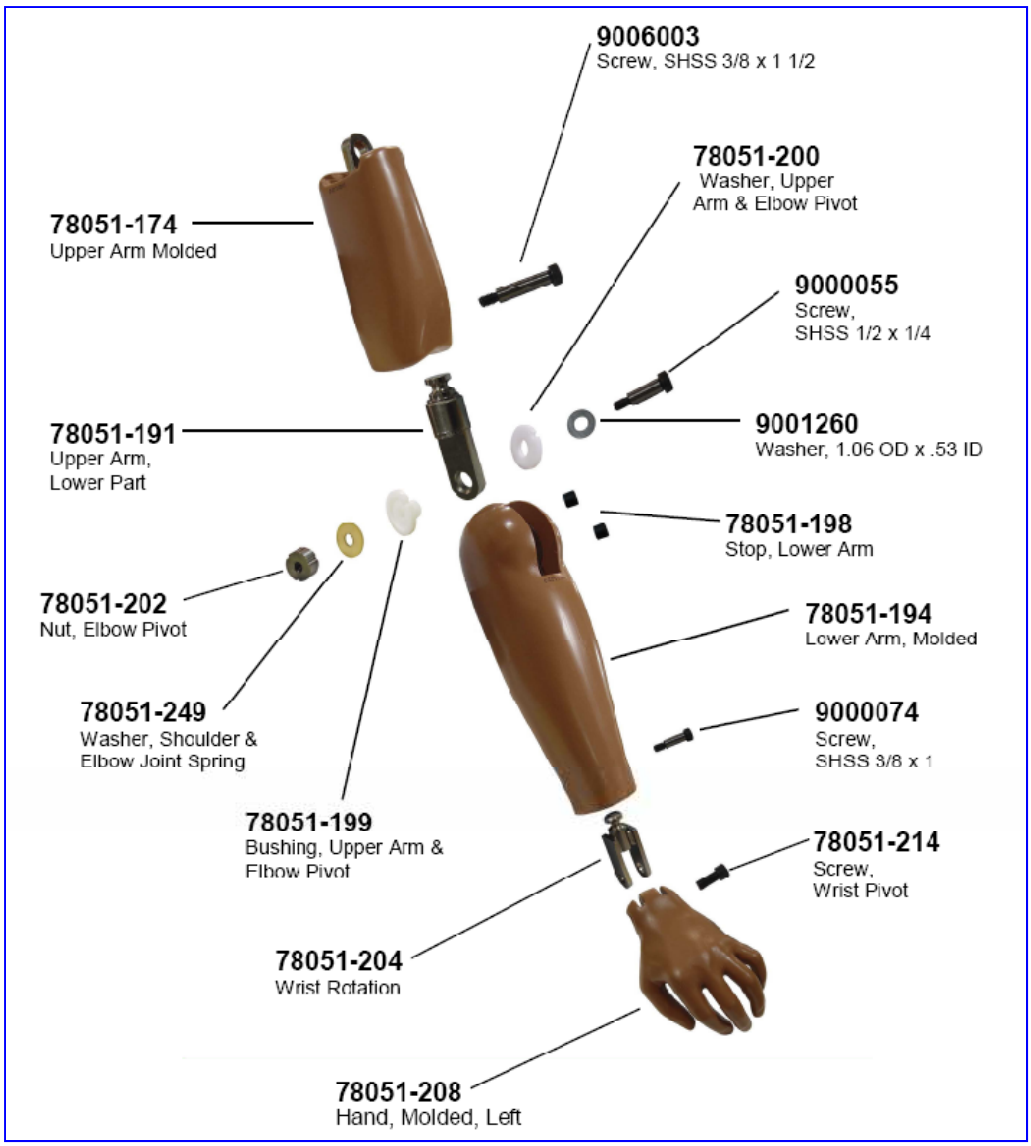


Figure 14 - Arm Assembly Components (Left Shown)

5.4.1.1 Arm Assembly Removal

1. To disassemble the arm start by detaching the upper and lower arm sections.
2. Do this by removing the 1/2 X 1-1/4" SHSS bolt at the elbow joint.
3. After taking out the bolt and washer the lower arm assembly can be removed by rotating the lower arm rearward.
4. In the elbow joint there are
    a. pivot washer
    b. pivot bushing
    c. pivot nut
    d. spring washer.
5. Check each component for damage and replace as necessary.
6. There are two components in the upper arm assembly that the user can take apart.
7. Take out the 3/8 X 1-1/2" SHSS in the upper arm section, just above the elbow.
8. Now the upper arm assembly can be pulled from the upper arm lower part.
9. The upper arm lower part is the component that is inserted into the elbow joint and provides the 'Z' axis rotation for the lower arm assembly.
10. If the upper arm flesh is damaged beyond repair the assembly will have to be re-molded.

11. The molded hand is detached from the lower arm assembly by taking out the wrist pivot screw (modified 1/2-20 X 1-1/4" Nylok® SHCS) and pulling the hand from the wrist assembly.
12. The wrist assembly is removed by taking out the 3/8 X 1" SHSS and pulling the wrist assembly from the lower arm.

5.5 Leg Assembly

The BioRID II dummy uses the legs from the Hybrid III 50th Male Dummy as specified in CFR 49 Part 572 Subpart E.

5.5.1 Leg Assembly Components

The components in Table 12 list the parts that are included in the leg assembly. Figure 15 Figure 14show a breakdown of the components in a left leg assembly.

Table 12 - Leg Assembly Components

Part Description	QTY
86-5001-001BR Leg Assembly, Left	1
78051-43 Upper Leg Bone	1
78051-41 Upper Leg, Molded	1
9000449 3/8-16 x 1 3/4 SHCS	1
78051-319 Load Cell Simulator	1
9000066 3/8-16 x 2 SHCS	1
79051-24P Pedestrian Knee Slider Replacement	1
79051-25P Pedestrian Knee Slider Replacement	1
79051-30Shoulder Bolt, Modified	2
79051-34 Rotation Stop Cover	1
9005079 8-32 x 1/2 SHCS	2
79051-35 Rotation Stop Arm	1
79051-32 Washer	1
79051-33 Compression Washer	1
79051-22 Knee Cap	1
78051-27 Knee Insert	1
78051-5 Knee Flesh, Left	1
9004028 1/4-28 x 3/8 FHCS	8
78051-73S Lower Leg Flesh	1
2110 Knee Weldment	1
1877 Tibia Bone	1
9000126 1/4-28 x 5/8 SHCS	4
A-1887 Leg Attachment Bolt	1
C-1884 Ankle Upper Shell	1
C-1885 Ankle Lower Shell	1
A-1590 Ankle Shaft	1
A-1672 Stop Pin Retainer	1
9000072 3/16 x 1/2 Dowel Pin	1
A-1888 Ankle Friction Pad	1
9000073 5/16-18 x 3/8 SSCP	1
9006010 10-32 x 1/4 SSCP	2

9000076 8-32 x 1/2 BHCS	2
78051-610 Ankle Bumper	1
A-1886 Foot Attachment Bolt	1
78051-600 Foot Assembly, Left	1
86-5001-002BR Leg Assembly, Right	1
78051-44 Upper Leg Bone	1
78051-42 Upper Leg, Molded	1
9000449 3/8-16 x 1 3/4 SHCS	1
78051-319 Load Cell Simulator	1
9000066 3/8-16 x 2 SHCS	1
79051-24P Pedestrian Knee Slider Repl.	1
79051-25P Pedestrian Knee Slider Repl.	1
79051-30Shoulder Bolt, Modified	2
79051-34 Rotation Stop Cover	1
9005079 8-32 x 1/2 SHCS	2
79051-35 Rotation Stop Arm	1
79051-32 Washer	1
79051-33 Compression Washer	1
79051-22 Knee Cap	1
78051-27 Knee Insert	1
78051-6 Knee Flesh, Left	1
9004028 1/4-28 x 3/8 FHCS	8
78051-74S Lower Leg Flesh	1
2110 Knee Weldment	1
1877 Tibia Bone	1
9000126 1/4-28 x 5/8 SHCS	4
A-1887 Leg Attachment Bolt	1
C-1884 Ankle Upper Shell	1
C-1885 Ankle Lower Shell	1
A-1590 Ankle Shaft	1
A-1672 Stop Pin Retainer	1
9000072 3/16 x 1/2 Dowel Pin	1
A-1888 Ankle Friction Pad	1
9000073 5/16-18 x 3/8 SSCP	1
9006010 10-32 x 1/4 SSCP	2
9000076 8-32 x 1/2 BHCS	2
78051-610 Ankle Bumper	1
A-1886 Foot Attachment Bolt	1
78051-601 Foot Assembly, Right	1

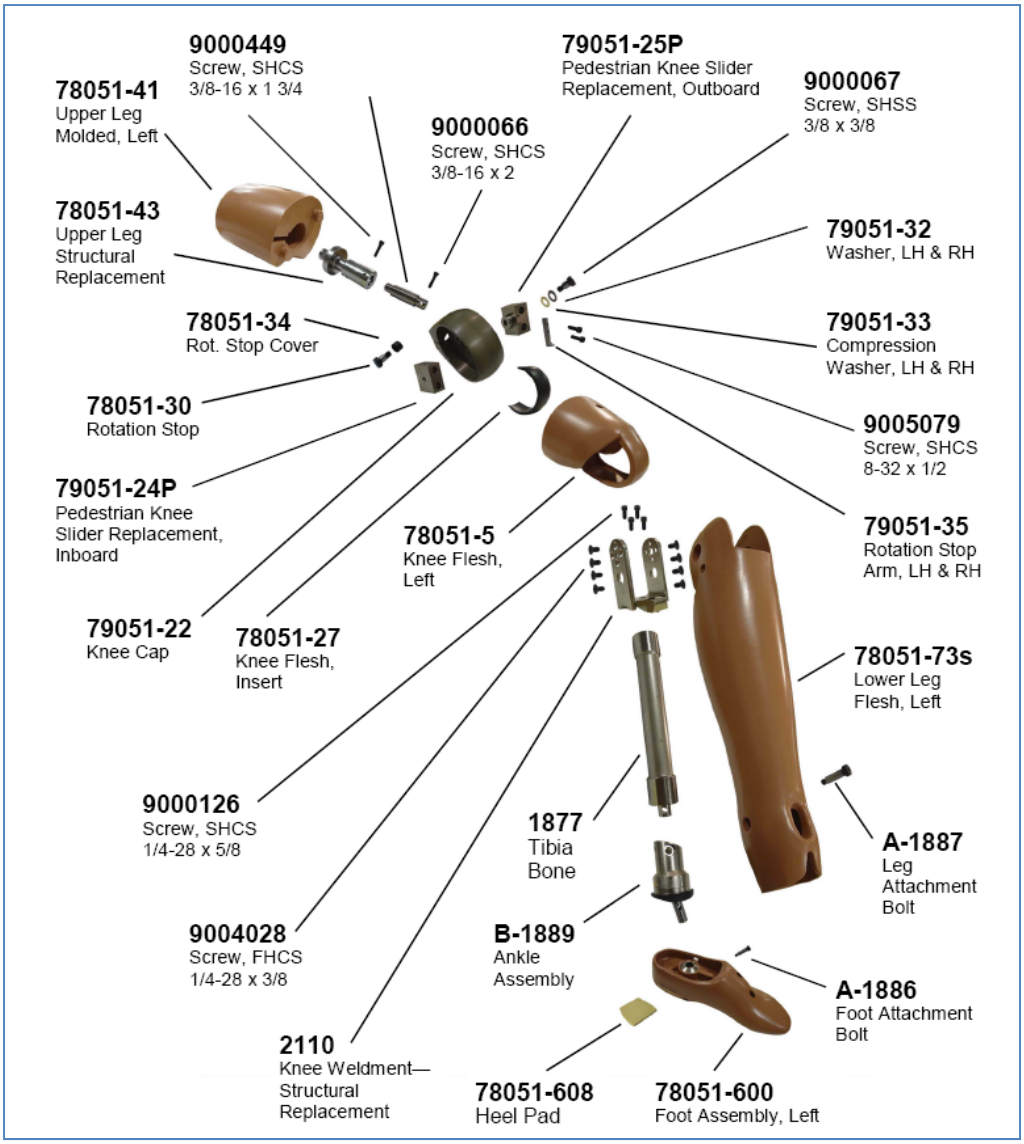


Figure 15 - Leg Assembly Components (Left Shown)

5.5.1.1 Leg Assembly Removal

1. To disassemble the leg, start by detaching the upper and lower leg sections.
2. Do this by pulling the flesh flaps away from the knee section and taking out the four (4) modified 1/4-28 X 3/8" FHCS on each side of the knee (total: 8-per leg) and then slide the knee clevis off the knee assembly.
3. To disassemble the upper leg assembly, start by taking out the 3/8-16 X 1-3/4" SHCS at the top of the assembly toward thigh–knee end.
4. Pull the knee assembly away from the thigh.
5. The femur load cell is installed between the knee and thigh and can be removed by taking out the 3/8-16 X 2" SHCS in the knee assembly.
6. With the knee detached, the femur flesh can be slid off the upper femur bone by pushing it toward the knee.
7. To disassemble the knee assembly take out the knee pivot bolt (modified 3/8" diameter SHSS) at the pivot center of the knee slider replacement assembly.
8. While taking out the knee pivot bolt notice that there are two (2) washers used with this bolt.
9. The first one is steel and the second is Urethane®.

10. The Urethane® washer (or compression washer) is installed into the outboard (outer surface of the knee) knee slider first and then the steel.

    NOTE: If this process is reversed the bolt head will damage the Urethane® washer as it is tightens into the assembly.

11. There is also a rotation stop installed on the outboard side of the knee bone. The stop consists of a modified 3/8 X 3/8" SHSS and a rubber sleeve.
12. The stop is removed by taking out the 3/8" screw and pulling the sleeve off the shoulder.

    NOTE: Be sure the threads of the screw do not extend into the inboard knee slider replacement rotation path.

13. The knee flesh is removed by holding the knee bone and peeling the flesh off the outer knee radius (the impact surface).
14. The knee insert, the black rubber part between the flesh and the knee bone, can be taken off the knee bone at the same time as the flesh.
15. Inspect the flesh and insert for cuts, tears and punctures.
16. To start disassembling the lower leg, first take off the molded foot assembly.
17. Remove the foot by taking out the modified 1/4 X 3/4" SHSS at the foot–ankle joint.
18. With the foot removed slide the lower leg flesh down the tibia toward the ankle.
19. Remove the knee clevis by taking out the four (4) 1/4-28 X 5/8" SHCS.
20. To disassemble the ankle assembly take out the leg attachment bolt and pull the ankle off the lower leg assembly.
21. Take out the 5/16-18 x 3/8" SSCP and the friction pad to remove the force on the ankle shaft.
22. Next, take out the two (2) #10-32 x 1/4" SSCP holding the stop pin retainer in place and pull out the pin retainer.

    IMPORTANT: Watch for the stop pin to fall out of the assembly when the retainer is removed.

23. Now, take out the six (6) #8-32 x 1/2" BHCS that connect the upper and lower ankle shells. Four (4) of these button head screws hold the ankle bumper in place and two (2) are under the pad.
24. Before reassembling the ankle make sure the ankle shaft and inside surfaces of the shells are clean and free of burrs.

    NOTE: Grease or liquid lubricants should be avoided inside the ankle assembly. Use graphite or some equivalent dry lubricant if necessary.

6.0 INSTRUMENTATION INSTALLATION

This section provides instruction for the installation of instrumentation into BioRID II dummy.

6.1 Head Assembly

The BioRID Head is equipped to accept three uniaxial accelerometers mounted on a block to measure Ax, Ay, and Az at the head center of gravity. Table 13 summarizes the parts used for instrumentation in the head. Figure 16 shows the orientation of the accelerometers with respect to the head.

Table 13 - Head Instrumentation Parts

Part Description	Quantity	Part Number
Uniaxial Piezoresistive Accelerometer	3	SA572-S4
#0-80 x 1/8" SHCS	6	9000152
Triaxial Mount Block	1	SA572-S80
#2-56 x 5/8" SHCS	2	9000531

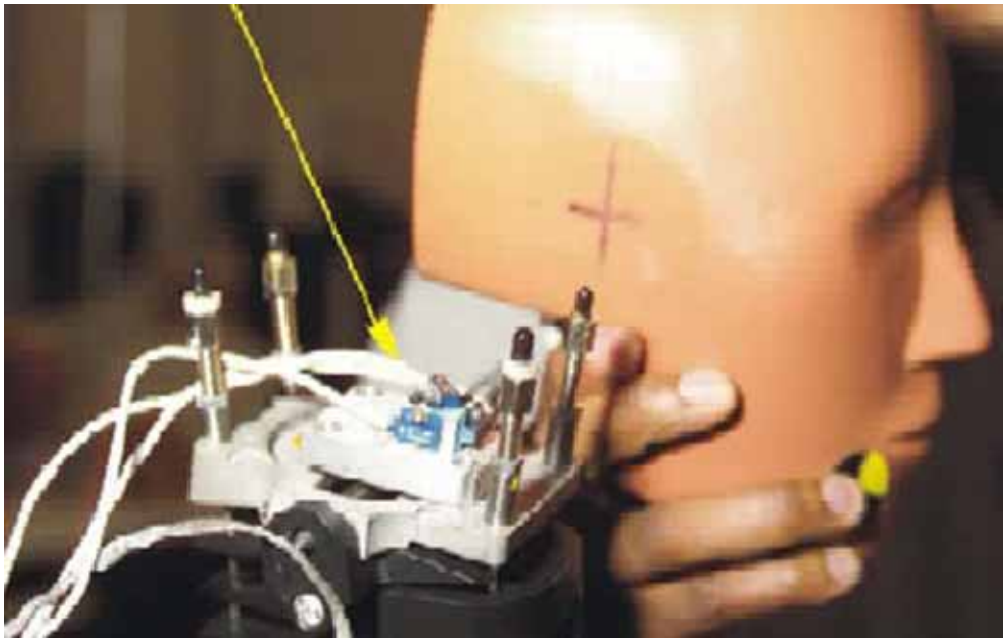


Figure 16 - Head Accelerometer Orientation

6.1.1 Installation of Head Accelerometers

1. Mount the three uniaxial piezoresistive accelerometers onto the triaxial mount block with two each #0-80 X 1/8" SHCS so that their seismic masses all point to one corner of the block (Figure 17).
2. Attach the triaxial block to the head mounting block using two #2-56 X 5/8" SHCS.
3. Attach the head mounting block to the upper neck load cell (or structural replacement) using four #10-24 X 7/16" SHCS.
4. Insert either the upper neck load cell or upper neck load cell structural replacement in the head cavity.

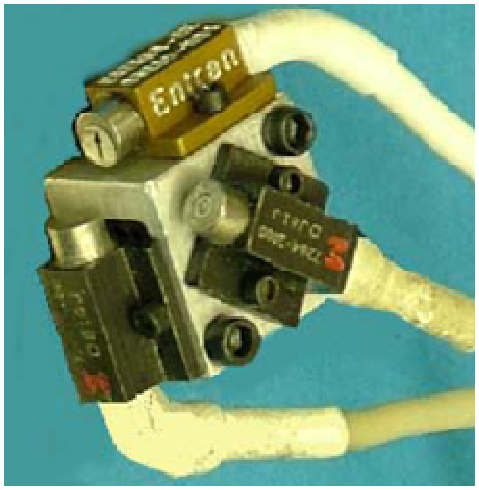


Figure 17 - Head accelerometers installed on triaxial mount block

6.1.2 Installation of Skull Cap Contact Switch

The BioRID II dummy is equipped to accept a standard skull cap skin with an electronic switch circuit. This skull cap is a direct replacement to the existing skull cap. Figure 18 shows a skull cap with the contact switch circuit. This skull cap shown has multiple holes to attach to the skull cap load cell.

For the switch circuit to work correctly, the skull cap must make contact to an electrically conductive surface attached to the headrest of a seat or dummy certification sled.

Figure 18 - Skull Cap Contact Switch

6.1.3 Installation of Skull Cap Load Cell Head and Skull Cap Assembly

The BioRID II dummy may be equipped with a skull cap load cell to measure the head forces Fx, Fy, and Fz during impact into a headrest. To use the skull cap load cell, a different head assembly must be used. This head and skull cap have the same mass and center of gravity as the normal BioRID II head assembly. Table 14 lists the components for the skull cap load cell head assembly.

Provisions are made to insure the head and skull cap are correctly used.

Table 14 - BioRID II Skull Cap Head Assembly

Part Description	Quantity	Part Number
Skull, Modified for Skull Cap	**1**	**ARA-123**
Skull Cap and Skin Assembly	**1**	**ARA-122**
Screw, FHCS ¼-20 X 1/2”	**2**	
Screw, SHCS ¼-28X 5/8”	**4**	
Head Skin for Skull Cap Load Cell Head	**1**	**ARA-124**
Ring Ballast	**1**	**4947**
Screw, FHCS 8-32 X 1/2”	**3**	
Skull Cap Load Cell	**1**	**6350JFL-51-30**
Load Cell Mounting Plate	**1**	**6355**
Screw, FHCS 10-24 X 1/2”	**4**	

Note: It is important to make sure the correct skull cap is used. When using the skull cap load cell, user must also use the correct head assembly.

6.2 Spinal Column (Cervical Portion) Assembly

The BioRID II dummy is equipped with neck instrumentation which includes an upper neck load cell measuring X, Y, and Z forces and moments, two uniaxial piezoresistive accelerometers at C4, lower neck load cell at T1 measuring Fx, Fz, My, and two uniaxial piesoresistive accelerometers at T1. Accelerometers may be located on the right or left side of the cervical vertebrae. Angular rate sensors may also utilize the accelerometer mounting on the cervical vertebrae.

6.2.1 Mounting of Cervical Spine Accelerometers

1. Cervical spine accelerometers are mounted only on the sides of the accelerometer block and when mounted to the spine measure Ax and Az accelerations.
2. Mount two uniaxial piezoresistive accelerometers onto the triaxial mount block with two each #0-80 X 1/8” SHCS so that their seismic masses all point to one corner of the block as shown in Figure 19.

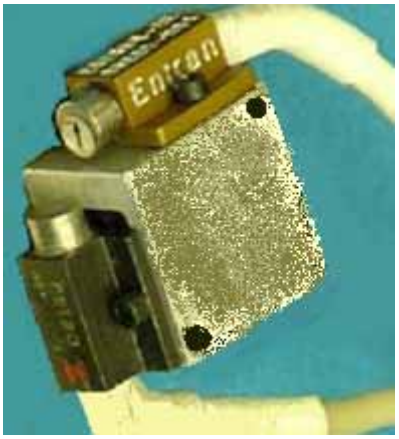


Figure 19 - Cervical Spine Accelerometer Mount

6.3 Spinal Column (Thoracic Portion) Assembly

The BioRID II dummy is equipped with thoracic instrumentation which includes two uniaxial piezoresistive accelerometers located at eighth (T8) thoracic vertebra and the first (L1) lumbar vertebra measuring Ax and Az accelerations and a lumbar load cell measuring X and Y axial forces and moment about Y axis. Accelerometers may be located on the right or left side of the thoracic vertebrae. Angular rate sensors may also utilize the accelerometer mounting on the thoracic vertebrae.

6.3.1 Thoracic Spine Accelerometer Installation

1. Thoracic spine accelerometers are mounted only on the sides of the accelerometer block and when mounted to the spine measure Ax and Az accelerations.

2. Mount two uniaxial piezoresistive accelerometers onto the triaxial mount block with two each #0-80 X 1/8" SHCS so that their seismic masses all point to one corner of the block as shown in Figure 20. The step is identical for T8 and L1 accelerometer locations.

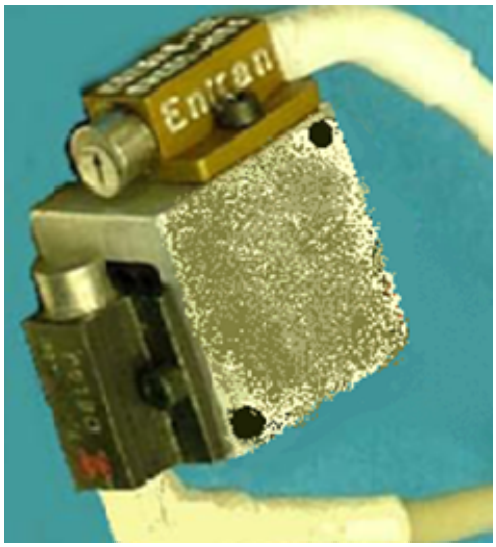


Figure 20 - Thoracic Spine Accelerometer Mount

6.4 Pelvis Assembly

The BioRID II dummy is equipped with an instrumentation cavity in the back of the pelvis for the installation of accelerometers, angular rate sensors, and/or tilt sensors to measure the pelvis Ax, Ay and Az accelerations and also the AVx, AVy and AVz angular rates.

6.5 Pelvis Accelerometer Installation

1. Mount the three uniaxial piezoresistive accelerometers onto the triaxial mount block with two each #0-80 X 1/8" SHCS so that their seismic masses all point to one corner of the block (Figure 21).
2. Attach the triaxial block to the pelvis accelerometer mounting plate using two #2-56 X 5/8" SHCS.
3. Attach the pelvis mounting plate to the pelvis instrumentation cavity.

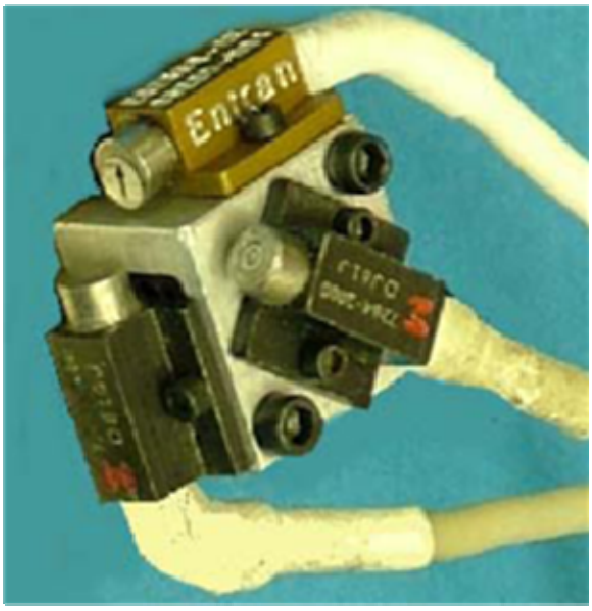


Figure 21 - Pelvis Accelerometer Mount

7.0 INSTRUMENTATION CABLE ROUTING

The dummy contains provisions for mounting numerous electronic instruments to evaluate various types of occupant restraint systems. Typically, the instruments are connected to the data acquisition system through the use of long cables. The instrumentation cables must be routed in and around the dummy in a manner that ensures that the dummy's motion is not affected by the cables while also being careful not to place the cables in a position where they are susceptible to damage from the test event. There are many acceptable methods of routing the cables and the following section is intended as a reference.

7.1 Grounding

To reduce the possibility of static electricity discharge and subsequent noise in the data acquisition system, a small length of cable, referred to as a grounding cable, is placed between the instruments on the dummy and ground. This cable is typically placed so it electrically connects the metal body of the accelerometers, load cells and ground. Figure 22 show a typical grounding scheme for the BioRID II dummy.

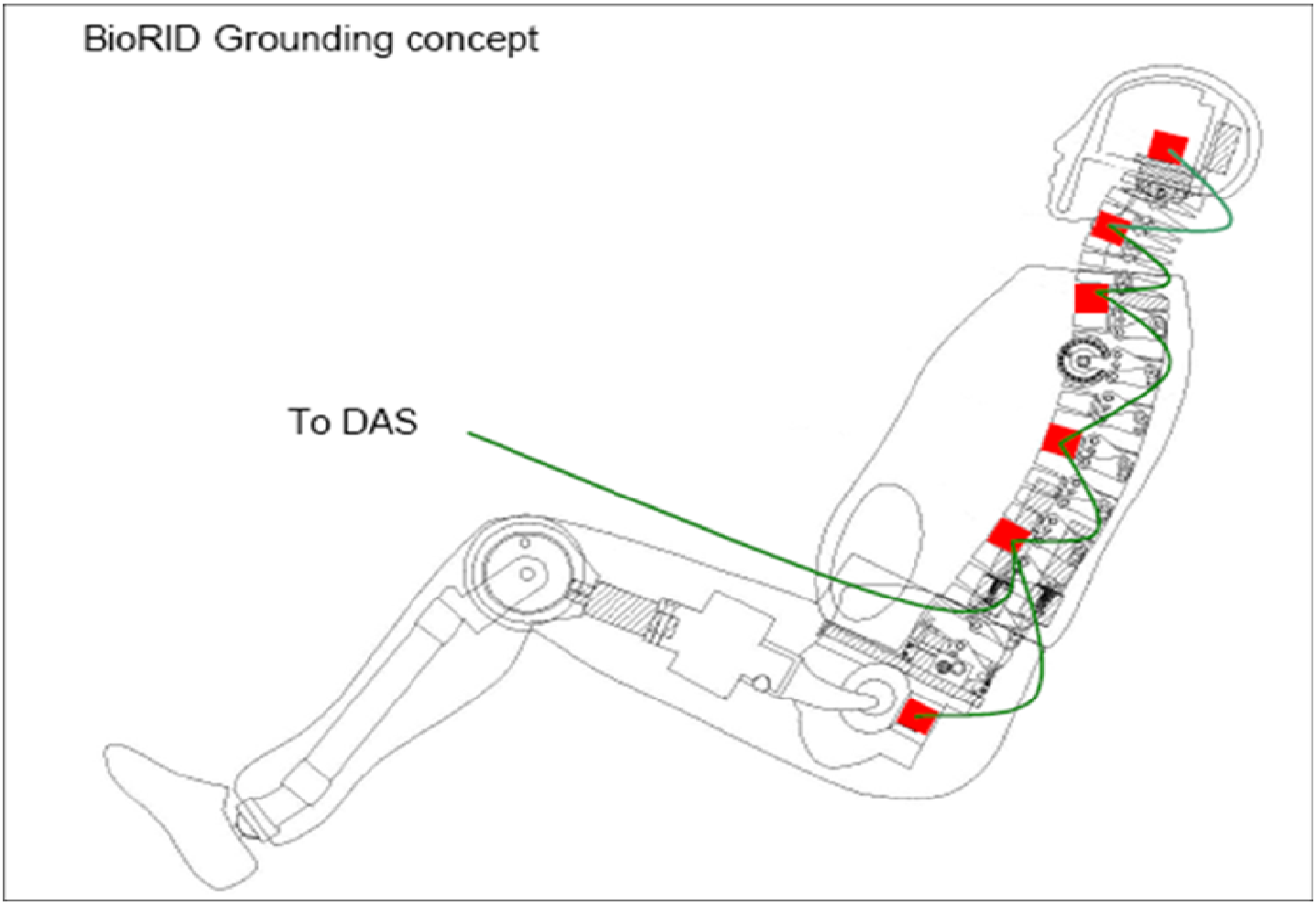


Figure 22 - Instrumentation Grounding Concept

7.2 Head and Cervical Neck cable Routing

1. Bundle the wiring for the head accelerometers and upper neck load cell together and tie wrap together.
2. Install the skull cap, carefully assuring that the wiring bundle is in the recessed area of the skull so that wiring is not damaged.
3. Route the cable bundle along the neck and add C4 accelerometer cables to the bundle near C4.
4. Continue to route cable to the T1 vertebrae adding the T1 accelerometer and loadcell cables to the bundle at the side of T1.

7.3 Thoracic Spine Cable Routing

1. Add self adhesive zip tie bases to the side plates of the spine. These are for anchoring the cable bundle.
2. Add a zip tie to each tie wrap base and tighten until the diameter of the tie is 10 mm. At this point no cables are inside the tie loop Figure 23 shows an example of the tie wrap loop attached to the adhesive base.

Figure 23 - Tie Wrap Base Loop

3. Secure the cable bundle together with each loop for the entire length of the spine at each base.
4. Add any accelerometer or other instrumentation cables to the bundle as necessary.
   NOTE: This method is to prevent any contribution of the instrumentation harness to influence the BioRID II spine stiffness and instrumentation results.
5. Figure 24 illustrates the proper cable routing for the BioRID II dummy.

Figure 24 - Thoracic Spine Cable Routing

7.4 Pelvis Instrumentation Cable Routing

1. Bundle the instrumentation cables together inside the instrumentation cavity in the back of the pelvis
2. Route the cable up the back on the top of the pelvis.
3. Combine all instrumentation bundles on the top of the pelvis.
4. Exit the entire bundle between the jacket and the top of the pelvis. Figure 25 shows an example of the entire cable bundle exiting the dummy.

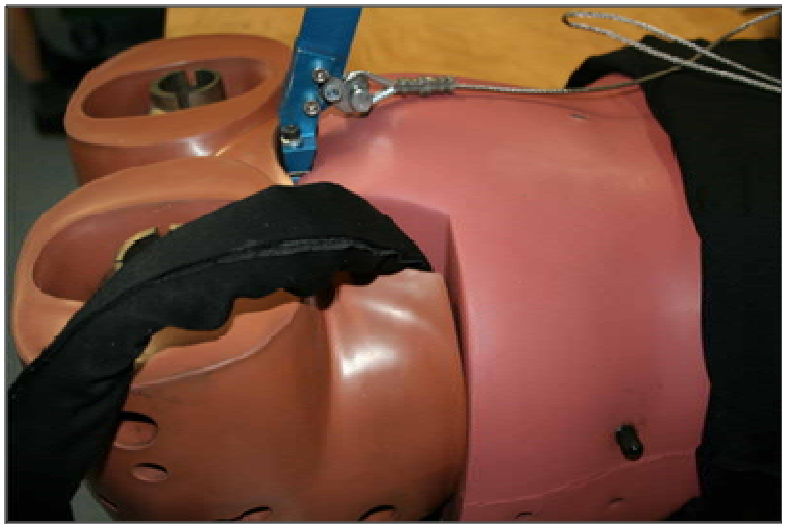


Figure 25 - Cable Bundle Exit

8.0 BIORID II ABDOMEN

The abdomen is filled with 2.06 liters (4.35 lbs) of water through the valve on the left side of the torso flesh. The core of the valve must be removed before filling using the valve tool included with the dummy tool kit. The valve core must be replaced after filling is completed. A one (1) gallon bottle with a three (3) foot long hose and a 14 gauge (1.7 mm ID) X 1-1/2" long needle is used to fill the abdomen.

8.1 Abdomen Filling Procedure

1. Fill the bottle with 2.06 liters (4.35 lb) of fresh water. The spigot valve must be closed.
2. Lay the torso down with the valve pointed upward.
3. Remove the plastic cap covering the fill valve and take out the valve core using the tool provided.
4. Insert the needle into the valve opening. Figure 26 shows the location of the abdomen fluid valve.
5. Holding the bottle and hose assembly above the abdomen, open the spigot on the bottle.
6. After all the water is emptied from the bottle and the hose into the abdomen, remove the needle from the valve. ***Do not over fill.***
7. Reinstall the valve core. Depress the core to allow air to escape. Gently squeeze the abdomen to remove all the remaining air. Water will be visible in the valve when all the air is removed. It may be necessary to do this step several times while tilting the torso in different directions.
8. Reinstall the plastic valve cap.

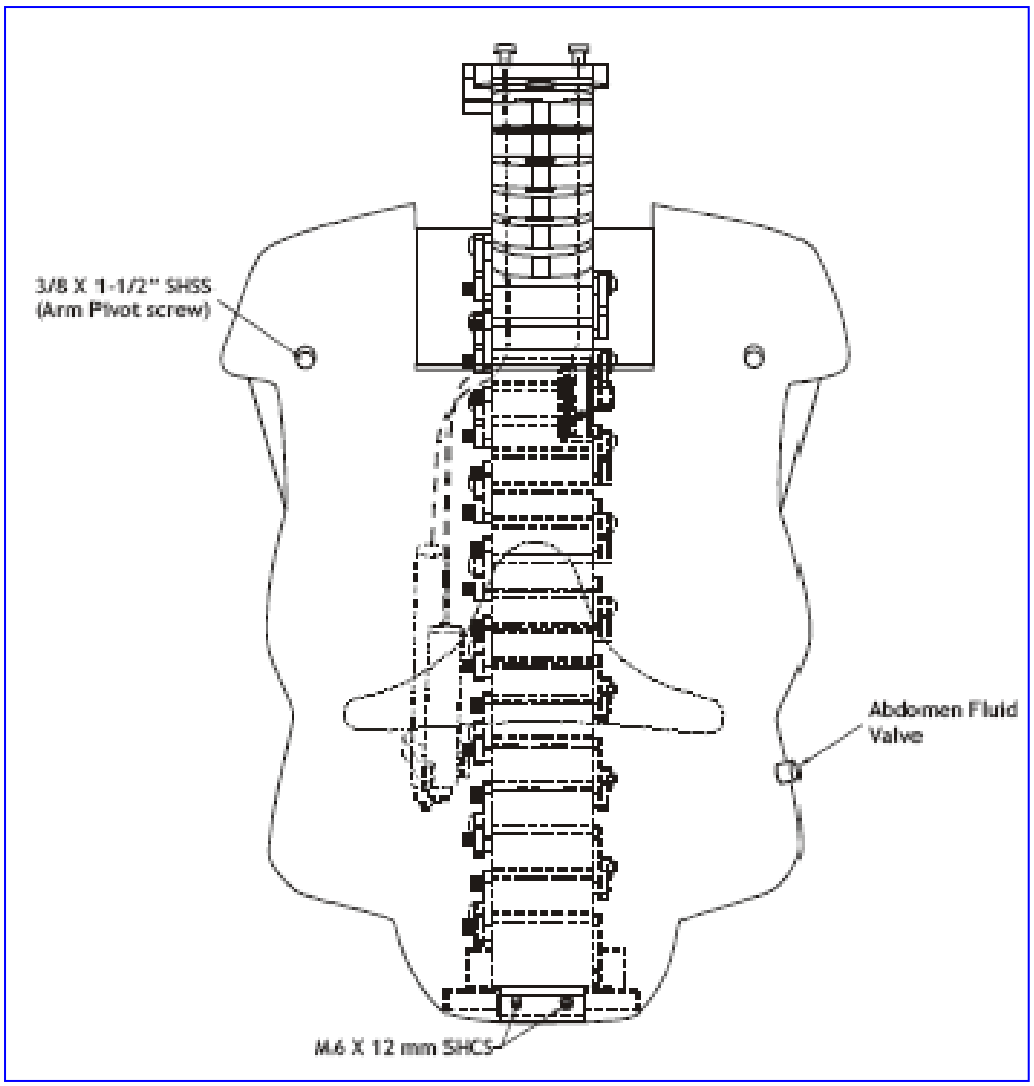


Figure 26 - BioRID II Jacket Assembly

9.0 BIORID II JOINT ADJUSTMENT PROCEDURE

The joints of a BioRID dummy are adjusted to a "one G suspended setting". This is defined as a torque level on the joint where the friction will allow an assembly to move toward the earth when a small force is applied to the unsupported end of the assembly.

9.1 BioRID II Joint Adjustment

9.1.1 Shoulder

1. Extend arm assembly laterally outward to a horizontal position and twist the upper arm if necessary to allow it to fall toward the torso.
2. Tight the shoulder clevis bolt so that the arm is suspended at one G.
3. Rotate the complete arm assembly forward and horizontal.
4. Adjust the shoulder yoke attachment screw, (as shown in Figure 27**Error! Reference source not found.**) so that the arm is held suspended at one G.

Figure 27 - Shoulder Joint Setting

5. Rotate arm at elbow inward 90 degree toward the chest.
6. Adjust elbow rotation bolt (as shown in Figure 28) through access in upper arm to hold lower arm horizontally suspended at one G.

Figure 28 – Elbow Yoke Rotation Setting

7. Reposition arm again as per instructional step 3.

8. Twist the lower arm at the elbow, allowing it to pivot downward.
9. Adjust the elbow pivot bolt through the access hole (as shown in
10. Figure 29) in the lower arm flesh at elbow to hold the lower arm suspended at one G.

Figure 29 - Elbow Joint Setting

11. With the hand extended outward, adjust the wrist pivot bolt at the base of the hand to hold it suspended at one G.
    Rotate hand toward torso and adjust wrist rotation bolt through access in wrist flesh (as shown in Figure 30) to hold it suspended at one G.

Figure 30 - Wrist Joint Setting

12. Repeat procedure for other arm assembly.

9.1.2 Legs and Feet

1. Legs and feet are to be set with dummy in an upright seated position.
2. With lower leg rotated at knee to vertical, lift upper leg assembly above horizontal.
3. Adjust femur ball set screw (as shown in Figure 31) so the leg is held suspended at one G.

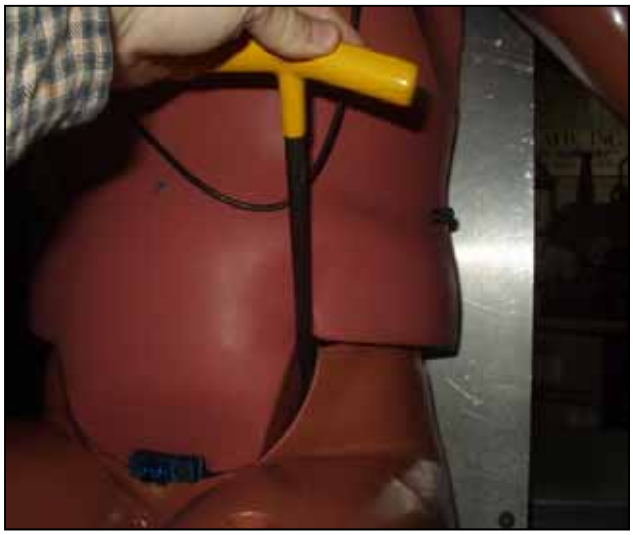


Figure 31 - Femur Joint Setting

1. Rotate the leg assembly outward and horizontal
   Adjust the knee clevis bolt (as shown in
   Figure **32**) so the lower leg is held suspended at one G.

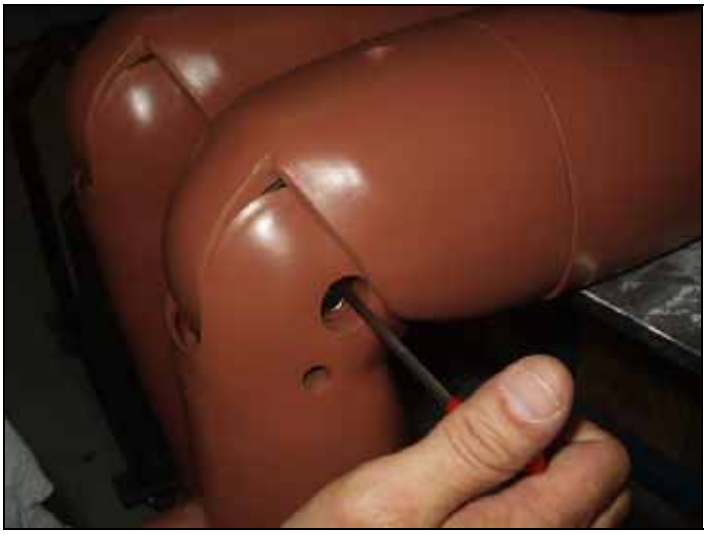


Figure 32 - Knee Joint Setting

2. Adjust the ankle ball joint set screw (as shown in Figure 33) so that the foot is held suspended at one G. This adjustment is more of an individual feel.

Figure 33 - Ankle Joint Setting

3. Repeat procedure for the other leg and foot assembly.

10.0 SETTING UP THE BIORID II DUMMY FOR IMPACT

The BioRID II dummy is a complex dummy that has numerous activities that need to be completed prior to being tested.

10.1 BioRID II Cable Installation Procedure

These instructions detail the installation of the BioRID II spring cables and damper cable.

10.1.1 BioRID II Cable Installation

Figure 34 is an exploded view of the upper neck components related to the three cables. In addition to the pair of spring cables (ARA-369) and damper cable (ARA-409) are list in Table 15.

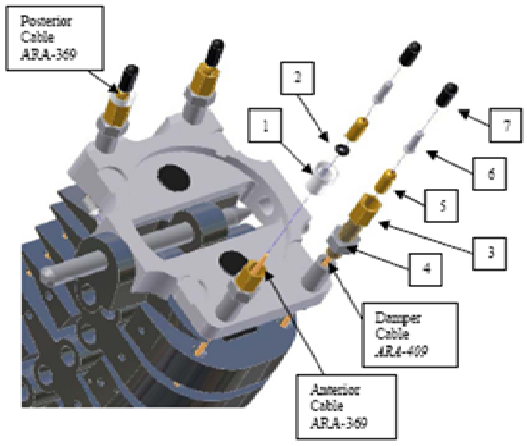


Figure 34 - BioRID II Cable Detail

Table 15 - Cable Components

Item Number	Description	Part Number	Qty
1	Cable Post Lead-in sleeve	ARA-711	2
2	Spring Cable O ring	9005132	2
3	Upper Cable Adjuster	ARA-406	4
4	M6 Hex Locknut	9009091	4
5	Cable Ferrule	9005133	4
6	Cable Cap	9010293	4
7	Cover Cap	ARA-413	4

1. Begin installation of the damper cable by feeding it down thru the top of the rear damper cable adjuster, and then down thru the back cable holes of the vertebra, from the O.C. plate down thru T3 (Figure 35).

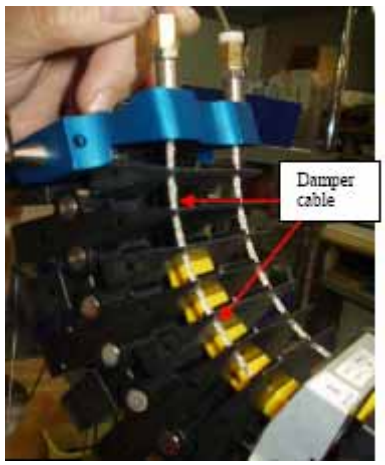


Figure 35- Damper Cable Installation

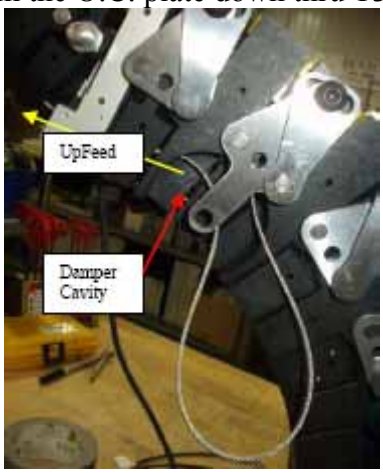


Figure 36 - Damper Cable Installation

2. After cable is fed out thru damper cavity, continue by feeding up thru the front cable holes on the vertebra, from T3 up thru the front damper cable adjuster on the O.C. plate (Figure 36).

3. Adjust damper adjustment screw so that it is ½ turn open. To do this, turn adjustment screw clockwise until travel stops, then turn counter-clockwise ½ turn (Figure 37).

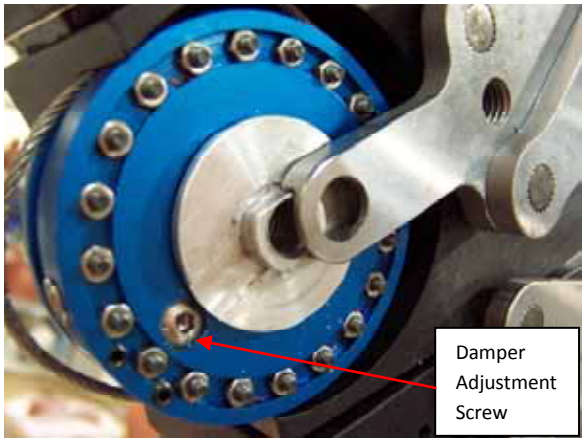


Figure 37 - Damper Adjustment Screw Setting

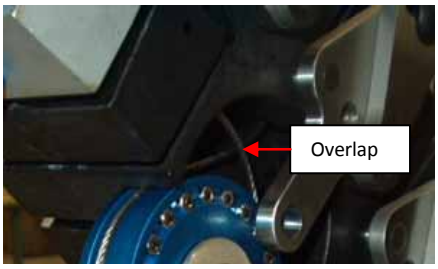


Figure 38 - Damper Cable Overlap

4. Overlap the cable as shown in Figure 38.
5. Wrap the cable around the damper drum as shown in Figure 39 making sure the cable is seated in the slot.
6. Slide tapered projection of end of damper paddle into tapered slot on mounting plate (Figure 40).

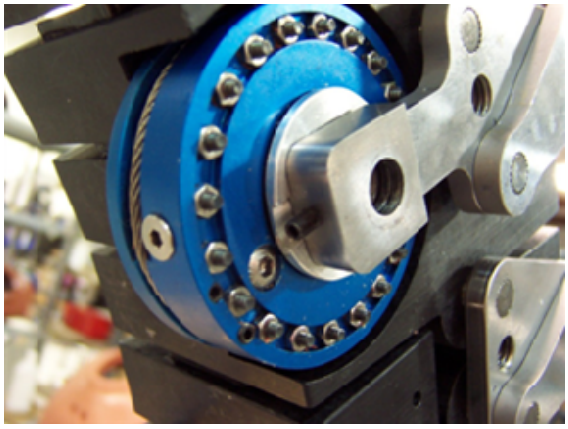


Figure 39 - Damper Cable Seating

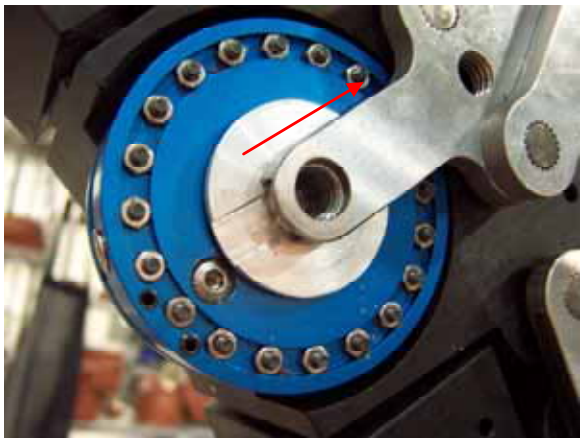


Figure 40 - Slide in Damper

7. Slide clamp bracket over damper/plate assembly (Figure 41).
8. After installing clamp bracket, be sure that shallow slot on seal washer and mating projection on clamp bracket are mated (Figure 42).

Figure 41 - Damper Clamp Bracket

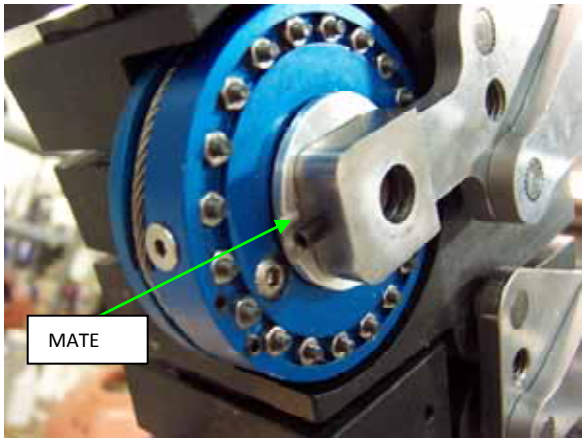


Figure 42 - Damper Clamp Bracket Mate

9. Install M8 mounting bolt and lock washer with fingers until only finger tight. Tighten M3 setscrew to firmly seat damper into tapered slot on mounting plate (fig 16).
10. Torque mounting bolt to 5 ft/lbs / 6.78 Nm. (fig. 17).

Figure 43 - Damper Clamp Set screw

Figure 44 - Damper Mount Bolt Torque

11. Feed one #9005133 ferrule onto end of rear damper cable (Figure 45).
12. Crimp ferrule onto cable somewhere within 4" / 100 mm from end of cable (Figure 46).

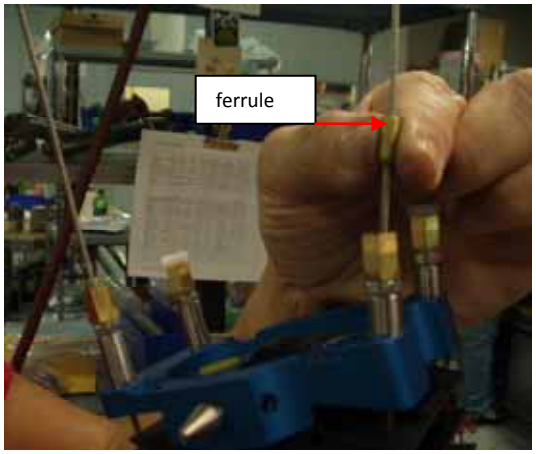


Figure 45 - Damper Cable Ferrule Installation

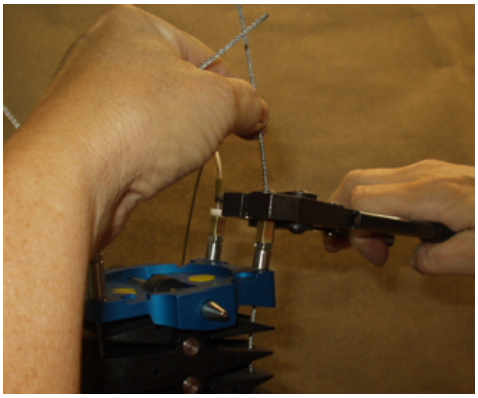


Figure 46 - Ferrule Crimping

13. Feed one #9005133 ferrule onto end of front damper cable (Figure 47). Be sure cable adjusters are adjusted all the way down. Pull up on both ends of cable with one hand to seat cable tight around damper (Figure 48) and so that rear ferrule touches top of cable adjuster (Figure 47).

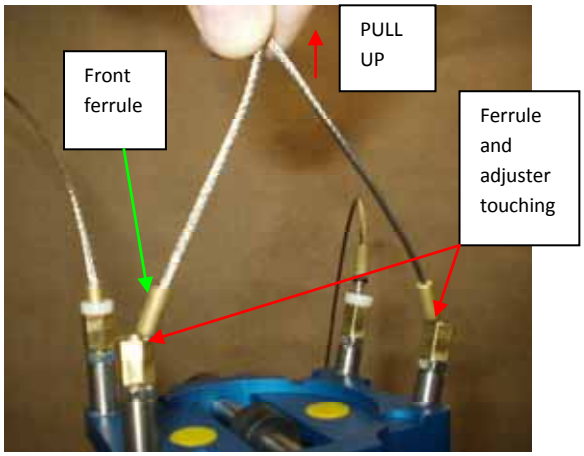


Figure 47 - Damper Cable Setting

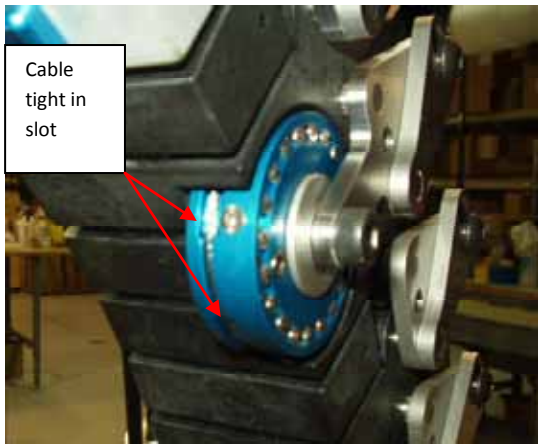


Figure 48 - Cable Tight Around Damper

14. Crimp front ferrule while it and the rear ferrules are touching the adjacent adjuster (Figure 49). Leave both damper adjusters adjusted all the way down.

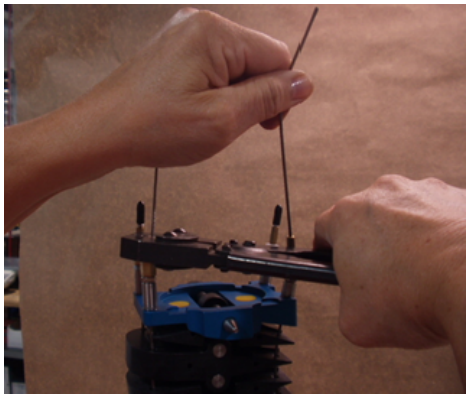


Figure 49 - Crimp Front Damper Ferrule

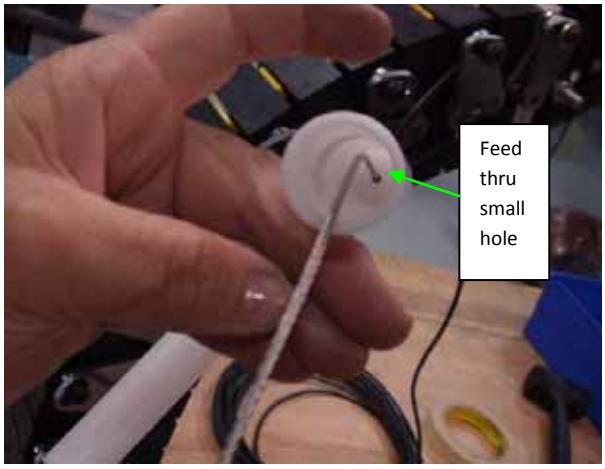


Figure 50 - Anterior Sprin Cable Insertion

15. Feed anterior (front) spring cable #ARA-369 thru small cable hole at top of longer spring tube (Figure 50) and up through all vertebra from T3 to O.C. plate.
16. Feed anterior spring onto end of cable (Figure 51).

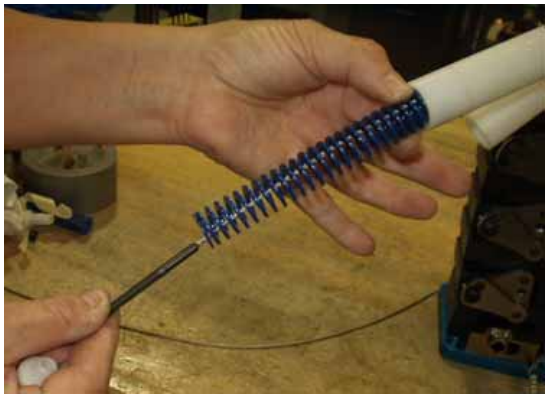


Figure 51- Anterior Spring Insertion

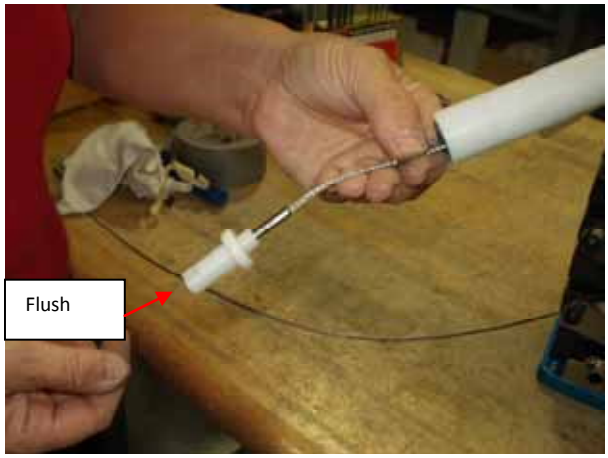


Figure 52 - Cable Adjust Installation

17. Install lower cable adjuster onto threaded stud (Figure 52) until adjuster is flush with end of cable stud.
18. Feed posterior (rear) spring cable #ARA-369 thru spring tube and vertebra as in step 15. Feed posterior spring onto end of cable. Install lower cable adjuster and turn upward so that there is 16 mm protruding. Verify this dimension with a pair of digital calipers (Figure 53).

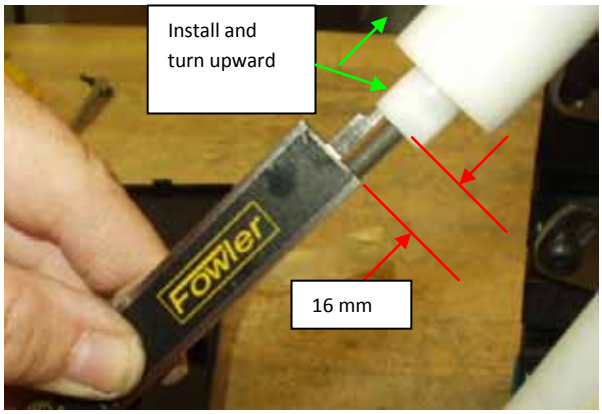


Figure 53 - Setting the Posterior Spring Cable

Figure 54 - Secure Posterior Cable

19. A piece of masking tape can be used to retain the cable and spring assemblies thru the next steps (Figure 54).

20. Be sure both front and rear upper cable adjusters are adjusted all the way down. Install a #9005132 o-ring on both front and back spring cables, followed by #9005133 ferrules as shown in Figure 55.

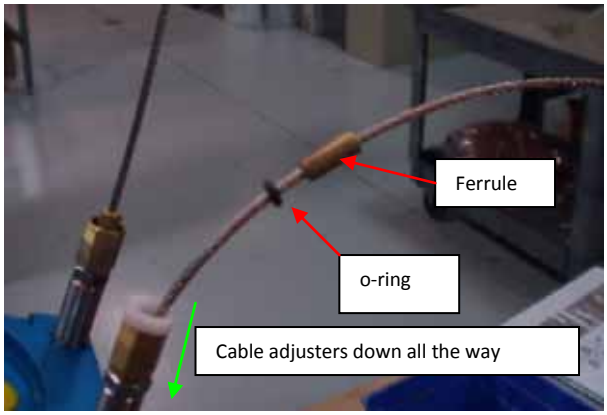


Figure 55 - Ferrule Installation Front and Rear Spring Cable

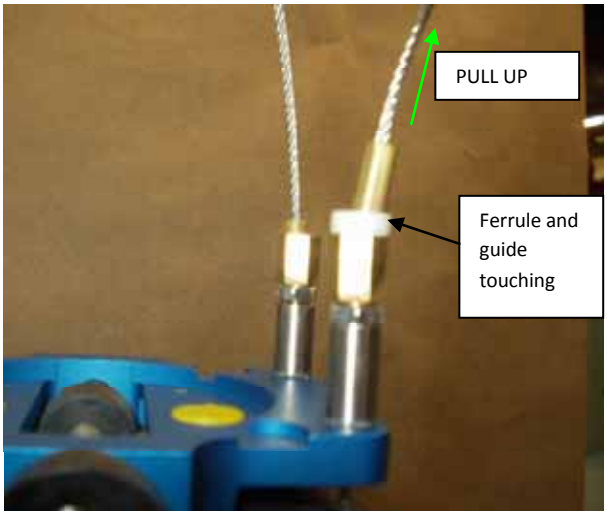


Figure 56 - Remove Slack from Spring Cable

21. Pull front cable up to **remove any slack** remaining in cable while tape is holding assembly, or if tape is not used. Slide ferrule down until it touches the top of the #ARA-711 cable guide while there still is no slack (Figure 56), and crimp ferrule in place (Figure 57).

Figure 57 - Crimp Ferrule

Figure 58 - Repeat for Front Spring Cable

22. Repeat step 17 for rear spring cable assembly (Figure 58).
23. If smaller cable crimpers were used for ease, finish crimping all four ferrules with #9000827 cable crimpers, or equivalent. Use smallest opening on jaws (Figure 59).

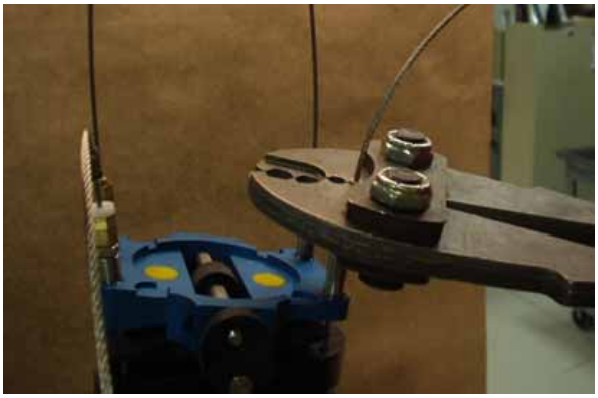


Figure 59 - Verify Crimps with Appropriate Crimpers

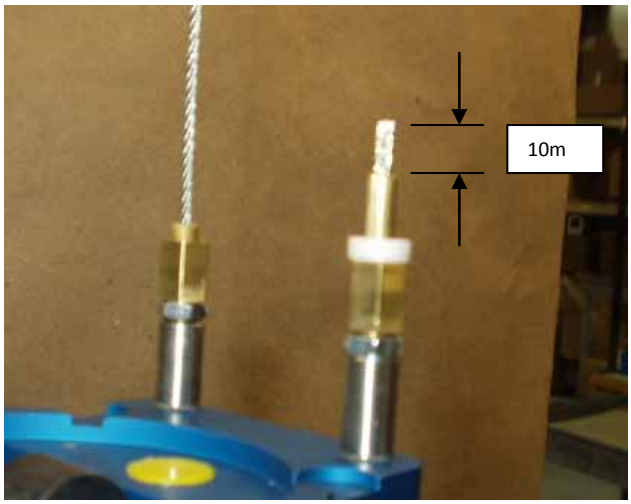


Figure 60 - Cut Cables above Ferrules

24. Cut ends of all four cables approx. 10mm above ferrules (Figure 60).
25. Place #9010293 cable caps on all four cables ends (fig 36) and crimp in place with small crimpers (fig 37).

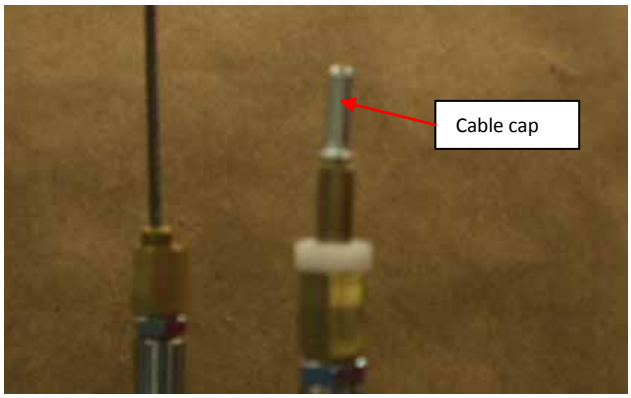


Figure 61 - Cable Cap Installation

Figure 62 - Crimp Cable Cap

26. Place 1 drop of Loctite #401 on sides of all 4 cable caps (Figure 63).
27. Install vinyl caps #ARA-413 on all 4 cable caps (Figure 64). Squeeze vinyl caps briefly to adhere to cable caps.

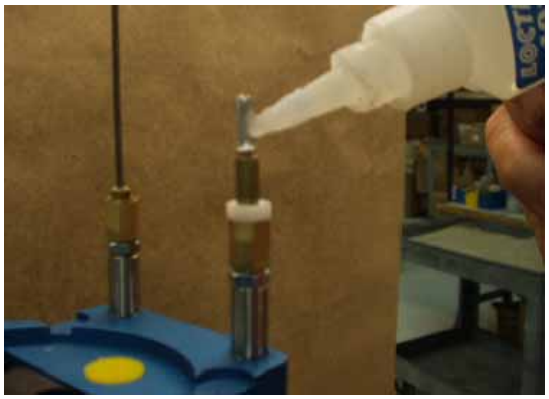


Figure 63 - Add Glue

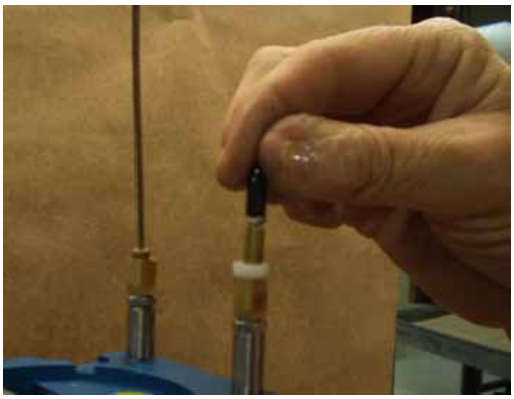


Figure 64 - Insert Cable Cap

Spine is now ready for the **BioRID II Certification** Procedure.

10.2 BioRID II Static Spine Setup Procedure

10.2.1 BioRID II Thoracic and Lumber Spine Setup

1. Place spine on bench top. Be sure all 17 torsion washer locking screws are loose.
2. Insert thoracic and lumbar vertebra spacer tool into front of lower spine as shown in Figure 65. Be sure inside edge of tool is within 1 mm of fronts of all thoracic and lumbar vertebrae, using brass or hard rubber hammer to tap up and down along outer edge of tool, for best placement. Use optional attachment handles (Figure 66) if necessary to aid in installation.

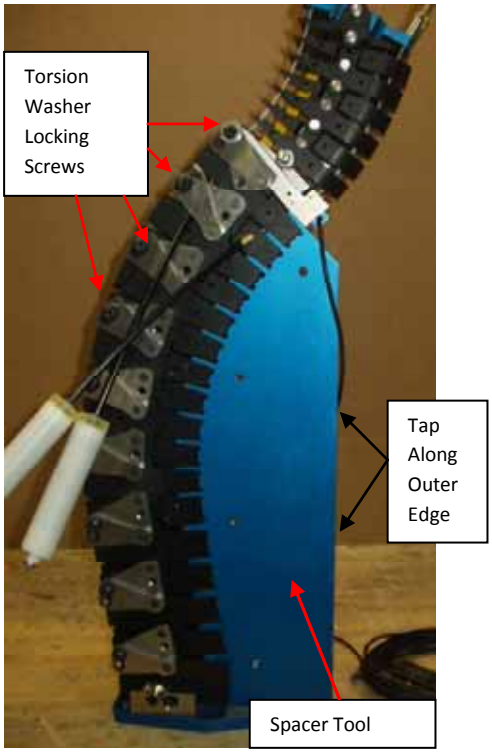


Figure 65 - Thoracic and Lumbar Vertebra Spacer Tool

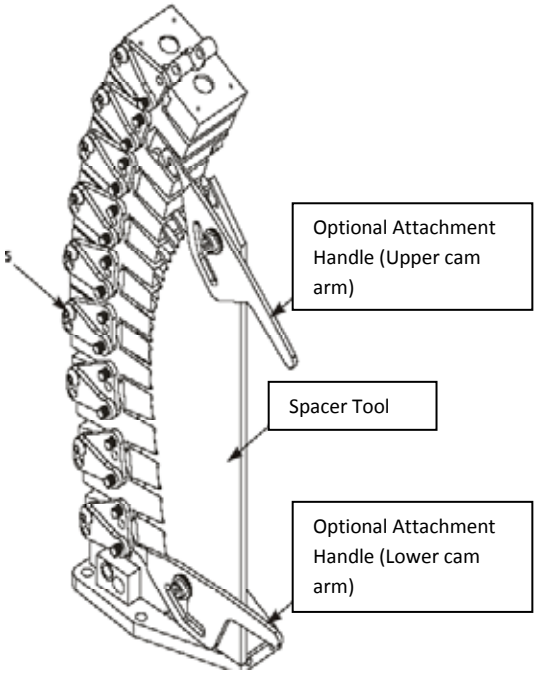


Figure 66 - Spacer Tool with Optional Handles

3. Begin tightening locking screws in place, (Figure 67) beginning at S1 lumbar plate screw on right side of spine and continuing upward on right side, using 15 ft/lbs torque for each screw, until reaching T1 thoracic plate screw (Figure 68), which only requires 10 ft/lbs.
4. After all 9 screws on right side of spine are tight; tighten all 8 screws on left side of spine to 15 ft/lbs, beginning at lowest, or L5 lumbar screw and continuing upward until all are tight. Hold bottom of spacer tool against pelvis interface plate while tightening L5 lumbar screw to prevent spine tilting backward while torqueing screw.

5. Remove plate by tapping with brass or hard rubber hammer, toward right side of spine. (Figure 69).

Figure 67 - Tighten Locking Screws

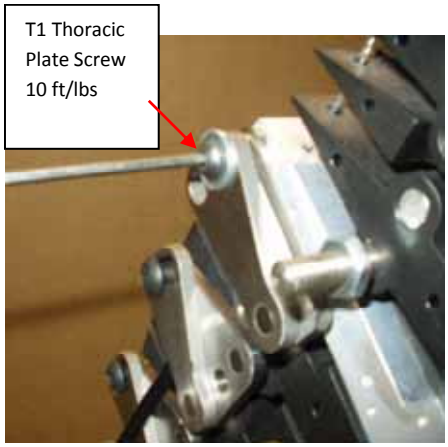


Figure 68 - T1 Plate Screw Torque

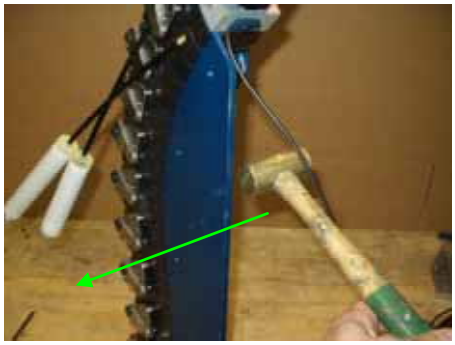


Figure 69 - Remove Setup Plate

10.2.2 BioRID II Cervical Spine Setup (Pretension)

1. Spine is placed on bench top (Figure 70). Both front and rear upper spring cable adjusters (Figure 71) are adjusted all the way down and locknuts are loose. Damper cable adjusters are also loose and cable is not clamped to damper.

2. Adjust spring cable adjuster (Figure 72) on front spring until the bottom is flush with the end of the spring cable stud.
   Note: Front spring is attached to the front of the O.C. plate, and is the longer spring tube.
   Adjust spring cable adjuster on rear spring until cable stud is protruding out from bottom of adjuster 16mm.
   Note: Rear spring is attached to the rear of the O.C. plate, and is the shorter spring tube.
   Measurement is applied using a pair of digital calipers (Figure 72). Record the resulting dimension for later reference.

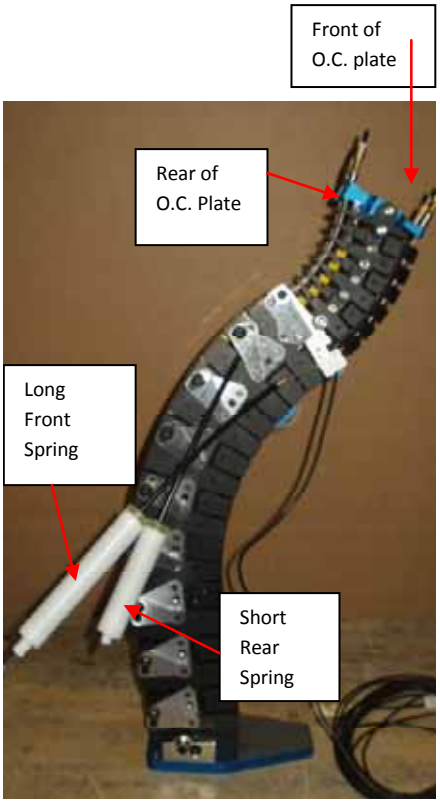


Figure 70 - Cervical Spine Setup

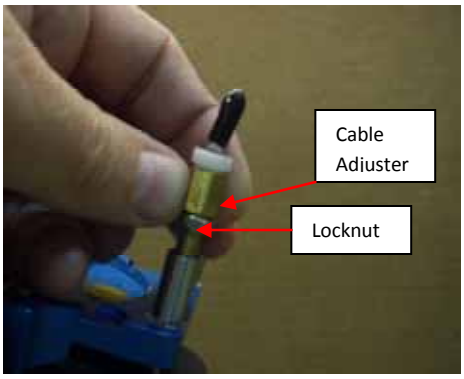


Figure 71 - Adjust Cable Adjusters Down

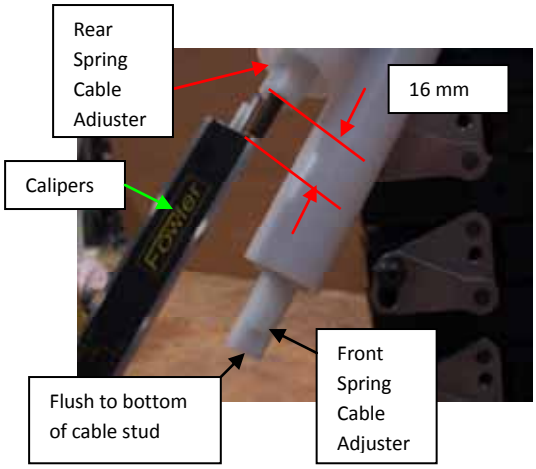


Figure 72 - Front Spring Cable Adjuster

3. Remove slack or free play from cables by turning (Figure 71) upper front and rear cable adjusters upward until slack on both cables is gone, but so that no tension is added. Check amount of slack or play during this procedure by pulling up on (Figure 73) and allowing to drop (Figure 74) both cables where they exit the upper adjusters, until play is gone after adjustments. Be careful not to add tension.

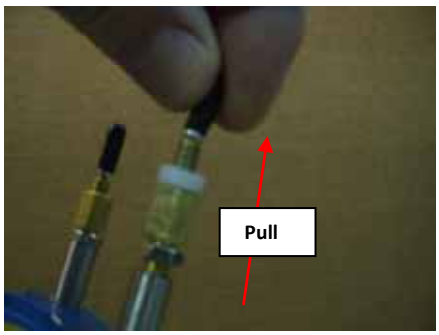


Figure 73 - Check for Slack - Pulling up

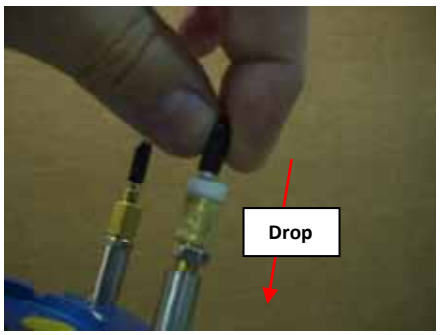


Figure 74 - Check for Slack - Dropping

4. After completing removal of slack, tighten both locknuts (Figure 75) on upper adjusters.

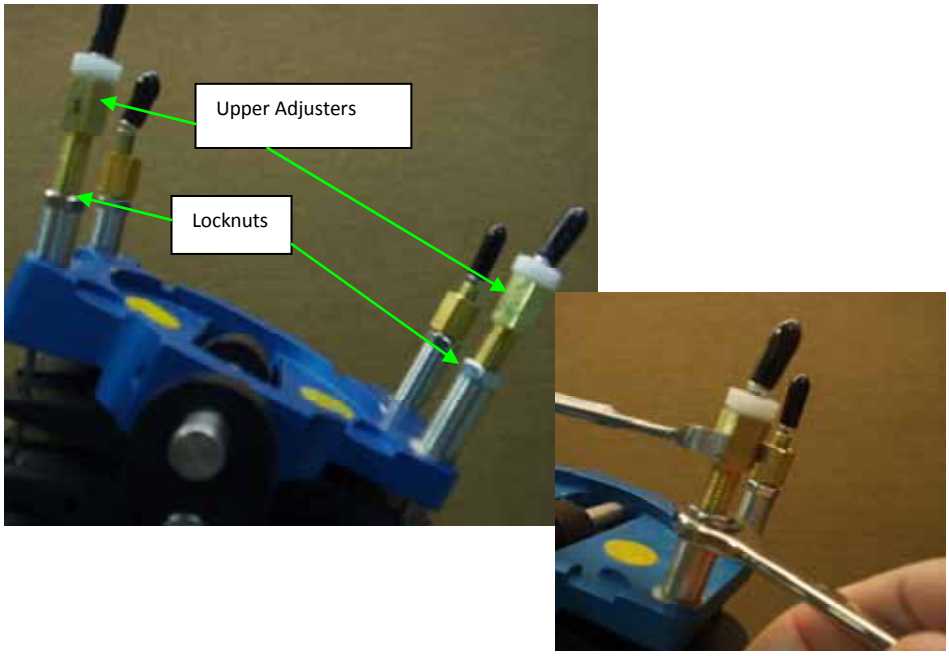


Figure 75 - Locking the Cable Adjusters

10.2.3 BioRID II Cervical Spine Setup (Tension)

Note: **Steps 1 and 2 below are performed <u>after</u> it is certain there is <u>no slack (free play) or</u> <u>tension</u> on both front and rear spring cables.**

1. Using a digital caliper to measure, adjust the rear lower spring cable adjuster counter-clockwise (down) ***<u>10 mm</u>*** so that the cable stud is now protruding **6 mm** (Figure 76). At this time there is 6mm free play in the rear cable.

2. Using digital calipers to measure, adjust the front lower spring cable adjuster clock-wise (up) so that cable stud is now protruding ***<u>24 mm</u>*** instead of flush. (Figure 77).

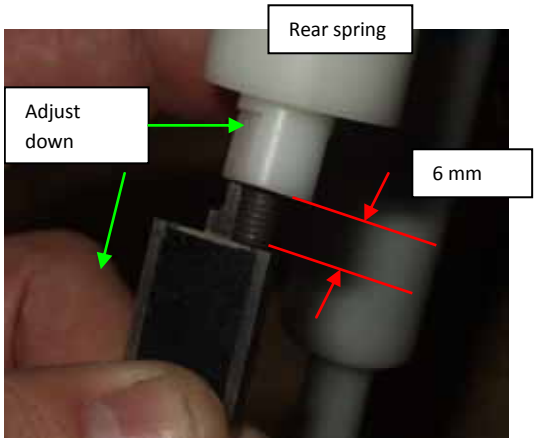


Figure 76 - Rear Lower Spring Cable Adjustment

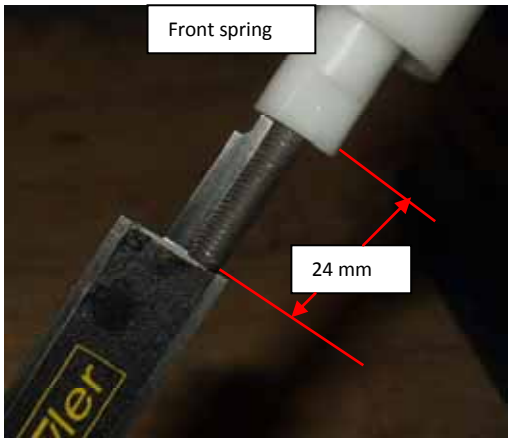


Figure 77 - Front Lower Spring Cable Adjustment

Note: ***It is important to maintain a <u>total bias of 14mm</u> on both springs:***

FRONT 24 mm added
BACK <u>-10 mm</u> subtracted
= 14 mm

3. Place locknuts on <u>both</u> cable studs, and lock them against the spring cable adjusters, (Figure 78).

Figure 78 - Lock the Spring Cable Adjusters

4. Push up on the ends of both cable adjusters to release any twist in the cables that may have resulted from cable adjustments. (Figure 79). Result of adjustments on cable studs should appear similar to Figure 80.

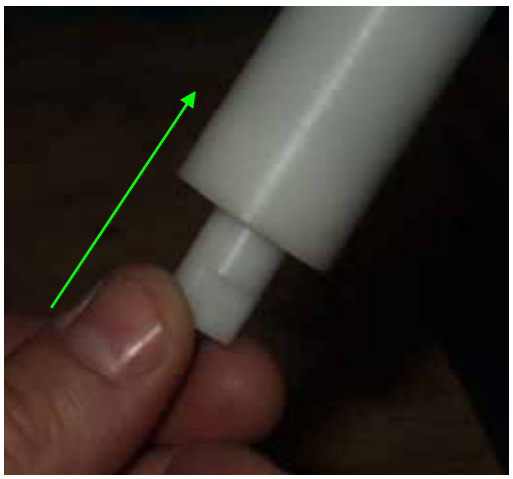


Figure 79 - Push Up to Release Cable Twist

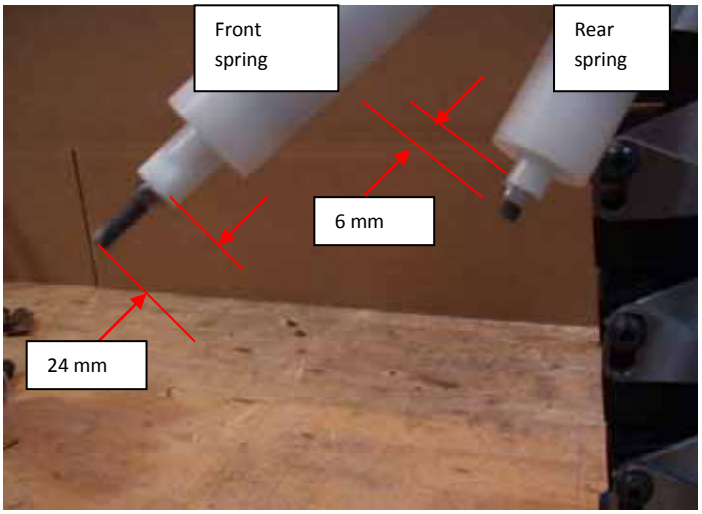


Figure 80 - Result of Cable Adjustment

5. Place a digital inclinometer on the top of the spine/pelvis interface plate and set to Zero (Figure 81).

Figure 81 - Zero Digital Inclinometer

6. Grasp the O.C plate with both hands and force the plate to tilt the plate down in the front, to the degree that the front spring and bumpers will force the plate to return upward in the front to a position. After allowing the O.C. plate to remain in this position for 30 seconds, measure the angle on the O.C. plate (Figure 82). Angle must be at or greater than 30 degrees. If this angle cannot be held, reset front and rear springs at lower adjusters to values shown in Figure 83.

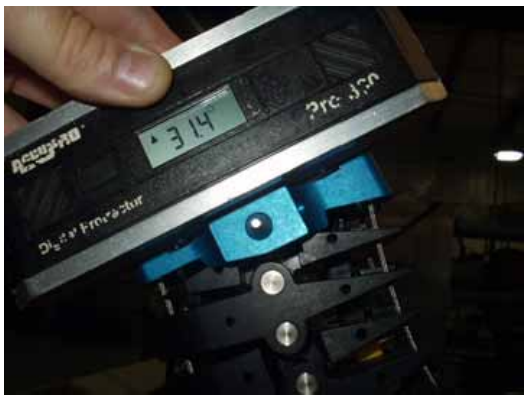


Figure 82 - Tilt OC Plate Down in Front

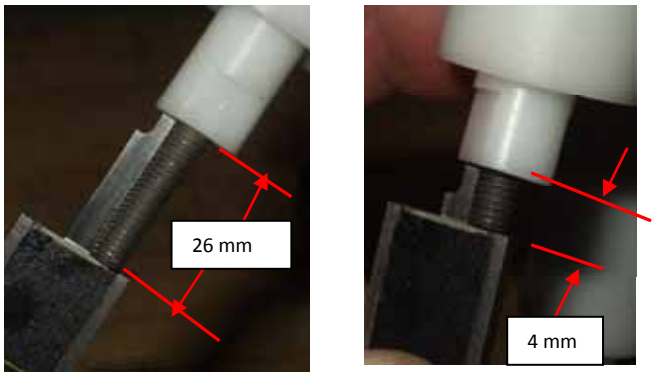


Figure 83 - Front and Rear Spring Adjustment if Front Angle cannot be Held

7. Grasp the O.C plate with both hands and force the plate to tilt the plate down in the back, to the degree that the rear spring and bumpers will force the plate to return upward in the rear to a position. After allowing the O.C. plate to remain in this position for 30 seconds, measure the angle on the O.C. plate (Figure 84).Angle must be at or less than 26 degrees. If this angle cannot be held, reset front and rear springs at lower adjusters to values shown in Figure 85. If angle still cannot be held, there is most likely a problem with compression-set on the front 8 cervical bumpers (ARA-220). Refer to "***Cervical Bumper Inspection and Replacement***" for confirming useable condition of front neck bumpers.

Figure 84 - Tilt OC Plate Down in Back

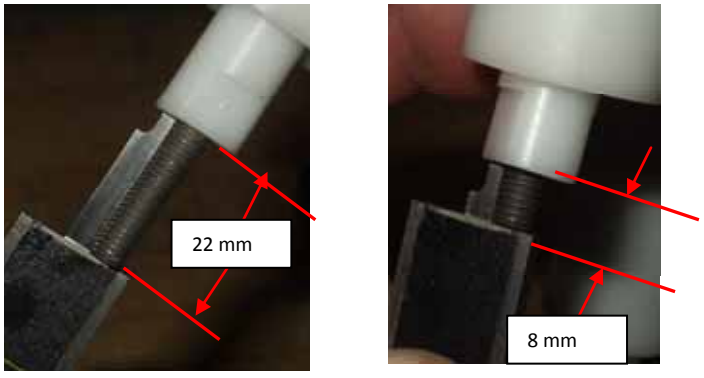


Figure 85 - Front and Rear Spring Adjustment if Back Angle cannot be Held

8. Once the O.C. plate is confirmed to be adjusted correctly, re-lock the cable stud locknuts.

10.2.4 BioRID II Damper Cable Adjustment

1. Spine is still in position from the previous step. Adjust damper cable adjusters (Figure 86) upward until tension is added to damper cable around damper drum.
2. Clamp cable to damper with both M3 set screws. (Figure 87). On older dampers that use only one M3 set screw, add one drop of Loctite 401 or equivalent, to cable and set screw where they are touching each other, after clamping.

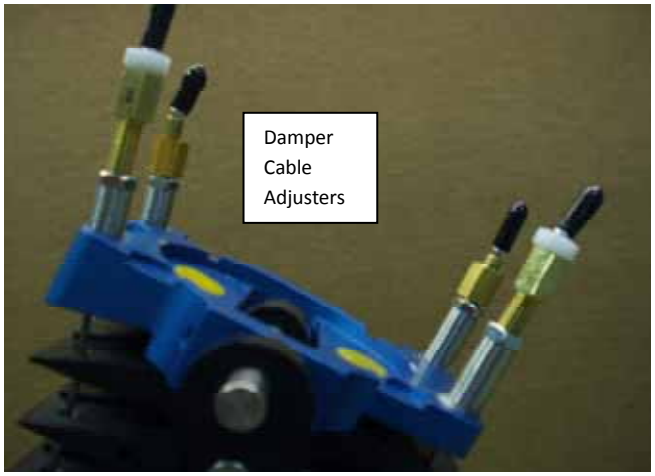


Figure 86 - Damper Cable Adjusters

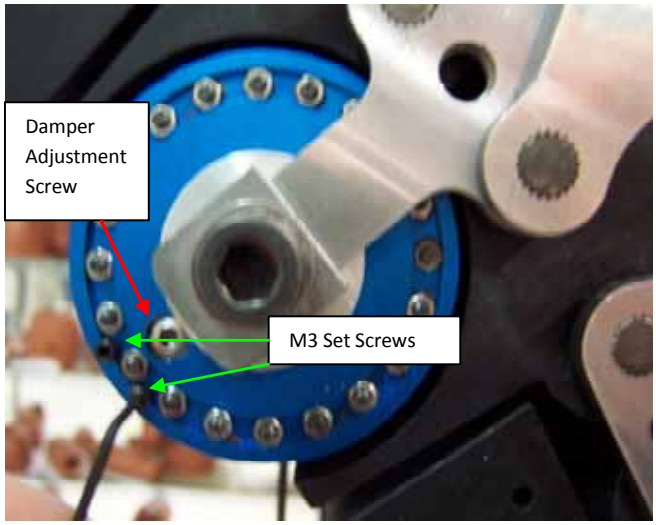


Figure 87 - Damper Adjustments

3. Place digital inclinometer laterally across O.C. plate (Figure 88) and add tension to damper cable using both cable adjusters, until angle across O.C. plate is Zero +/- .5 degree. After angle is correct, tighten both locknuts on damper cable adjusters. Leave spine in position for next step.

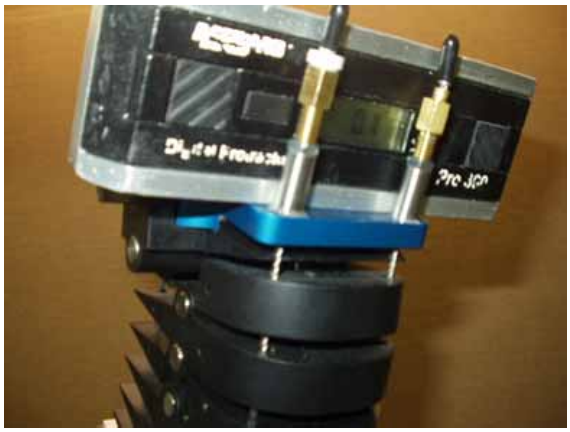


Figure 88 - OC Plate Lateral Angle Setting

10.2.5 BioRID II Static Spine Measurements

The BioRID II has static spine measurements to ensure the dummy posture is correct. This procedure should be repeated after initial dummy certification to verify Figure 89 shows a summary of these measurements.

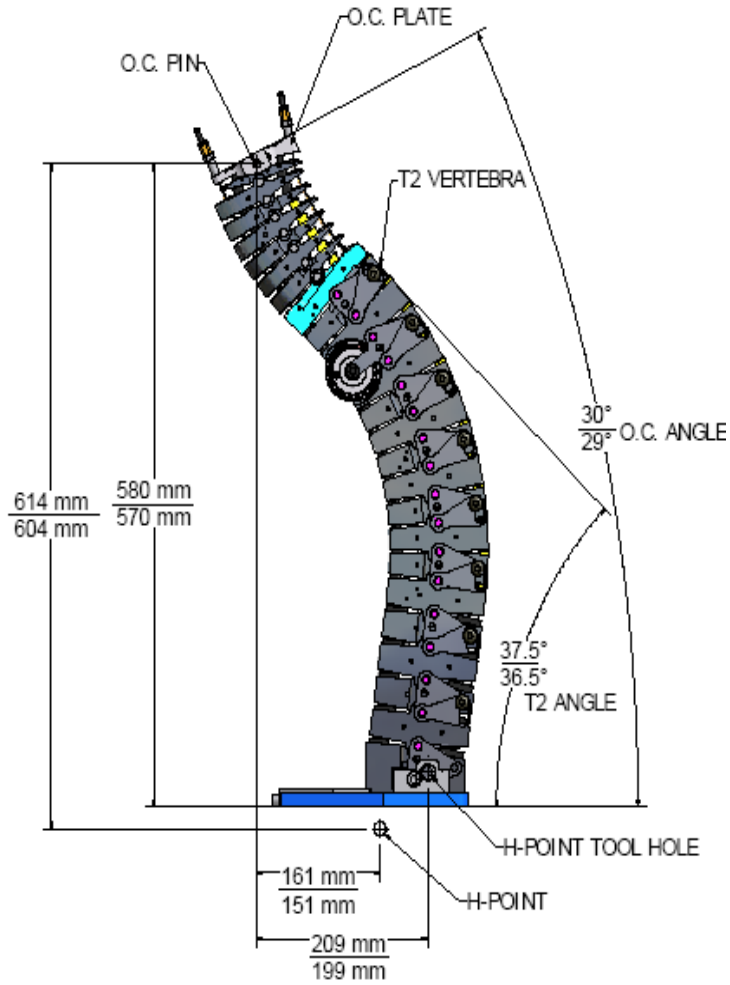


Figure 89 - BioRID II Spine Setup Measurements

1. Spine is still in position from previous step. By hand, force O.C. plate to an angle between 29-30 degrees, using the digital inclinometer to verify. The O.C. plate will hold this angle with the damper in the system (Figure 90).

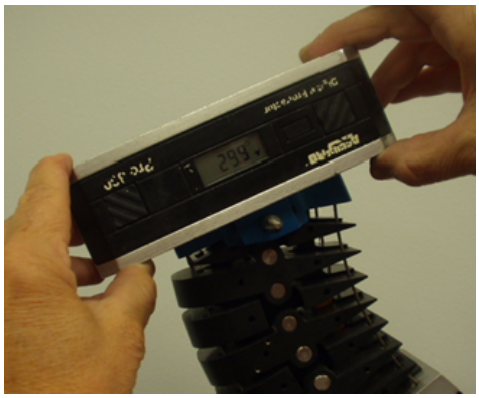


Figure 90 - OC Plate Angle Setting

2. Measure Z dimension from center of O.C. pin to bottom of spine/pelvis inter-face plate (bench top). Dimension must be 570-580 mm (604-614 mm to H-point).
3. Measure X dimension from center of O.C. pin to center of H-point tool square insertion hole. Dimension must be 199-209 mm (151-161 mm to H-point).

4. Figure 91 shows the Denton #TRA-063 measurement tool, used for verifying the X and Z dimensions. Record dimensions on data sheet.

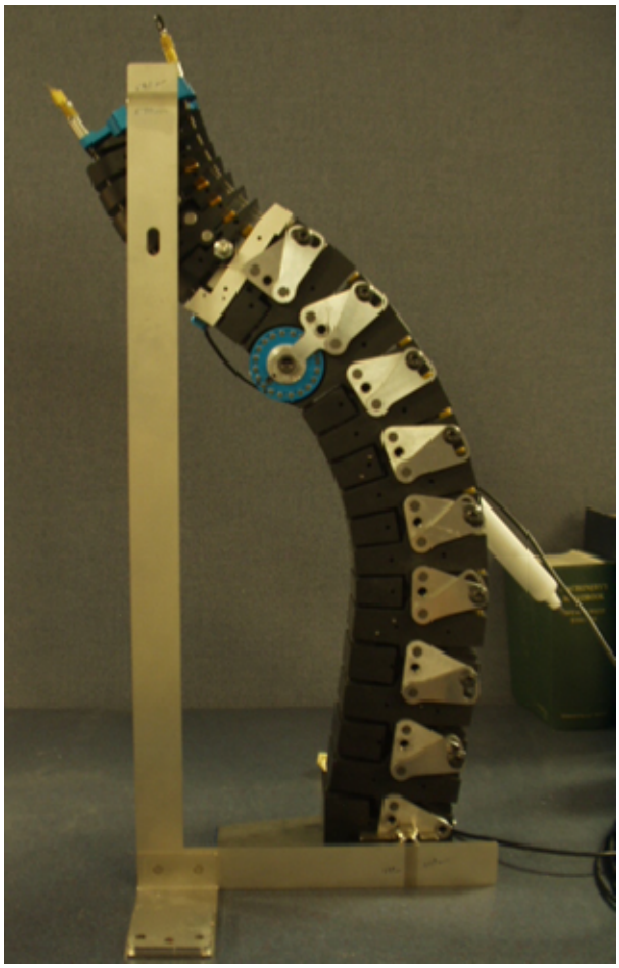


Figure 91 - X and Z Measurement Tool

5. Figure 92 shows Denton #TRA-075 H-point block insert, useful for accurately indicating center of H-point block square hole.

6. Using the digital inclinometer, verify the angle on the rear of T2 vertebra at 36.5-37.5 degrees (Figure 93).

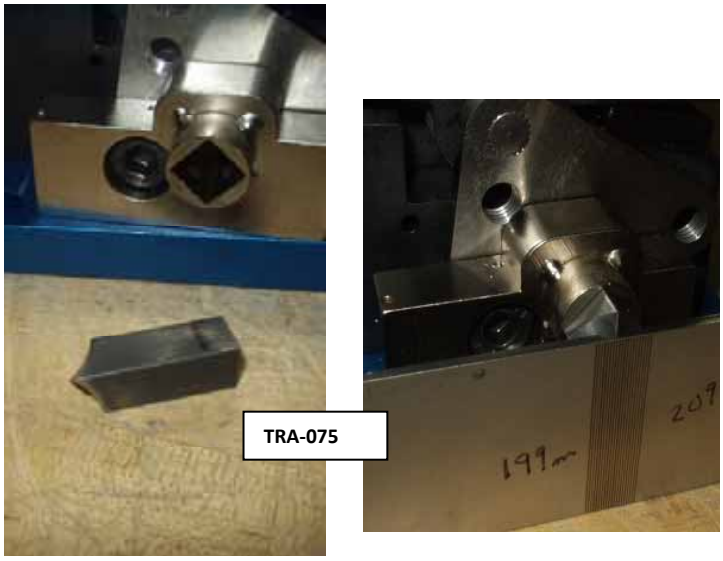


Figure 92 - H-Point Measurement Tool

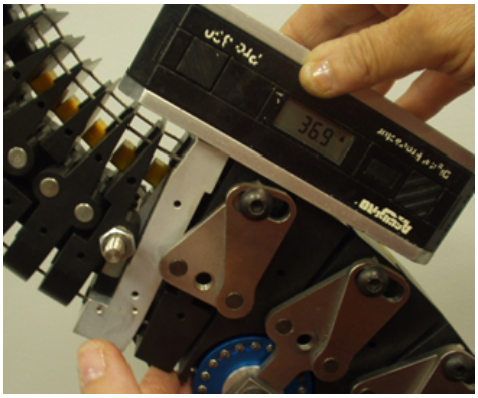


Figure 93- T2 Angle Setting

11.0 MAINTENANCE

11.1 BioRID II Cervical Bumper Inspection and Replacement

11.1.1 Overview

The cervical region (vertebrae C1 down thru C7 plus T1, Figure 94) employs sixteen (16) cube-shaped bumpers, of which the FRONT (8) are 40A durometer, black in color and 10mm tall. The REAR (8) bumpers are split into 2 regions, the uppermost 3 are the same 40A, 10mm tall as used in the front, and the bottom 5 are 30A durometer, yellow in color and 9 mm tall.

Figure 94 - Cervical Region

11.1.2 Recommended Replacement

It is recommended to replace the FRONT cervical bumpers every 4 months due to the high degree of compression applied to these bumpers.

A dummy that is being recertified is automatically issued all 8 FRONT standard replacement bumpers. If the bumpers are not in good condition due to compression and are not replaced, the effect on the calibration data will show a higher amplitude in Pot A and/or Pot B Rotation.

11.1.3 Bumper replacement procedure

1. Figure 95 shows the items needed for bumper replacement. The 2mm allen wrench is used for removing the T1 pin in order to have access to the bumper on top of the T1 vertebrae or load cell.

2. Remove both lower cable adjusters and muscle substitute springs from the lower ends of the spring cables (Figure 96).

Figure 95 - Bumper Replacement Tools

Figure 96 - Remove Muscle Substitute Springs

3. Tap or push the O.C. pin out of the spine (Figure 97).
4. Pull the spring cables up out of the upper cable adjusters, as far as possible (Figure 98).

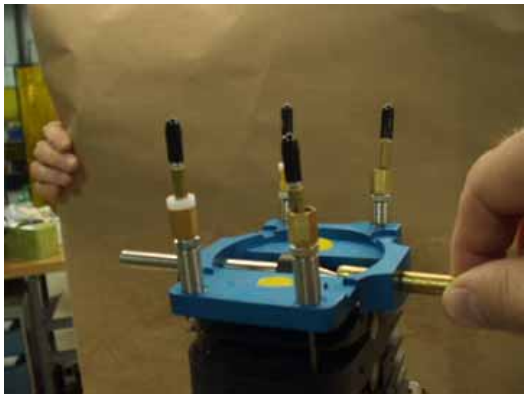


Figure 97 - Push OC Pin Out of Spine

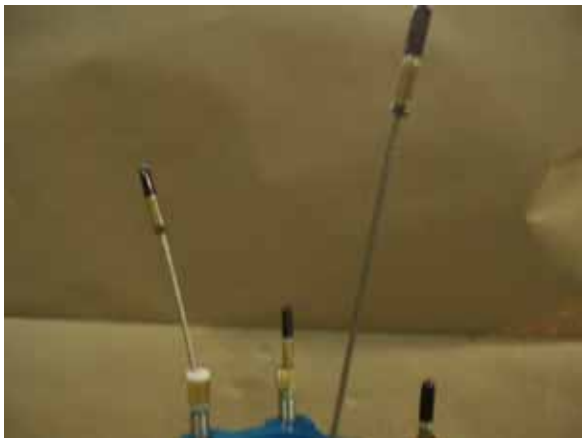


Figure 98 - Pull Up Spring Cables

5. Swing the O.C. plate up and over in the direction shown in Figure 100. It will not swing in the other direction as the damper cable does not allow enough travel.
6. Slide the next pin out, which is at the joint between C1 and C2 vertebrae (Figure 101). All of the joint pins from The O.C. pin down to C7 are easily removed and reinstalled by tapping gently or pushing with a punch (Figure 99).

Figure 99 - Remove Pins

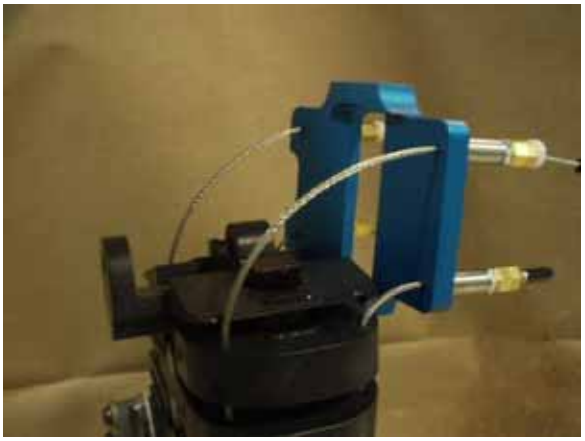


Figure 100 - Swing OC Plate Up

Figure 101 - Remove Pin and Separate Vertebra

7. Use a sharp pick to dislodge the bumper from each vertebra, from C1 down to C7 (Figure 102).
8. Use the pick to clean the surface of glue and bumper residue (Figure 103).

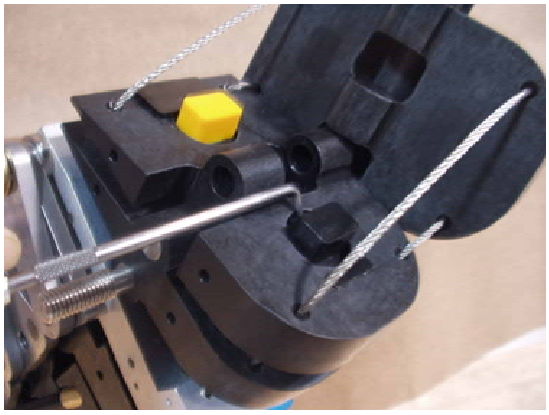


Figure 102- Remove Bumper

Figure 103 - Clean Surface

9. Place one drop of Loctite 401 in center of bore in vertebrae (Figure 104).
10. Be sure to wear latex or other protective gloves, and immediately place new bumper in bore, on top of loctite 401, and center it side-to-side, and also front-to-back. Press downward on bumper with finger for 10 seconds to bond (Figure 105) all bumpers from C1 to C7.

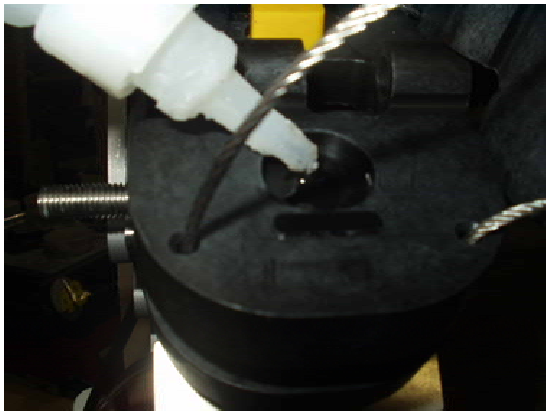
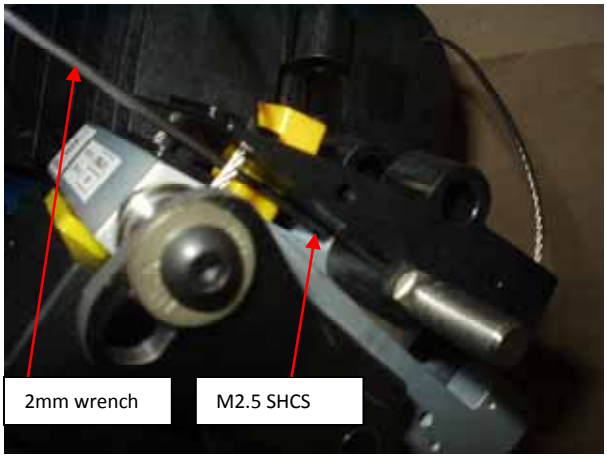


Figure 104 - Add One Drop of Adhesive

Figure 105 - Place in Bumper and Hold

11. Remove the two M2.5 SHCS that retain the T1 pin at the C7-T1 joint (Figure 106).
12. Slide the T1 pin out of the vertebrae joint and set aside along with the two M2.5 SHCS for re-installation later (Figure 107).



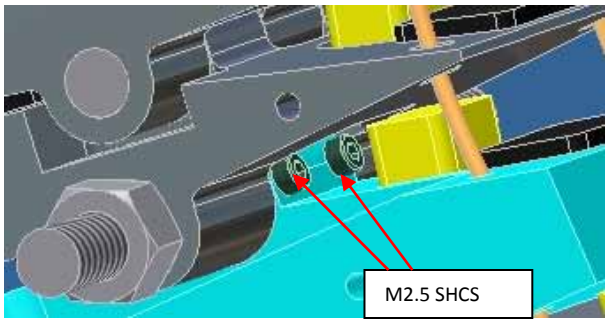


Figure 106 - Remove T1 Retaining Screws

Figure 107 - Remove T1 Pin

13. Use the pick to dislodge the front bumper in the T1 vertebrae or load cell (Figure 108).
14. Use the pick to carefully clean the surface of glue and bumper residue (Figure 109). Do not disturb black potting on load cell.

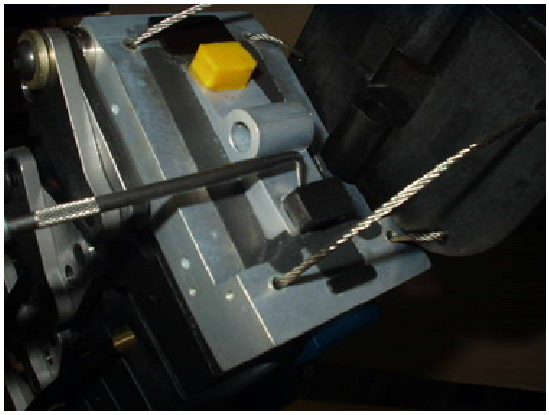


Figure 108 - Remove Bumper

Figure 109 - Clean Surface

15. Place one drop of Loctite 401 in center of rectangular cavity in T1 vertebrae (Figure 110).
16. While wearing protective gloves, immediately place new bumper in cavity, on top of loctite 401 (Figure 111). It will be positively located as cavity is approximately the same shape as the bumper. Press downward on bumper with finger for 10 seconds to bond (Figure 112).

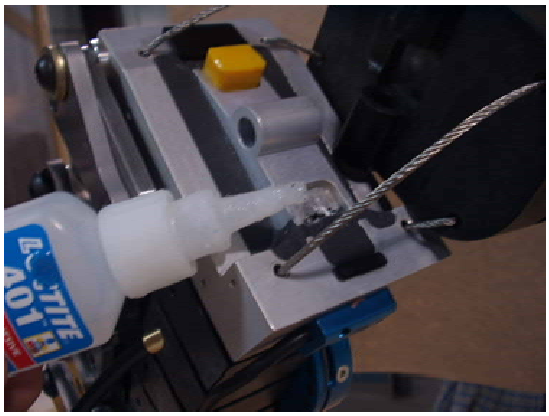


Figure 110 - Add Drop of Adhesive

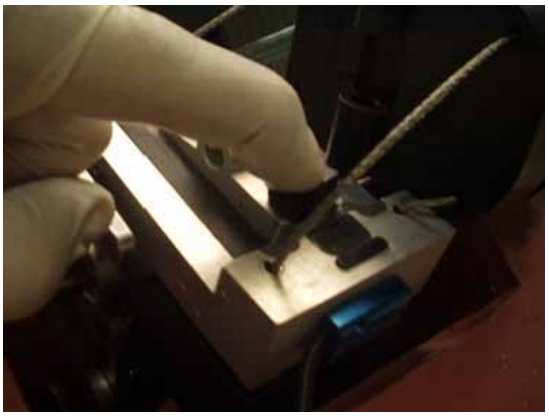


Figure 111 - Press and Hold Bumper

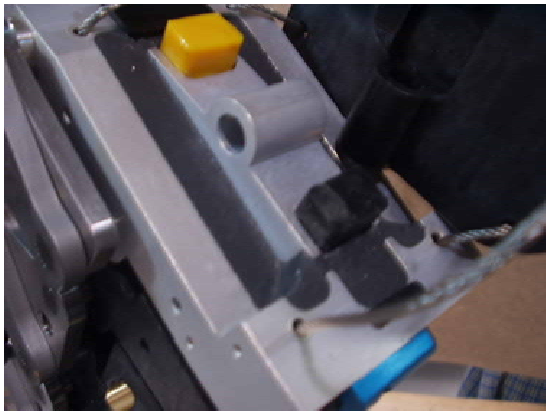


Figure 112 - Hold for 10 Seconds

17. Re-install T1 pin thru C7-T1 joint (Figure 113). **Use care to avoid damaging C7 or especially the T1 load cell joint with the threads on the T1 pin!** Be sure to line up edge of flats on pin to edge of vertebrae (Figure 114) and orient face of flat to be parallel with back end face of T1 load cell. This must be done to line up threaded holes for M2.5 SHCS.

    Note: Face of flat on pin is precisely perpendicular to threaded holes for two M2.5 SHCS

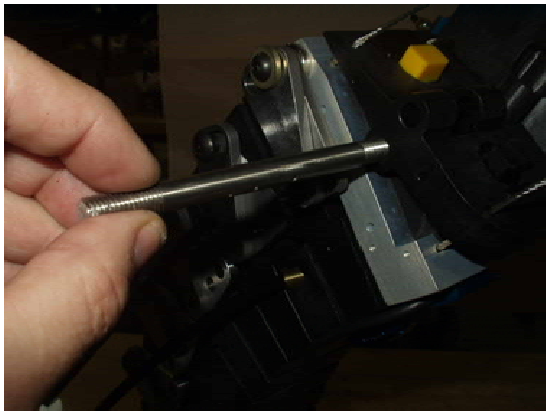


Figure 113 - Insert T1 Pin

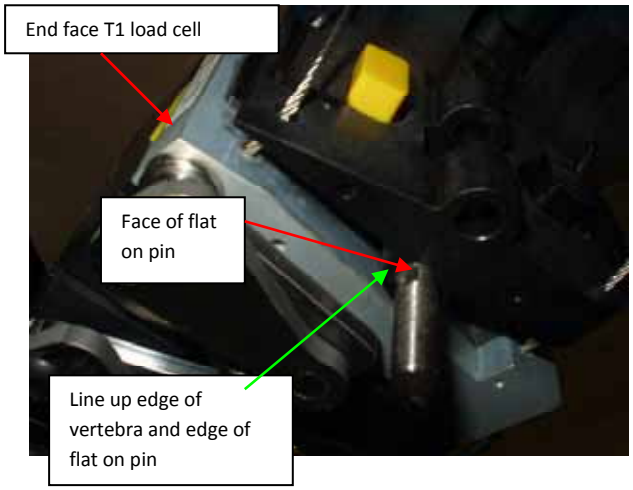


Figure 114 - T1 Pin Alignment

18. Re-install both M2.5 SHCS (Figure 115) with 2mm allen wrench. Be careful not to over-torque. A torque of 15 inch/pounds is recommended, if a torque wrench is able to be used. *The use of a magnet touched to the wrench for a few seconds to slightly and temporarily magnetize it will aid in installation of screws.*

19. Re-install all pins from C1 thru C7 joints (Figure 116) by tapping lightly or pushing thru with punch. Ends of pins must be flush with vertebrae when finished.

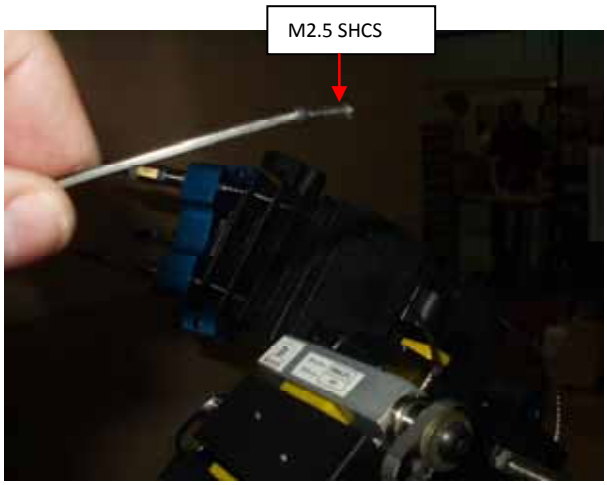


Figure 115 - Install T1 Locking Screws

Figure 116 - Install Remaining Pins

20. Re-install Muscle substitute springs and lower spring cable adjusters onto both spring cables.

Refer to "Biorid Certification" procedure to set up and certify dummy.

11.2 Physical Measurements

The BioRID II dummy must meet physical dimensions and mass in Table 16 prior to use.

Table 16 - Physical Measurements

Feature	Lower (in)	Upper (in)
Right H-Point above seat	3.30	3.50
Left H-Point above seat	3.30	3.50
Right H-Point from Seat Rear	5.30	5.50
Left H-Point from Seat Rear	5.30	5.50
Seated Height	34.60	35.00
Right Thigh Clearance	5.50	6.10
Left Thigh Clearance	5.50	6.10
Right Buttock to Knee Length	22.80	23.80
Left Buttock to Knee Length	22.80	23.80
Right Knee Pivot Height	19.10	19.70
Left Knee Pivot Height	19.10	19.70
Right Foot Length	9.90	10.50
Left Foot Length	9.90	10.50
Right Foot Breadth	3.60	4.20
Left Foot Breadth	3.60	4.20
Total Dummy Mass (lbs)	168.70	173.90

1. Level dummy measurement chair. If not adjust the leveling feet
2. Position the BioRID II dummy on the measurement chair as shown in Figure 117. Position the head strap under the nose. Insert the head leveling tool on the top of the skull. Insert the H-Point tool through the pelvis into the H-Point reference square hole mounted at the base of the spine.

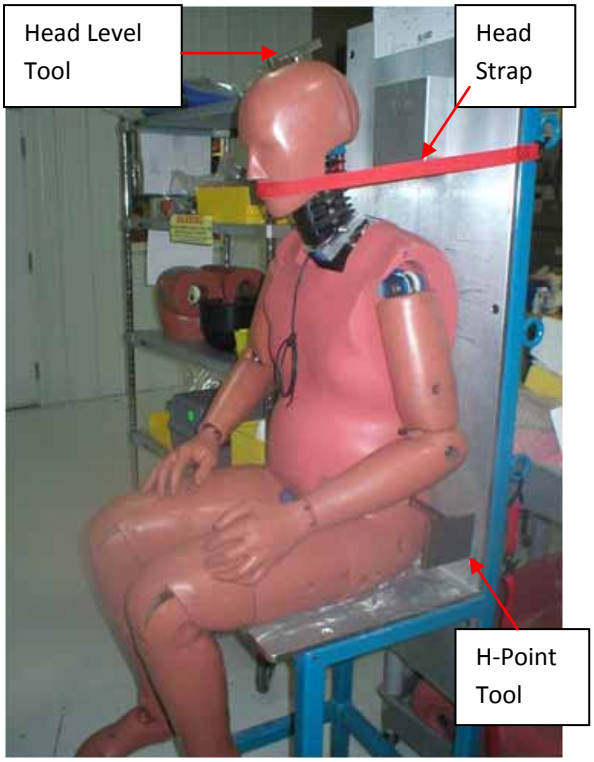


Figure 117 - BioRID II Physical Measurements

3. Position the lower torso so the H-Point reference hole on the H-point tool is a distance of 5.3 – 5.5 inches from the back (rear) of the seat on both sides of the dummy as shown in Figure 118.

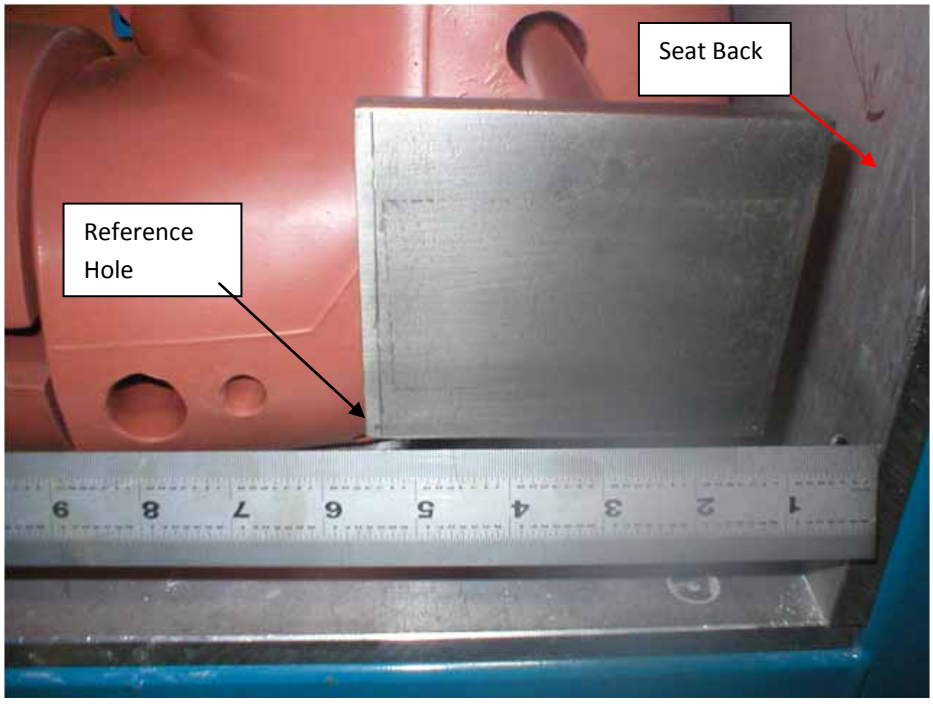


Figure 118 - Measurement Starting Position

4. Zero the digital inclinometer on the seat surface (Figure 119).
5. Measure the height from the seat to the H-Point reference hole, this dimension must be between 3.3 – 3.5 inches on both sides of the dummy (Figure 120).

Figure 119 - Zero Angle Reference

Figure 120 - H-Point Height

6. Place the inclinometer on the top of the H-Point tool and note the result. This angle must be between 0 – 6 degrees (Figure 121).
7. Place the inclinometer on the top of the head leveling tool. The head angle should be 26.5 +/- 2 degrees. The head strap can be adjusted to allow slump on the spine to attain correct angle (Figure 122).

Figure 121 - H-Point Angle

Figure 122 - Head Angle

8. Place a level across the thighs and measure from the seat to the bottom side of the level to find the clearance. This dimension must be 5.50 – 6.10 inches on both sides (Figure 123).
9. Please a level across the front of both the knees and measure from the knee to the rear of the seat to find knee to buttock length. This dimension should be 22.80 – 23.80 inches (Figure 124).
10. Place a level on the top of the head and center the bubble. Measure the dimension from the seat to the underside of the level. This height should be 34.6 – 35.0 inches (Figure 125).

Figure 123 - Thigh Height

Figure 124 - Width Measurement

Figure 125 - Head Height

11. Level the feet front to back by placing the level on the bottoms of the feet. Measure knee pivot height on the both sides. The dimension should be 19.10 – 19.70 inches.
12. Measure the length of the feet heel to toe. The dimension should be 9.9 – 10.5 inches
13. Measure the width of the feet. The dimension should be 3.6 – 4.2 inches.

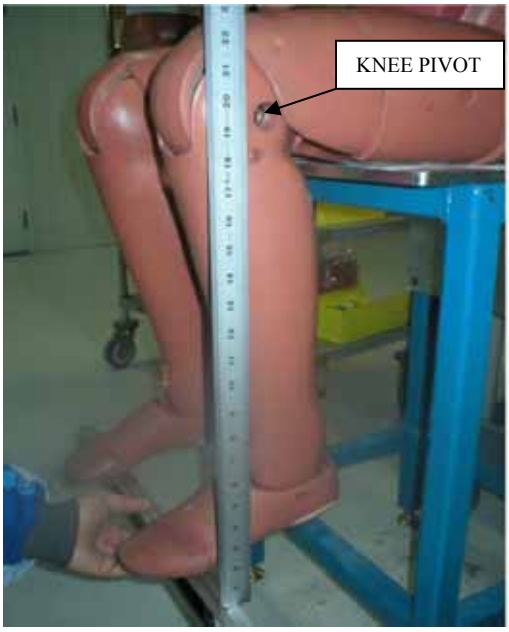


Figure 126 - Bottom of Feet to Knee Pivot

Figure 127 - Foot Length and Width

11.3 BioRID II Mass Measurements

Check the masses of the various dummy segment assemblies on initial inspection. They should conform to the masses specified in the following table.
After replacing parts or accelerometers, recheck the mass of the pertinent segment.

Table 17 - Assembly Mass

ASSEMBLY	Mass (lbs)	
	Lower Corridor	Upper Corridor
Head	9.9	10.1
Torso	92.50	94.50
Right Upper Arm	4.2	4.6
Left Upper Arm	4.2	4.6
Right Lower Arm	3.65	3.85
Left Lower Arm	3.65	3.85
Right Hand	1.15	1.35
Left Hand	1.15	1.35
Right Upper Leg	13.0	13.4
Left Upper Leg	13.0	13.4
Right Lower Leg	9.3	9.6
Left Lower Leg	9.3	9.6
Right Foot	2.4	2.7
Left Foot	2.4	2.7

11.4 BioRID II Damper Filling

It is essential for proper dummy response to have a damper full of oil and no air inside. To bleed the air from the damper, it must first be removed from the dummy, during a period of time that a recertification is planned.

11.4.1 BioRID II Damper Filling Procedure

1. Open the damper adjustment screw 2 full turns, by first closing (CW) and then opening (CCW) 720 degrees.
2. Remove the Damper fill hole cover screw, M3 FHCS (Figure 128).
3. Install the M8 mounting screw finger tight, which will be used for turning the paddle to isolate air pockets in the damper.
4. Turn the M8 mounting screw all the way CW.
5. Using the syringe of ISO 680 damper oil, inject as much oil as allowed before oil begins flowing out around the needle (Figure 129).

Figure 128 - Remove Oil Fill Screw

Figure 129 - Inject Oil

6. Turn the paddle very slowly CCW while holding the damper in one hand (Figure 130). When oil is passing thru the orifice inside the damper, it feels like a steady drag. When an air pocket suddenly passes thru the orifice, the drag is gone and the paddle suddenly rotates easier and faster. This phenomenon is easily felt by both hands holding the damper and wrench. After the air is felt to pass thru the orifice and the drag suddenly starts again from the oil, stop rotating the paddle, and turn slowly back CW, at which time the air will again be felt, but now the air pocket is directly under the fill hole. Repeat filling with the syringe, and stop when oil is seen flowing out around the needle. Repeat this process until the damper is free of air, several times if necessary, thru the entire rotation travel of the damper. The tiniest bubble of air can be felt, like a tiny shock or "blip" when it passes thru the orifice. It may be easier to install the fill hole cover screw tightly, between each syringe application to avoid accidentally pumping oil out of the damper if it is rotated a little too fast.
7. If the M8 screw tends to loosen in the CCW direction, rotate the paddle CW with the screw until the travel is gone, and tighten enough with the wrench to keep the screw tight during the CCW rotation.

Figure 130 - Work out Air

Figure 131 - Add Sealant to Cover Screw

8. When the damper is bled of air, coat the tapered portion of the cover screw with "Ultra-Copper" silicone sealant or equivalent (Figure 131).
9. Install the fill hole cover screw tightly.
10. Wipe off the excess sealant with a rag.

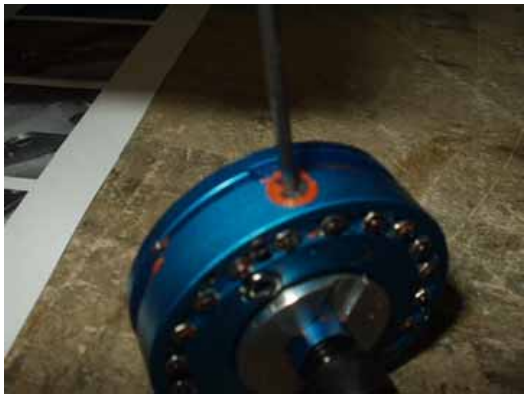


Figure 132 - Tighten Cover Screw

Figure 133 - Wipe off Excess Sealant

Damper is now ready for reinstallation in dummy spine.

11.5 Damper Removal and Installation

In the event of required maintenance or service to the T1 load cell, neck bumper replacement, or damper replacement or maintenance, it is necessary to remove the damper. The following are steps to remove and re-install the ARA-375 damper. Figure 134 is a view of the damper assembly. Figure 135 is a exploded view of the damper assembly.

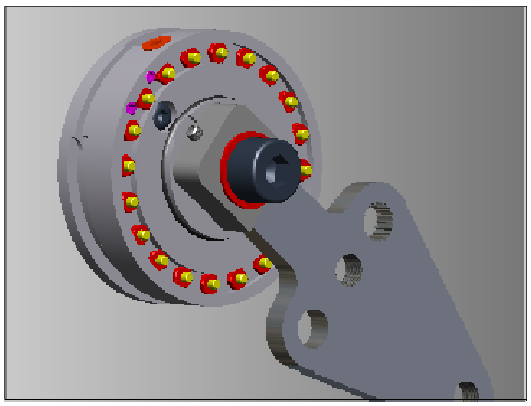


Figure 134 - View of Damper Assembly

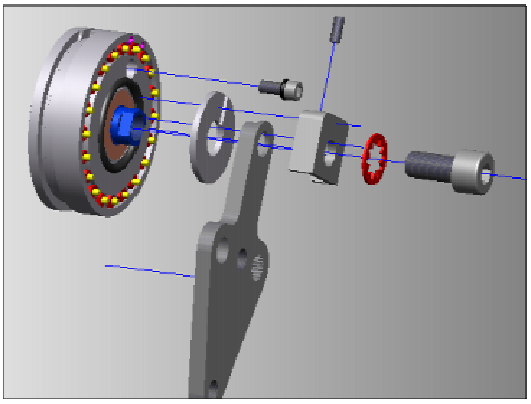


Figure 135 - Exploded View of Damper Assembly

1. Loosen locknuts on both adjusters for damper cable, and then turn adjusters until bottomed out so that cable is as loose as possible.
2. Loosen both M3 cable clamping set screws to enable removal of cable from mating slot on side of damper body.
3.

Figure 136 - Loosen Adjusters

Figure 137 - Loosen M3 Clamping Screws

4. Back off M3 setscrew (9010295) two turns. Remove M8. Damper mounting screw (9010294). Remove Clamp Bracket (ARA-346)
5. Slide damper toward the front of the spine.

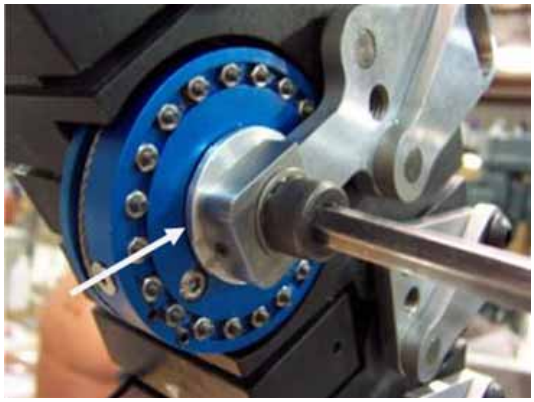


Figure 138 – Back Off Set Screw

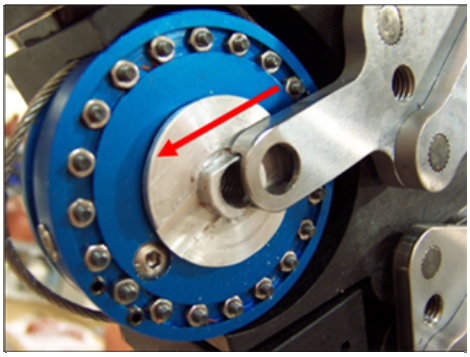


Figure 139 -Slide Out Damper

6. Turn Damper to untwist cable. Disengage damper from Cable. Set damper aside for maintenance and/or later re-installation (Figure 140).

7. View of spine with damper removed. Note overlap of cable. The direction shown is required for proper operation Figure 141.

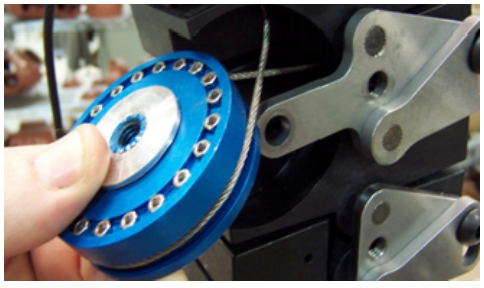


Figure 140 - Turn Damper and Disengage Cable

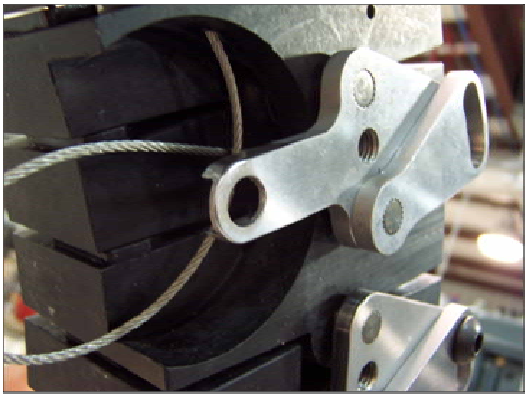


Figure 141 - View of Twist in Cable

8. When re-installing damper, be sure cable overlap is correct.

9. Slide tapered projection of paddle into tapered slot on mounting plate. If the parts will not mate, then the projection is out of position (Figure 142).
10. Slide damper all of the way into mating slot on plate (Figure 143).

Figure 142 - Install Damper

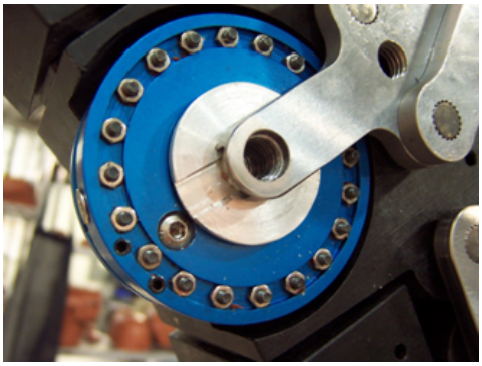


Figure 143 - Slide Damper into Mating Slot

11. Slide clamp bracket (ARA-346) over damper/plate assembly.
12. After installing clamp bracket, be sure that shallow slot on seal washer and mating projection on clamp bracket are mated. It may be necessary to spin washer to line-up slot with projection.

Figure 144 - Slide on Clamp Bracket

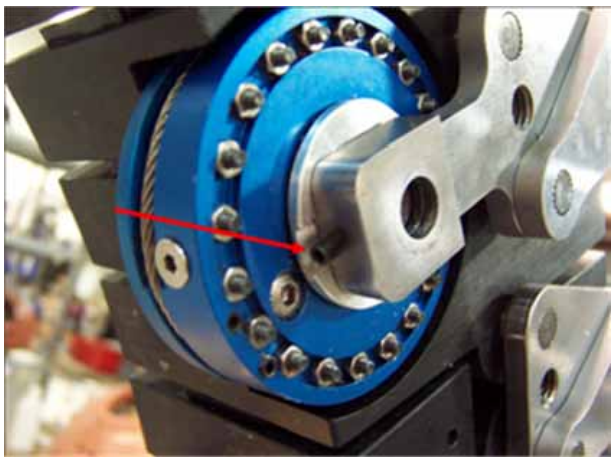


Figure 145 - Properly Aligned Bracket

13. Install M8 mounting bolt (9010294) and lock washer (9005200) with fingers until finger tight.
14. Tighten M3 set screw (9010295) to firmly seat damper into tapered slot on mounting plate.

Figure 146 - Install Mounting Bolt Finger Tight

Figure 147 - Tighten Set Screw

INSPECTION PROCEDURES AND TESTS

DEFINITION: Inspection tests are supplemental to the calibration tests to insure that a component meets its design intent. They are performed by the dummy manufacturer on new parts. The dummy user may conduct inspection tests when a part is damaged or replaced

Appendix A – Accelerometer Handling

ACCELEROMETER HANDLING GUIDELINES

General

The accelerometers used in anthropomorphic test dummies, such as the Hybrid III Dummy Family, are small, low mass piezoresistive accelerometers. Because of their design and inherent mechanics, certain precautions must be observed when handling and mounting accelerometers to avoid damaging them.

When handling and mounting the accelerometer, avoid dropping the accelerometer or striking the unit against hard surfaces. Keep the unit in its protective sleeve until the unit is installed

Preliminary Check-Out

Before installing any accelerometer into the dummy, check that it operates properly. Three simple tests that require minimal test equipment should be conducted:

1. Impedance Test Read the input impedance (Red to Black) and output impedance (Green to White) with an ohmmeter. Compare the measured values to those on the accelerometer Calibration Data Sheet. The measured impedance should be within +/- 25% of the calibrated value.

2. Insulation Resistance If the input and output impedances are within acceptable limits, use a multimeter, ohmmeter, or megohmmeter set at 50 volts maximum. Measure the insulation resistance between:

1. all leads connected together and the cable shield
2. all leads connected together and the accelerometer case
3. cable shield and the transducer case.

All three readings should be at least 100 megohms. Be careful when connecting 50VDC to eliminate the possibility of voltage spikes.

Zero Measurand Output After the impedance and insulation resistance tests, measure the output of the accelerometer with zero G acceleration. With the unit still in its sleeve, turn the unit on its side so the accelerometer mounting surface is perpendicular to the table top (sensitive axis horizontal and perpendicular to the gravity field.) Apply the specified excitation voltage to the accelerometer and measure its output with a DC millivolt meter. Allow the unit to warm-up for two minutes. The accelerometer should have a Zero Measurand Output (ZMO) within the manufacturer's specified limits.

If any of these initial checks do not give proper readings, indicating a possible malfunction, remove the excitation source immediately and take the following measurements.

3. Check and record leg 1, leg 2, leg 3, and leg 4 resistances.
2. Disconnect, check and record excitation voltage from the source.
3. Reconnect, check, and record excitation with the unit connected.
4. Check and record ZMO again.
5. Check and record static outputs +1G and -1G and compare to calibrated sensitivity.
6. Check that the temperature and environment fall within accelerometer specification.
7. Check to see if the accelerometer case is under stress.
8. Check leads for abrasion or cuts.

If the reason for the erroneous reading cannot be found, contact the accelerometer manufacturer.

Installation

When mounting or removing the accelerometer, you must use the proper techniques and tools. The mounting surface should be clean and free of burrs. A recommended surface roughness is .8128 μm (32 microinch) rms or less. Make sure that no dirt or particles can be clamped between the unit and mounting surfaces.

Remove the unit from the protective sleeve. With the sleeve absent, handle the unit by the case, not the cable. This will prevent the unit from slapping the mounting surface during installation. Place the unit on the mounting surface and align the mounting holes.

Correct torque is important to ensure correct mounting and performance. When mounting the accelerometer, use only the materials and parts which are supplied with the accelerometer. Always use the proper mounting torque recommended by the accelerometer manufacturer. If applicable, use the supplied mounting washers and screws, or mounting stud. Using the supplied wrench, turn the screws into the mounting holes using the recommended torque. Usually, this is roughly equivalent to finger tight with the supplied wrench. Installation of the unit with higher torque values, dry threads, or thread adhesives is not recommended as excessive torque will be required to break the screw loose when the accelerometer is dismounted. EXCESSIVE TORQUE CAN CREATE AN OVERRANGE TRANSIENT SHOCK PULSE, UPON REMOVAL OF THE UNIT, WITH SUFFICIENT HIGH FREQUENCY CONTENT TO DAMAGE OR DESTROY THE UNIT. Do not over torque the screws. Do not use snap type torque wrenches. Do not cement the unit to the mounting structure.

Where practical, tie down the cable within 4 to 6 cm (1.6 to 2.4 in) of the unit. Whipping of the cable during vibration and shock will strain the cable unnecessarily at the unit.

Connect the unit to the signal conditioner and check for proper functioning through the use of standard techniques such as shunt calibration across the passive arms of the accelerometer.

Recalibration

Sensitivity and Zero Measurand Output calibrations should be performed at 6 to 12 month intervals, depending on usage. Usually, 12 month intervals are sufficient if you know the accelerometer has not been used beyond its rated specifications. If the unit is used under severe environments, the shorter calibration interval may be desirable.

Cleaning

Dirty units may be wiped clean using a damp cloth and a solvent such as acetone. DO NOT SOAK OR IMMERSE the unit in any solvent or water. Do not use any sharp tool such as a screwdriver to remove dirt or contaminants. If tools such as pliers are needed to handle the accelerometer, cover the jaws with masking tape to prevent unwanted metal to metal contact.

Appendix B – Repairing of Vinyl Flesh & Silicon Jacket

GUIDELINES FOR REPAIRING VINYL FLESH & SILICONE JACKET

Silicone Jacket
Small repairs to the silicone jacket can be accomplished using RTV. If the tears are large, replace the jacket.

Vinyl Limb Flesh
Dummy flesh is often damaged, but can be repaired. The most common types or flesh damage are punctures, tears, and scrapes. Scrapes can be fixed by rubbing an iron, at low temperature, over the affected area several times. Punctures and tears require patching.

To repair the flesh, use an iron to bond the dummy's flesh to patches of repair materials. The iron is similar to a standard electronic soldering iron. Its output should range from 60 to 90 Watts. The best tip is a broad, flat paddle tip like the one in the dummy tool kit provided by the dummy manufacturers. For best results, a variable power supply should be used to control the heat output from the iron. Without this control, repairs will be more difficult and may be unsightly from black flakes of burnt flesh imbedded in the flesh. These flakes are caused by overheating the flesh, which happens when an iron is too hot or remains in one position too long. Another cause of black residue in the flesh is improper or infrequent cleaning of the iron tip. The tip should be cleaned frequently during the repair job, between each melting of flesh if possible. The best method for doing this is to tap the iron quickly on a buffing wheel.

Conduct all flesh preparations and repairs in a well-ventilated area. When patching, first clear away any loose material which may be hanging from the damaged areas, such as shredded vinyl or foam. Clean the area with 99% solution isopropyl alcohol and dry for fifteen minutes. Any residue from tape or chalk must be removed. If it remains after the initial cleaning, continue to clean with isopropyl alcohol until the area is completely clean. Since isopropyl alcohol is flammable, make sure the surface is dry before applying heat. Do not use soldering flux or any other chemical on the flesh or repair iron.

After preparation, a patch can be bonded to the flesh. Cut a patch of adequate size from the material provided in the dummy tool kit. The patch should be approximately 10 mm (0.5 in) wider than the damaged area on all sides. To check that the iron is at a usable temperature, test it on a small piece of patch material. The flesh should easily melt but not instantly burn. With the patch held over the damaged area, slide the iron between the patch and dummy flesh. Hold the iron in position until you see both materials melting. When both the patch and the flesh look like a gel, move the iron to a new point while holding the patch in place until they have both cooled. Continue this all the way around the damaged area until the patch is completely bonded to the flesh.

For large areas, or areas where the patch must bend to conform to the dummy part, it may be easier to "tack" a few points around the edge of the patch to hold it in place, then

return to fill in the unbonded sections. Once you bond the patch to the flesh, you need to blend the patch into the flesh. This will eliminate any protruding edges that may later snag and ruin the repair. To blend the patch, work the iron tip around the patch edges in a circular motion, blending the patch material into the flesh as you work your way around the patch. If the iron is too hot, black flakes will appear; if it is too cold, the patch will not readily melt, and the patch is probably not very well bonded to the flesh. Continue working the patch into the flesh until the repair is fairly well hidden and let it cool. After the area cools, you can return to touch-up any areas.

If a certain area of flesh is frequently damaged and is not expected to contribute significantly to dummy response, duct tape can be placed on the flesh but under the clothing to help protect it. Tape should not be used on any area which directly affects the test data, such as head, neck, ribs or spine. The engineer running the test should approve use of additional reinforcement such as tape before conducting tests.

Appendix C – Joint Adjustments

JOINT ADJUSTMENT PROCEDURES

The joints of the Hybrid III dummies are adjusted to a "one G suspended setting." This is defined as a torque level on the joint where the friction will allow an assembly to move toward the earth when a small force is applied to the unsupported end of the assembly. For example, when the dummy's arm is fully extended laterally so it is perpendicular to the body, the shoulder yoke clevis bolt should be tight enough to support the weight of the arm, but loose enough so when you tap the dummy's wrist, the whole arm will slowly fall towards the dummy. The following sections describe how to position the body parts and which joints to tighten to allow a one G setting.

Hands and Arms

1. Extend complete arm laterally outward to a horizontal position. Twist the arm so the elbow cannot rotate downward. Tighten the shoulder yoke clevis bolt so the arm is suspended at one G.

2. Rotate the complete arm assembly so it points forward and is horizontal. Twist the arm so the elbow cannot rotate downward. Adjust the shoulder yoke rotation hex nut so the arm is suspended at one G.

3. Bend the elbow 90° so the hand moves toward the chest. Adjust the elbow rotation bolt through access in the upper arm to hold the lower arm horizontally suspended at one G.

4. Reposition the arm so it points forward and is horizontal. Twist the lower arm at the elbow, so the lower arm can pivot downward to vertical. Adjust the elbow pivot bolt through access holes in the lower arm flesh at the elbow to hold the lower arm suspended at one G.

5. Extend the arm and twist the palm so it faces down. Adjust the wrist pivot bolt at the base of the hand so it is suspended at one G.

6. Adjust the wrist rotation bolt through access in the wrist flesh to hold it suspended at one G.

7. Repeat procedure for other hand and arm.

Legs and Feet

1. Remove abdominal insert.

2. With the lower leg at 90° to the upper leg, and the dummy in a seated position, lift the upper leg assembly above horizontal. Adjust the femur ball set screw so the upper leg is held suspended at one G.

3. Rotate the lower leg assembly so it is horizontal. Adjust the knee clevis bolt so the lower leg is held suspended at one G.

4. Adjust the ankle ball joint set screw so the foot is held suspended at one G. The ankle adjustment is not critical and is determined by individual feel.

5. Repeat procedure on other leg and foot.

Appendix D – Torque Table

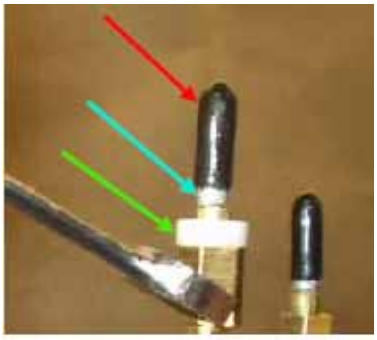
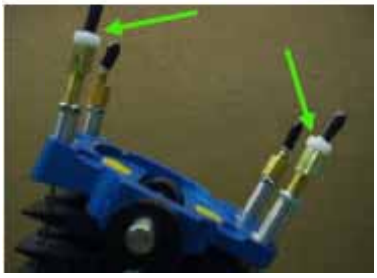
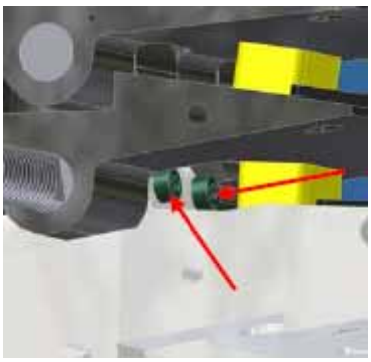
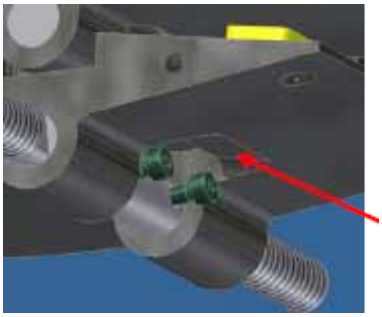
TORQUE VALUE CHART

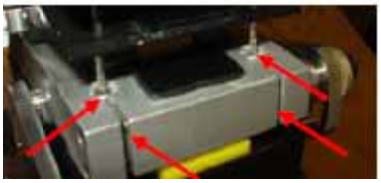
Torque (in lbs.)	
9003016 — BHCS 10-32 x 5/8	30
9005002 — SHCS ¼ - 20 x 1	96
9005016 — SHCS ¼ - 20 x 7/8	96
9005023 — SHCS ¼ - 28 x 7/8	96
9005029 — SHCS 10 - 24 x 3/8	30
9005040 — SHCS 5/16 - 18 x ¾	198
9005060 — SHCS 5/16 - 18 x ¾	198
9005065 — SHCS 5/16 - 24 x 7/8	198
9006002 — SHSS 3/8 x 1	324
9006027 — SHSS ¼ - ¾	70
9007001 — FHCS ¼ - 20 x 1	60
78051-30 — SHSS 3/8 x .375	324
78051-92 — SHCS 10 - 24 x 1 ½	30
78051-94 — SHCS ¼ - 20 x 5/8	96
78051-98 — SHCS 3/8 - 16 x 1	324
78051-100 — SHCS 3/8 - 16 x 2	324
78051-103 — SHCS 10 - 24 x .30	30
78051-117 — BHCS 10 - 32 x 5/8	30
78051-118 — BHCS 10 - 32 x ½	30
78051-226 — FHCS 10 - 32 x .41	30
A-1898 — BHCS 8 - 32 x ½	23

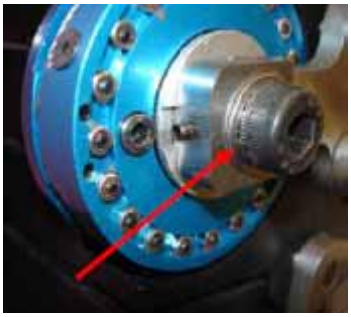
Appendix E – BioRID II Design Checklist

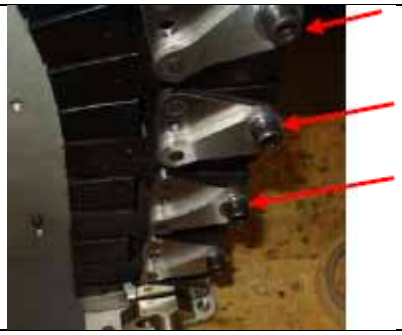
BioRID II Design Checklist		✓
	**VERIFY THE SKULL CAP IS FOR BIORID, AND THAT IT HAS THE CORRECT SIZE CABLE CLEARANCE SLOT.** **REFER TO GTR DWG # ARA-104, ARA-106**	
	**VERIFY SKULL AND CAP CONTAINS ERROR PROOFING PIN-HOLE COMBINATION.** **REFER TO GTR DWG # ARA-108, ARA-104, ARA 106**	
	**VERIFY THE CORRECT SIZE HOLES IN THE HEAD TO CLEAR THE FRONT CABLE ADJUSTERS (12.7 MM).** **REFER TO GTR DWG # ARA-104**	
	**VERIFY THE CORRECT HEAD IS INSTALLED (NON-SKULL CAP LOAD CELL VERSION).** **REFER TO GTR DWG # ARA-103**	

BioRID II Design Checklist		✓
	**VERIFY THE HEAD SKIN IS CUT OUT UNDER THE CHIN (NOT A H-III50M HEAD SKIN).** **REFER TO GTR DWG # ARA-108 G11**	
	**VERIFY THAT THE OC PLATE HAS CLEARANCE FOR INSTRUMENTATION CABLES.** **REFER TO GTR DWG # ARA-100 J6,G2**	
	**VERIFY THE PRESENCE OF OC PIN SET SCREWS.** **REFER TO GTR DWG # ARA-100 J6,G2**	
	**VERIFY HEAD SKIN IS TRIMMED TO AVOID MECHANICAL LOAD PATH AROUND UPPER NECK LOAD CELL.**	

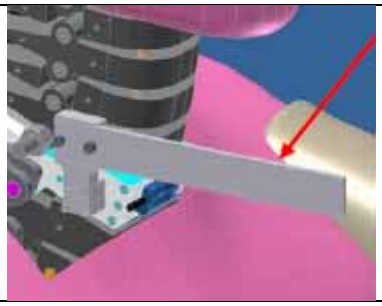
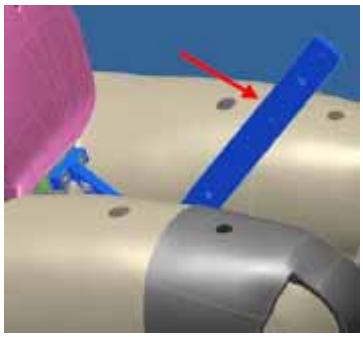
BioRID II Design Checklist		✓
 	**VERIFY THAT PLASTIC CAPS AND ALUMINUM CRIMPS ARE STILL IN PLACE ON TOP OF ALL FOUR CABLES ABOVE THE ADJUSTERS IN THE HEAD, AND THAT BOTH DELRIN SLEEVES ARE IN PLACE ON BOTH MUSCLE SUBSTITUTE CABLE ADJUSTERS.** **REFER TO GTR DWG # ARA-200 B5** **PADI SECTION 10.1.1**	
	**VERIFY THAT PRESENCE OF THE M2.5 SHCS THAT LOCK THE T1 PIN IN PLACE, AND THAT THEY ARE TIGHT.** **REFER TO GTR DWG # ARA-200 C8**	
	**VERIFY THAT BOTTOM OF C7 VERTABRA HAS CLEARANCE FOR T1 LOCKING SCREWS.** **REFER TO GTR DWG # ARA-200 C8, ARA-208 F5, J5**	

BioRID II Design Checklist		✓
 	**CHECK CERVICAL VERTABRAE DIMENSIONAL THICKNESSES FRONT (15.3 +/- 0.1mm) AND BACK (1.2 +/- 0.1mm) AND VERIFY WITH DRAWINGS** **REFER TO GTR DWG # ARA-201 J5** **REFER TO GTR DWG # ARA-203 J2, J6** **REFER TO GTR DWG # ARA-206 J2, J6** **REFER TO GTR DWG # ARA-207 J2, J6** **REFER TO GTR DWG # ARA-208 J2, J6**	
 	**VERIFY T1 LOAD CELL OR STRUCTURAL REPLACEMENT DESIGN WITH REMOVABLE BUSHINGS AND SLOTS TO ALLOW REMOVAL WITHOUT CUTTING CABLES** **REFER TO GTR DWG # ARA-301 GLOBAL, AND PADI SECTION 5.2.3**	
	**VERIFY USE OF STAINLESS STEEL NECK PINS (WILL NOT RUST)** **REFER TO GTR DWG # ARA-209, ARA-212 GLOBAL**	

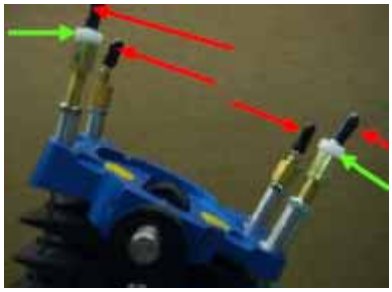
BioRID II Design Checklist		✓
	**CHECK CERVICAL VERTEBRAE HOLES WITH CLASS ZZ GO GAGE PINS: .316+" OR 8.02+ mm DIA. SHOULD NOT GO IN. .315+" OR 8.00+ mm DIA. SHOULD GO IN** **REFER TO GTR DWG # ARA-201 H5** **REFER TO GTR DWG # ARA-203 H5** **REFER TO GTR DWG # ARA-206 H5** **REFER TO GTR DWG # ARA-207 H5** **REFER TO GTR DWG # ARA-208 H3**	
	**VERIFY DAMPER (ARA-375) IS INSTALLED, IDENTIFIED BY PRESENCE OF CLAMPING BLOCK** **REFER TO GTR DWG # ARA-375 GLOBAL,** **REFER TO GTR DWG # ARA-377** **GLOBAL**	
	**VERIFY PRESENCE OF LOCK WASHER UNDER THE M8 DAMPER ATTACHMENT SCREW.** **REFER TO GTR DWG # ARA-375 A3**	
	**VERIFY PRESENCE OF SLOT IN T3 TORSION PLATE FOR MUSCLE SUBSTITUTE CABLE SHEATH CLEARANCE.** **REFER TO GTR DWG # ARA-319 A2** **REFER TO GTR DWG # ARA-200 D3**	

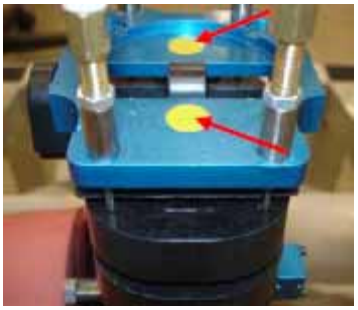
BioRID II Design Checklist		✓
	**VERIFY THE DAMPER CABLE GUIDE WHEEL IS THE CORRECT SIZE/DESIGN/REVISION.** **REFER TO GTR DWG # ARA-343 GLOBAL**	
	**VERIFY THE TORSION PLATE FASTENERS ARE SHCS WITH WASHERS INSTEAD OF BHCS.** **REFER TO GTR DWG # ARA-200 GLOBAL, AND PADI SECTION 5.2.4**	
 	**VERIFY THAT THE S1 SCREW INCLUDES THE TENSION WASHER AND THAT THE SCREW IS TORQUED TO THE PROPER SPECIFICATION.** **REFER TO GTR DWG # ARA-200 J15, AND PADI SECTION 5.2.4**	

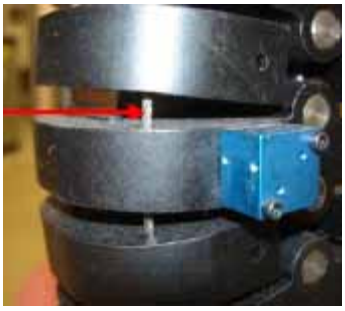
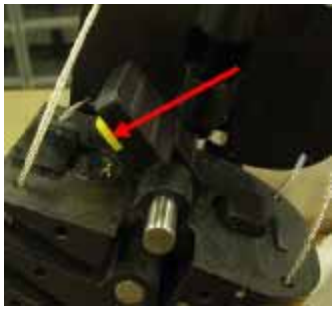
BioRID II Design Checklist		✓
	**VERIFY THE NEW DESIGN H POINT LOCATORS ARE INSTALLED** **REFER TO GTR DWG # ARA-933 GLOBAL** **REFER TO GTR DWG # ARA-934 GLOBAL** **REFER TO GTR DWG # ARA-200 J15**	
	**VERIFY S1 IS PRESENT, WHICH USES A LUMBAR LOAD CELL OR STRUCTURAL REPLACEMENT TO IMPROVE DURABILITY AND INTERCHANGABILITY.** **REFER TO GTR DWG # ARA-562 GLOBAL,** **REFER TO GTR DWG # ARA-564 GLOBAL** **REFER TO GTR DWG # ARA-200 K10, AND** **PADI SECTION 5.2.4**	
	**SETUP SPINE BY CAREFULLY FOLLOWING THE SETUP PROCEDURE.** **REFER TO PADI SECTION 10.2.5**	

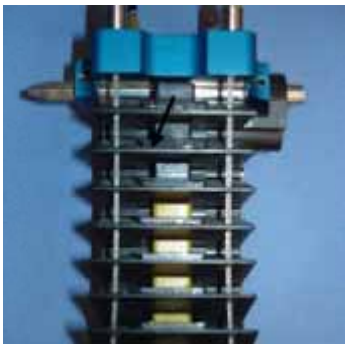
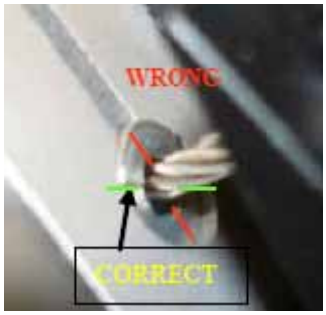
BioRID II Design Checklist		✓
	**VERIFY CORRECT JACKET VERSION (ARMS WILL HANG STRAIGHT DOWN).** **REFER TO GTR DWG # ARA-395 GLOBAL** **REFER TO GTR DWG # ARA-002 GLOBAL**	
	**VERIFY CORRECT SIZE SHOES ARE INSTALLED** **REFER TO PADI SECTION 2.2**	
	**VERIFY USE OF NEW T1 ANGLE INDICATOR ATTACHED TO ACCEL. MOUNT LOCATION** **REFER TO GTR DWG # ARA-930 GLOBAL**	
	**VERIFY USE OF NEW PELVIS ANGLE INDICATOR UPDATED TO CLEAR BELT** **REFER TO GTR DWG # ARA-915 GLOBAL**	

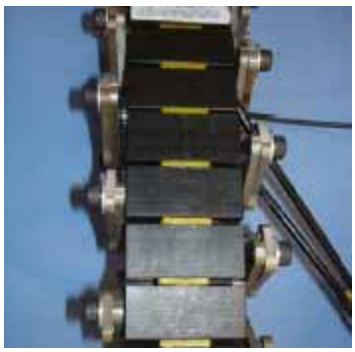
Appendix F – BioRID II Maintenance Checklist

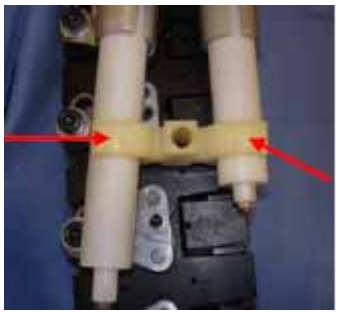
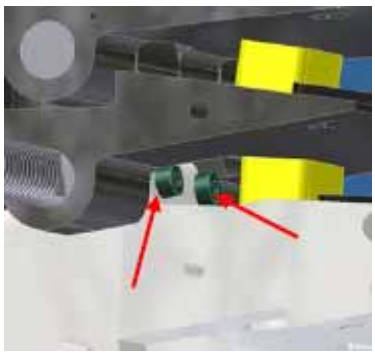
BioRID II Maintenance Checklist		✓
	**VERIFY THE SKULL CAP IS FOR BIORID, AND THAT IT HAS THE CORRECT SIZE CABLE CLEARANCE SLOT.** **REFER TO GTR DWG # ARA-104, ARA-106**	
	**VERIFY THE HEAD SKIN IS CUT OUT UNDER THE CHIN, UNLIKE THE HIII 50TH HEAD SKIN.** **REFER TO GTR DWG # ARA-103 GLOBAL**	
	**VERIFY THE HEAD MASS ASSEMBLY WITH ACCELEROMETERS IS 4.540 +/- 0.045KB (10.000+/- 0.10LB)**	
	**VERIFY THAT PLASTIC CAPS ARE STILL IN PLACE ON TOP OF ALL FOUR CABLES ABOVE THE ADJUSTERS IN THE HEAD, AND THAT BOTH DELRIN SLEEVES ARE IN PLACE ON BOTH MUSCLE SUBSTITUTE CABLE ADJUSTERS.** **REFER TO GTR DWG # ARA-200 GLOBAL** **PADI SECTION 10.1.1**	

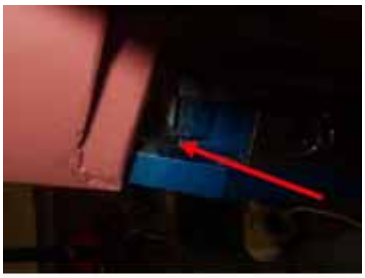
BioRID II Maintenance Checklist		✓
	**VERIFY THAT THE 4 LOCKNUTS ON THE O.C PLATE CABLE ADJUSTERS ARE TIGHT.** **REFER TO PADI SECTION 10.1.1**	
	**VERIFY THE PRESENCE AND GOOD CONDITION OF LOAD CELL/O.C. PLATE BUMPERS. IF THE YELLOW O.C BUMBERS ARE COMPRESSED THE HEAD WILL ROCK. VERIFY THAT THERE IS NO PLAY BETWEEN THE O.C PLATE AND THE HEAD WHEN THE PIN IS INSTALLED. REPLACE IF NECESSARY.** **REFER TO GTR DWG # ARA-105 GLOBAL**	
	**VERIFY THAT THE M8 DAMPER MOUNTING SCREW IS TIGHT AND TORQUED TO 5 ft/lbs** **REFER TO PADI SECTION 11.5**	
	**VERIFY THAT THE DAMPER CABLE IS SECURE IN THE SLOT OF THE DAMPER BODY AND THE TWO CLAMPING SCREWS ARE TIGHTENED** **REFER TO PADI SECTION 11.5**	

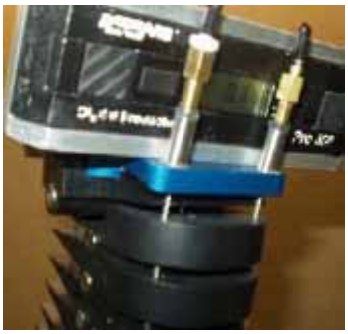
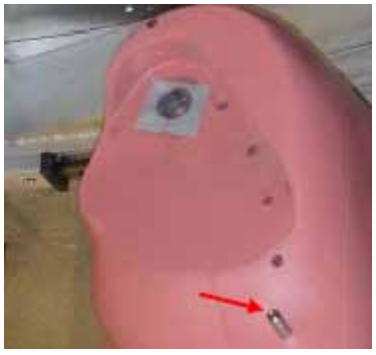
BioRID II Maintenance Checklist		✓
	**VERIFY THAT THE SERRATED LOCK WASHER IS UNDER THE M8 DAMPER ATTACHMENT SCREW** **REFER TO GTR DWG # ARA-375 A3** **PADI SECTION 11.5**	
	**VERIFY THAT THE DAMPER CLAMP TONGUE POSITIONED CORRECTLY IN THE SLOT** **REFER TO GTR DWG # ARA-375 GLOBAL** **PADI SECTION 11.5**	
	**VERIFY THAT THERE ARE NO KINKS, BENDS OR DAMAGE IN ANY OF THE CABLE ASSEMBLIES. AVOID TWISTING THE CABLES DURING THE DUMMY SETUP** **REFER TO PADI SECTION 10.1.1**	
	**NECK BUMPERS MUST BE REPLACED EVERY 4 MONTHS.** **REFER TO GTR DWG # TRA-086 GLOBAL** **REFER TO GTR DWG # TRA-087 GLOBAL** **REFER TO GTR DWG # TRA-088 GLOBAL** **PADI SECTION 11.1**	

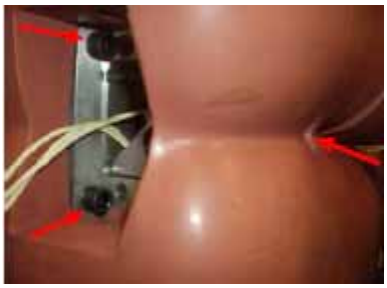
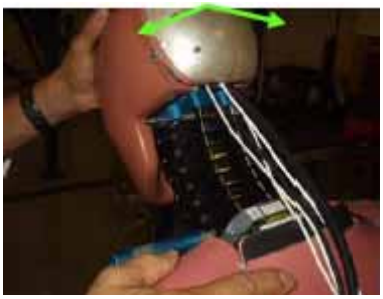
BioRID II Maintenance Checklist		✓
	**VERIFY THE PRESENCE AND CORRECT POSITION OF ALL CERVICAL BUMPERS IN THE NECK ASSEMBLY. CHECK BOTH FRONT AND BACK.** **REFER TO GTR DWG # ARA-200 GLOBAL** **PADI SECTION 11.1**	
	**VERIFY THAT THE T1CABLE BUSHINGS ARE NOT CLAMPED SO THAT SPLIT BETWEEN HALVES IS PARALLEL TO SIDES OF T1, OR CABLE CAN RIDE ON THE SPLIT RESULTING IN DRAG** **REFER TO GTR DWG # ARA-301 GLOBAL** **PADI SECTION 10.2.2**	
	**CHECK TO SEE IF THERE IS EXCESSIVE WEAR ON THE T1 CABLE BUSHINGS RESULTING IN AN OVAL APPEARANCE** **REFER TO PADI SECTION 10.2.2**	
	**VERIFY THAT THE SPLIT BUSHINGS ARE TIGHT IN THE REPLACABLE T1 LOAD CELL** **REFER TO PADI SECTION 10.2.2**	

BioRID II Maintenance Checklist		✓
	**CHECK CERVICAL VERTEBRAE HOLES WITH CLASS ZZ GO GAGE PINS: .316+" OR 8.02+ mm DIA. SHOULD NOT GO IN. .315+" OR 8.00+ mm DIA. SHOULD GO IN** **REFER TO GTR DWG # ARA-201 H5** **REFER TO GTR DWG # ARA-203 H5** **REFER TO GTR DWG # ARA-206 H5** **REFER TO GTR DWG # ARA-207 H5** **REFER TO GTR DWG # ARA-208 H3**	
	**VERIFY THAT ALL TORSION PLATE FASTENERS ARE TIGHT, BOTH SIDES OF THE DUMMY. INCLUDING THE LOWEST LUMBAR SCREW NOTED WITH AN ARROW.** **REFER TO GTR DWG # ARA-200 GLOBAL** **PADI SECTION 10.2**	
	**VERIFY THE PRESENCE AND CORRECT POSITION OF ALL BUMPERS IN THE THORACIC AND LUMBAR AREA. CHECK BOTH FRONT AND BACK OF SPINE.** **REFER TO GTR DWG # ARA-200 GLOBAL** **PADI SECTION 5.2.4.1**	
	**VERIFY THAT THE MUSCLE SUBSTITUTE CABLE FERRULES ARE GLUED INTO THE T3 VERTEBRA AND NOT LOOSE.** **REFER TO GTR DWG # ARA-200 GLOBAL** **PADI SECTION 5.2.2**	

BioRID II Maintenance Checklist		✓
	**VERIFY THAT THE SPRING HOUSING HOLDER DOES NOT RIDE UP OVER THE END OF THE ADJACENT SHCS.** **REFER TO PADI SECTION 5.2.2**	
	**CHECK TO SEE IF THE SPRING HOUSING COUPLING IS DEFORMED ALLOWING THE HOUSINGS TO SNAP OUT** **REFER TO PADI SECTION 5.2.2**	
	**VERIFY THAT THE M2.5 SHCS THAT LOCK THE T1 PIN IN PLACE ARE TIGHT.** **REFER TO GTR DWG # ARA-200 C8** **PADI SECTION 5.2.3.1**	
	**VERIFY THAT THE S1 SCREW INCLUDES THE TENSION WASHER AND IS TORQUED TO THE PROPER SPECIFICATION.** **REFER TO GTR DWG # ARA-200 J15** **PADI SECTION 5.2.4**	

BioRID II Maintenance Checklist		✓
	**VERIFY THAT THE 2 NUTS ON THE SPRING CABLE THREADED STUDS ARE INSTALLED AND TIGHT.** **REFER TO GTR DWG # ARA-200 GLOBAL** **PADI SECTION 10.1**	
 	**VERIFY THAT JACKET LUMBAR PLATE IS ENGAGED IN SLOT AT BOTTOM OF S1, AND THAT M6 SCREWS ARE TIGHT.** **REFER TO GTR DWG # ARA-002 GLOBAL** **PADI SECTION 5.2.1**	
	**SETUP SPINE BY CAREFULLY FOLLOWING THE SETUP PROCEDURE.** **REFER TO PADI SECTION 10.2.5**	

BioRID II Maintenance Checklist		✓
	**VERIFY THAT THE LATERAL TILT OF THE O.C. PLATE IS ADJUSTED TO ZERO +/- 0.2 DEGREES RELATIVE TO THE LUMBAR PLATE, WHEN ADJUSTING THE DAMPER CABLE TENSION. VERIFY THAT THIS ADJUSTMENT WAS THE FINAL CABLE ADJUSTMENT.** **REFER TO PADI SECTION 10.2**	
	**INSPECT THE JACKET FOR ANY TEARS. MINOR REPAIRS CAN BE ACCOMPLISHED WITH RTV. FOR MAJOR TEARS THE JACKET SHOULD BE REPLACED.** **REFER TO PADI SECTION Appendix B**	
	**VERIFY THE ABDOMEN CONTAINS THE CORRECT AMOUNT OF WATER, WHICH IS 2.06 LITRES (4.35 LB). WEIGHT OF JACKET, PINS, AND WATER SHOULD BE 21.87+/- .30 KG.** **REFER TO GTR DWG # ARA-395 GLOBAL** **PADI SECTION 8.1**	
	**VERIFY THAT THE JACKET PINS ARE IN THE CORRECT LOCATION AND ARE ALL SECURE.** **REFER TO GTR DWG # ARA-200 GLOBAL** **PADI SECTION 5.2.4**	

BioRID II Maintenance Checklist		✓
	**VERIFY THE SCREWS AT THE BASE OF THE SPINE ARE TIGHTENED AFTER REINSTALLING JACKET ONTO THE SPINE.** **REFER TO GTR DWG # ARA-200 GLOBAL AND PADI SECTION 5.2.4**	
	**VERIFY THE SCREWS AT THE BASE OF THE SPINE ARE TIGHTENED AFTER REINSTALLING SPINE INTO THE PELVIS.** **REFER TO GTR DWG # ARA-002 GLOBAL**	
	**VERIFY THAT THERE IS NO LATERAL PLAY IN THE NECK.** **REFER TO PADI SECTION 10.2.4**	
	**VERIFY THE TEFLON PAD BEHIND THE DUMMY IS INSTALLED CORRECTLY AND IN THE CORRECT POSITION, WITH TEFLON AGAINST VERTEBRAE.** **REFER TO GTR DWG # ARA-002 GLOBAL PADI SECTION 5.2.1**	

BioRID II Maintenance Checklist		✓
	**VERIFY THAT THE SPINE ADJUSTMENT IS BALANCED SO THAT IT CAN HOLD THE HEAD AT +4 DEGREES AND –4 DEGREES ON THE CERTIFICATION SLED.**	
	**STORE THE DUMMY WITH THE PELVIS AN JACKET SUPPORTED IN A SLIGHTLY RECLINED POSITION** **REFER TO PADI SECTION 3.1**	
	**CHECK JACKET STIFFNESS ANNUALLY WITH DYNAMIC IMPACT TEST** **REFER TO BioRID Jacket Certification Procedures**	

BioRID II Maintenance Checklist		✓
	**VERIFY THAT THE NECK STABILIZING BRACKET IS BEING USED WHEN THE DUMMY IS NOT IN USE.** **REFER TO PADI SECTION 3.0**	
	**VERIFY THAT THE INSTRUMENTATION CABLE STRAIN RELIEFS HAVE LOOPS AS CALLED OUT IN THE PADI p.14** **REFER TO PADI SECTION 7.3**	
	**VERIFY THAT FEMUR PLUNGERS ARE SET TO 1-2 G.** **REFER TO PADI SECTION 9.1.2**	

BioRID II Maintenance Checklist	✓
	**VERIFY THAT ALL ARM AND LEG JOINTS ARE SET AT 1-2 G.** **REFER TO PADI SECTION 9.1.2**	

BioRID II Maintenance Checklist		✓
	VERIFY THAT THE PELVIS FLESH IS NOT PULLING AWAY FROM THE FRONT OF THE BONE (storage issue)	