



SURFACE VEHICLE INFORMATION REPORT

J2862™

MAY2023

Issued 2015-02
Stabilized 2023-05

Superseding J2862 FEB2015

User's Manual for the Small Adult Female Hybrid III Test Dummy

RATIONALE

The technical report covers technology, products, or processes which are mature and not likely to change in the foreseeable future. The technical committee makes a conscious decision not to maintain the document any longer.

STABILIZED NOTICE

This document has been declared "STABILIZED" by SAE Dummy Testing and Equipment Committee and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

SAE Executive Standards Committee Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2023 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
http://www.sae.org

SAE WEB ADDRESS:

Full document details: SAE J2862_202305

For more information on this standard, visit
https://www.sae.org/standards/content/J2862_202305/

Documents

Document Sharing Hub

TABLE OF CONTENTS

1.	SCOPE	3
2.	REFERENCES	3
3.	DEFINITIONS AND ABBREVIATIONS	4
4.	PART NUMBERS	5
5.	CONSTRUCTION.....	5
6.	INSTRUMENTATION	6
7.	DISASSEMBLY AND REASSEMBLY PROCEDURES	8
7.1	Complete Assembly.....	8
7.2	Head and Neck Removal.....	9
7.3	Head	12
7.4	Neck	14
7.5	Upper Torso.....	16
7.6	Chest Deflection Transducer	21
7.7	Clavicle	23
7.8	Lower Torso.....	25
7.9	Arms	29
7.10	Legs	30
7.11	Lower Legs	32
7.12	Instrumented Lower Leg	33
7.13	Ankle and Foot	35
8.	CERTIFICATION TESTS	36
8.1	Head Drop Test	36
8.2	Neck Tests.....	38
8.3	Thorax Impact Test.....	43
8.4	Knee Impact Test	46
8.5	Knee Slider Test.....	47
9.	INSPECTION TESTS	49
9.1	External Measurements.....	49
9.2	Mass Measurements	53
9.3	Hip Joint Range of Motion Test	54
9.4	Foot Test	56
9.5	Ankle Motion Test.....	58
9.6	Torso Flexion Test.....	61
9.7	Low-speed Thorax Impact Test.....	64
10.	NOTES	64
10.1	Marginal Indicia	64

Appendix A	Accelerometer handling guidelines	65
Appendix B	Guidelines for repairing flesh	67
Appendix C	Joint adjustment procedures	68
Figure 1	Instrumented anthropomorphic test device	7
Figure 2	Complete anthropomorphic test device	9
Figure 3	Head and neck assembly	10
Figure 4	Neck compression tool	11
Figure 5	Six-channel head	12
Figure 6	Side view of head skin with filled chin	13
Figure 7	Bottom view of head skin with filled chin	13
Figure 8	Neck assembly	14
Figure 9	Upper torso assembly	17
Figure 10	Shoulder joint assembly	17
Figure 11	Chest depth measurement setup	20
Figure 12	Chest depth gage	20
Figure 13	Chest deflection assembly	21
Figure 14	Transducer arm clearance check	23
Figure 15	Clavicle assembly	24
Figure 16	Section view of clavicle	24
Figure 17	Lower torso assembly	26
Figure 18	Lumbar spine assembly	26
Figure 19	Femur removal tool	27
Figure 20	"H" point location	28
Figure 21	Arm assembly	29
Figure 22	Leg assembly	31
Figure 23	Knee with slider	32
Figure 24	Instrumented lower leg	34
Figure 25	Ankle and foot assembly	35
Figure 26	Head drop test setup specifications	38
Figure 27	Neck pendulum arm specifications	40
Figure 28	Neck extension setup specifications	41
Figure 29	Neck flexion setup specifications	41
Figure 30	Thorax impact test setup specification	44
Figure 31	Hysteresis definition	45
Figure 32	Knee impact test setup specifications	47
Figure 33	Knee slider test setup specifications	48
Figure 34	External dimensions setup specification	51
Figure 35	Hip joint range of motion test setup	55
Figure 36	Foot test setup	56
Figure 37	Foot compression test performance specifications	57
Figure 38	Ankle range of motion setup	59
Figure 39	Foot position for ankle test	60
Figure 40	Torso pull bracket	62
Figure 41	Torso flexion test setup	63
Table 1	Torque specifications	8
Table 2	Hybrid III small adult female external dimensions	52
Table 3	Hybrid III small adult female total and segment masses	53

INTRODUCTION

In the late 1980's the Centers for Disease Control (CDC) awarded Ohio State University a grant to develop multi-sized test dummies based on the Hybrid III design. To aid in this endeavor, the Mechanical Human Simulation Subcommittee of the Society of Automotive Engineers (SAE) formed a Task Group to define the specifications for an adult size small female dummy which would have, at least, the same level of biofidelity and measurement capacity as the 50th Hybrid III dummy.

The Hybrid III Small Female Test Dummy is based on the characteristic size and weight measurements taken from anthropometry studies of the 5th percentile adult female. Its impact response requirements for the head, neck, chest, femur, knee and ankle were extrapolated from the biofidelity requirements of the Hybrid III mid-size male dummy. (See Mertz, H. J., Irwin, A. L., Melvin, J. W., Stalnaker, R. L., Beebe, M. S., "Size, Weight, and Biomechanical Impact Response Requirements for Adult Size Small Female and Large Male Dummies", SAE #890756, SP-782, 1989.) The Hybrid III small female dummy is designed to represent the lower extreme of the United States adult population.

MANUAL OVERVIEW

Appendices - Several guidelines and procedures apply to various parts throughout the dummy, and are included in the appendices for easier reference. First, when handling an instrumented dummy, improper techniques can damage instrumentation, particularly accelerometers. Appendix A contains guidelines for safe handling of instrumented dummies. Second, the vinyl flesh of dummies can be damaged, but is often repairable. Appendix B contains instructions for repairing dummy flesh. Third, procedures for adjusting the joints throughout the dummy are included in Appendix C.

Other SAE Documents - In addition to the attached appendices, other SAE publications are particularly useful when working with the Hybrid III dummies. SAE J211-1 provides the most recent guidelines and procedures for dummy instrumentation and filtering. SAE Information Report J1733 illustrates the instrumentation available for the Hybrid III dummy, along with descriptions of how to apply the positive right-hand rule sign convention.

1. SCOPE

This user's manual covers the small adult female Hybrid III test dummy. It is intended for technicians who work with this device. It covers the construction and clothing, disassembly and reassembly, available instrumentation, external dimensions and segment masses, as well as certification and inspection test procedures. It includes instructions for safe handling of the instrumented dummy, repairing dummy flesh, and adjusting the joints throughout the dummy.

2. REFERENCES

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

SAE J211-1	Instrumentation for Impact Test – Part 1 – Electronic Instrumentation
SAE J1733	Sign Convention for Vehicle Crash Testing
SAE J2517	Hybrid III Family Chest Potentiometer Calibration Procedure
SAE J2878	Low Speed Thorax Impact Test Procedure for the HIII 5 th Dummy
SAE J2915	H-III5F Spine Box Update to Eliminate Noise
SAE J2921	H-III5F Chest Jacket Harmonization

Mertz, H.J., Irwin, A.L., Melvin J.W., Stalnaker, R.L., and Beebe, M.S., "Size, Weight and Biomechanical Impact Response Requirements for Adult Size Small Female and Large Male Dummies," SAE 890756, SP-782, 1989.

Banglmaier, R.F., Pecoraro, K.M., Feustel, J.R., Scherer, R.D., and Rouhana, S.W., 2005, "Development and Evaluation of a Proposed Neck Shield for a 5th Percentile Hybrid III Dummy," Stapp Car Crash Journal, vol. 49.

3. DEFINITIONS AND ABBREVIATIONS

3.1 BHCS

Button Head Cap Screw

3.2 CERTIFICATION TESTS

Tests conducted to assure that the dummy is manufactured and maintained at the SAE specified performance levels for responses which could affect dummy measurements that are used by government and safety engineers to assess occupant injury potential. Certification tests are performed by the dummy manufacturer to assure the performance of new components or assemblies. Certification tests are performed periodically by dummy users to assure that the dummy is properly maintained.

3.3 FHCS

Flat Head Cap Screw

3.4 INSPECTION TESTS

Inspection tests are supplemental to the certification tests to insure that a component meets its design intent. Inspection tests are performed by the dummy manufacturer on new parts. Inspection tests may be performed by dummy users when a part is damaged or replaced.

3.5 MIDSAGITTAL PLANE

The plane that divides the body into left and right halves

3.6 RHMS

Round Head Machine Screw

3.7 SHCS

Socket Head Cap Screw

3.8 SHSS

Socket Head Shoulder Screw

3.9 SSCP

Socket Screw, Cup Point

3.10 1 G SUSPENDED JOINT SETTING

The torque setting of a joint that supports the weight of its distal limb that will move when a minimal external force is applied (see APPENDIX C – JOINT ADJUSTMENT PROCEDURES).

4. PART NUMBERS

All part numbers in this manual refer to the drawing package in 49 CFR, Part 572, Subpart O. Copies of the drawing package for this dummy can be obtained from Leet-Melbrook, Division of New RT, 18810 Woodfield Road, Gaithersburg, MD, 29879.

5. CONSTRUCTION

The skull and skull cap are both one-piece cast aluminum, with a removable one-piece vinyl head and skull cap skin. The skull cap is removable for access to the head instrumentation. The vinyl skin is tuned to give a human-like response to forehead impacts.

The neck has a biofidelic "angle versus moment" response in both dynamic flexion (forward bending) and extension (rearward bending) articulations. A neck cable controls stretching responses, and increases the neck's durability to high axial tension forces.

The two-piece aluminum clavicle and clavicle-link assembly have cast integral clavicles to interface with shoulder belts.

Six spring steel ribs with polymer-based damping material approximate the human chest force-deflection response characteristics. The sternum assembly connects to the front of the ribs and incorporates a slider for a chest deflection transducer to measure rib cage deflection relative to the thoracic spine.

A straight lumbar spine gives a sitting posture to simulate a person of smaller stature in the driving position.

The pelvis has a human shape and comes equipped with load cell replacements for pelvis submarining-indicating transducers.

A knee slider mechanism is used that consists of steel sliders with energy absorbing molded rubber mounted on aluminum knees. This allows for displacement of the tibia relative to the femur, simulating ligament response.

The leg assemblies are steel tubes covered with vinyl. The legs are interchangeable with instrumented versions.

Constant friction movable joints are used that need few adjustments and provide consistent articulations.

The standard model has a "seated" pelvis construction. A "sit/stand" pelvis version is optional as are a neck covering for airbag testing, a deformable face for steering wheel rim testing, and a deformable abdomen for lap belt submarining and steering wheel rim evaluations.

When used in testing, the dummy should wear a snug-fitting cotton knit T-shirt and pants. The neckline should be small enough to prevent contact between a shoulder belt and the dummy's skin. The pants should end above the dummy's knee. The T-shirt and pants should each weigh no more than 0.14 kg (0.3 lb). Garments similar to thermal underwear (trimmed to be short-sleeved and above the knee) usually meet these requirements. To improve the quality of high-speed films taken of the dummy during testing (by avoiding excessive glare), the garments are usually dyed to a light pink. The shoes used with the small adult female dummy are woman's low dress black oxfords, size 7 ½E, that meet military specification MIL-S-21711E. Each shoe weighs 0.41 kg ± 0.09 kg (0.90 lb ± 0.2 lb). To make it easier to put the shoe on the dummy, the shoe should be cut to extend the tongue. Talc may also be applied to the foot.

6. INSTRUMENTATION

The following is the instrumentation which the SAE Task Group agreed would be needed to evaluate various types of occupant restraint systems and which is available for use with the Hybrid III small adult female dummy. Figure 1 illustrates an instrumented dummy.

- Three uniaxial (or one triaxial) accelerometers in head and chest
- Six-channel upper neck load cell
- Six-channel lower neck load cell
- Chest displacement transducer (supplied with dummy)
- Three uniaxial accelerometers on the sternum plate
- Three uniaxial accelerometers on the spine box that are aligned with the sternal accelerometers
- Six-channel thoracic spine load cell
- Five-channel lumbar spine load cell
- Three uniaxial (or one triaxial) accelerometers in the pelvis
- Submarining-indicating transducers
- Six-channel femur force load cell (single channel also available)
- Tibia-femur displacement transducers
- Instrumented legs:
 - Knee clevis load cell, (medial and lateral loads in the z direction)
 - Upper tibia transducer (M_x , M_y , F_x , F_z)
 - Lower tibia transducer (M_x , M_y , F_x , F_y)

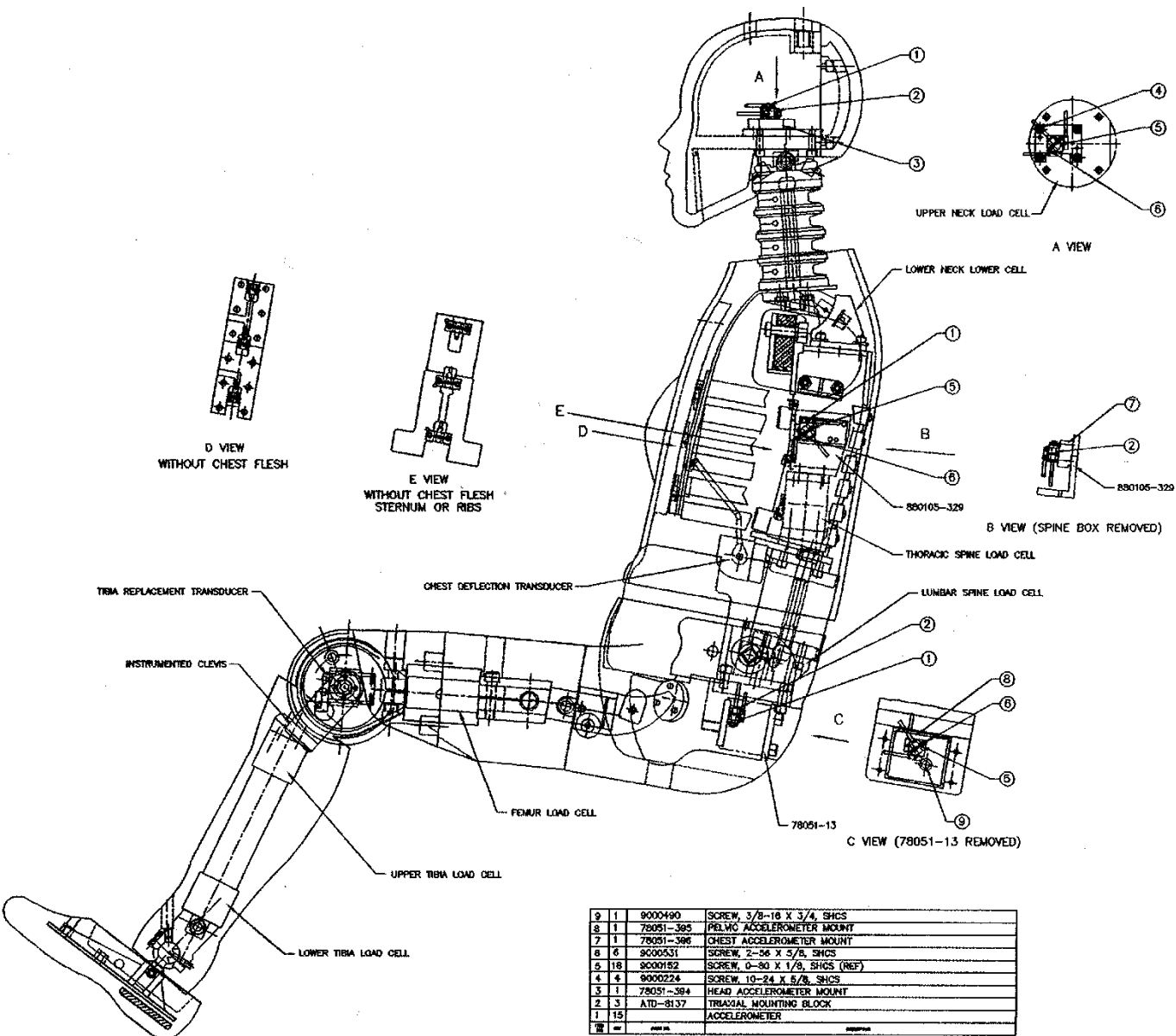


Figure 1 - Instrumented anthropomorphic test device

7. DISASSEMBLY AND REASSEMBLY PROCEDURES

Table 1 gives the torque specifications for fasteners used in the dummy. The torque values specified apply to clean and dry parts. They should be used, unless specified otherwise. Note that a lubricated screw requires less torque (15% to 25% less) to attain the same clamping force as a non-lubricated screw.

Table 1 - Torque specifications

Thread Size	Torque (in-lb)	Torque (N-m)
0-80	1.00	0.113
2-56	2.50	0.283
4-40	12.0	1.36
6-32	23.0	2.60
8-32	41.0	4.63
10-24	60.0	6.78
10-32	68.0	7.68
1/4-20	144	16.3
1/4-28	168	19.0
5/16-17	300	33.9
5/16-24	300	33.9
3/8-16	540	61.0
3/8-24	600	67.8

NOTE: The references for these specifications are Smith Fastener Company, Brake Products Inc., and C & J Fastener Inc.

7.1 Complete Assembly

The complete anthropometric test device consists of six major assembly groups shown in Figure 2:

Head Assembly(880105-100X for six-channel neck load cell)
Neck Assembly.....(880105-250)
Upper Torso Assembly.....(880105-300)
Lower Torso Assembly.....(880105-450)

Complete Leg Assemblies(88105-560-1 [left] and -560-2 [right])
Complete Arm Assemblies(880105-728-1[left] and -728-2[right])

Generally, the arms are considered part of the upper torso and the legs are part of the lower torso, but for this manual they are considered separate units.

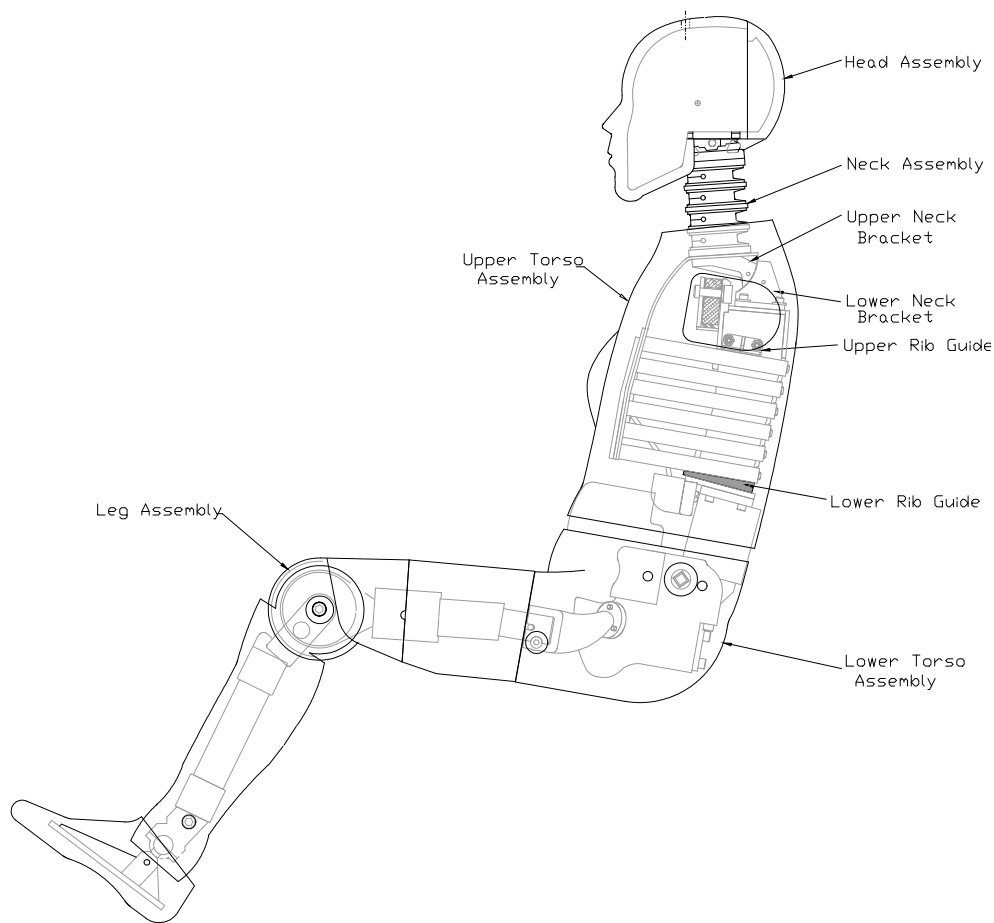


Figure 2 - Complete anthropomorphic test device

7.2 Head and Neck Removal

Refer to the following parts list and Figure 3 to remove the head and neck from the complete assembly:

Nylok® SHCS 3/8-16x1.....	(9000021).....	Item 1, Figure 3
Upper Neck Bracket	(880105-207)	Item 2, Figure 3
SHCS, 10-24x5/8	(90000224).....	Item 3, Figure 3
Bib Assembly.....	(880105-1060)	Item 4, Figure 3
Pivot Pin	(78051-339).....	Item 5, Figure 3
Nodding Block	(78051-351).....	Item 6, Figure 3
Clamping Washer.....	(78051-305).....	Item 7, Figure 3

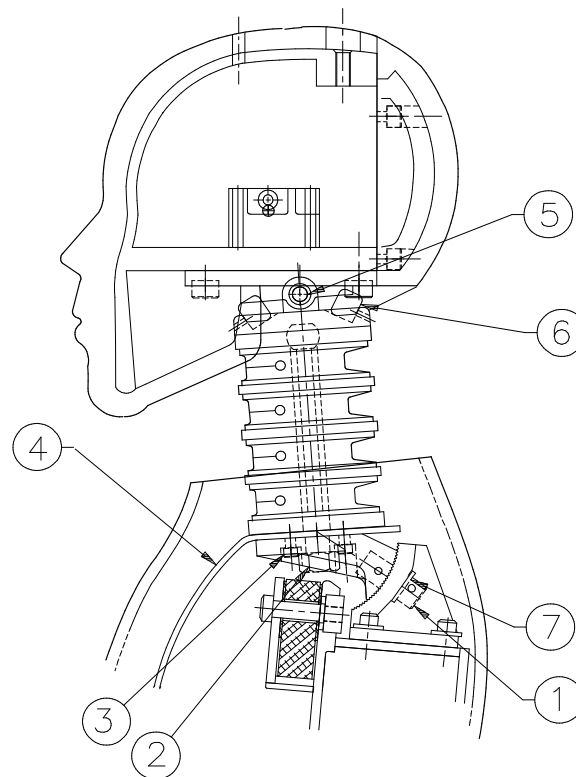


Figure 3 - Head and neck assembly

To disassemble the head and neck, first remove the neck shield, if used (Banglmaier et al., 2005). Detach the Velcro® fastener and unwrap it from the neck. The next step is to detach the head-neck assembly from the upper torso. This is done by removing the 3/8-16 x 1 SHCS Nylok® (Item 1, Figure 3) and clamping washer that hold the upper neck bracket to the lower neck bracket.

Notice that the clamping washer (Item 7, Figure 3) is curved on one side. This curvature is designed to mate with the radius on the underside of the lower neck bracket; be sure to install this properly during reassembly. With this screw removed, remove the hex jam nut, flat washer, and four 10-24 x 5/8 SHCS (Item 3, Figure 3) that hold the upper neck bracket to the bib assembly and neck assembly. Remove the neck from the bib assembly.

To disassemble the head assembly from the neck assembly, remove the four 10-24 x 1/2 SHCS (Item 15, Figure 5) that hold the skull cap in place. Completing the removal of the head from the neck will require the use of a compression tool to squeeze the nodding blocks (Item 6, Figure 3) located between the head and neck. If the nodding blocks are not compressed, it will be difficult and possibly damaging to remove the neck pivot pin (Item 5, Figure 3). When disassembling the head, the load cell can remain in the head. Loosen the two set screws that hold the pivot pin.

7.2.1 Using Neck Compression Tool

Remove the skull cap and attach the H3-5 adapter to the back of the head using at least two 10-24 x 3/8 SHCS (see Figure 4). Then place the exposed portion of the neck cable in the cylindrical cup on the tool, and attach the compression tool to the adapter plate as shown in Figure 4 with at least two 1/4-20 x 1-3/8 SHCS. With the tool attached, turn the handle until the nodding blocks are compressed enough to relieve the pressure on the pin. The pivot pin should slide out of the load cell or load cell replacement easily, but may require a light tap with a rubber mallet.

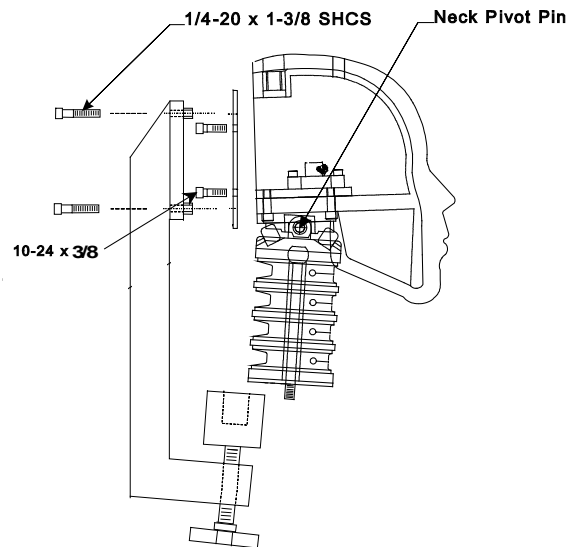


Figure 4 - Neck compression tool

After the pin is removed, detach the tool. The neck will then be free to be pulled away from the head assembly.

There are two brass washers (Item 7, Figure 5) located inside of the pivot pin joint that will fall out as the two components are separated. Do not confuse the brass washers with any others; they are trimmed for the proper fit of this joint.

NOTE: Newly purchased washers (78051-253) should be trimmed. This can be accomplished in several ways. The following procedure is recommended:

1. Rub the washer on coarse sandpaper or a file and check and recheck the fit of the joint. Repeat the trimming until the nodding joint and the load cell can be assembled snugly with the trimmed washers.
2. The fit of the nodding joint and load cell should be snug, but easy to assemble.

7.2.2 Head and Neck Reassembly

- Reattach the neck to the head.
- Reattach the skull cap to the back of the head.
- Reattach the neck and the upper neck bracket to the bib assembly.
- Position the upper neck bracket so its zero degree mark is aligned with the zero degree mark on the lower neck bracket.
- Reattach the upper neck bracket to the lower neck bracket.

7.3 Head

The Head (880105-100X) is made up of:

Neck Pivot Pin	(78051-339).....	Item 6, Figure 5
Washer, Nodding Joint.....	(78051-253).....	Item 7, Figure 5
Structural Replacement.....	(78051-383X [6-channel])	Item 8, Figure 5
SHCS, 1/4-28 x 7/8	(9000264).....	Item 9, Figure 5
Washer, 1/4 ID x 3/8 OD	(9000677).....	Item 10, Figure 5
Cap Flesh.....	(880105-106)	Item 11, Figure 5
Machined Cap	(880105-103)	Item 12, Figure 5
Skull.....	(880105-102 [6-channel]).....	Item 13, Figure 5
Head Skin.....	(880105-109)	Item 14, Figure 5
SHCS, 10-24 x 1/2	(9000624).....	Item 15, Figure 5
SSCP, 8-32 x 1/4	(9000452).....	Item 16, Figure 5

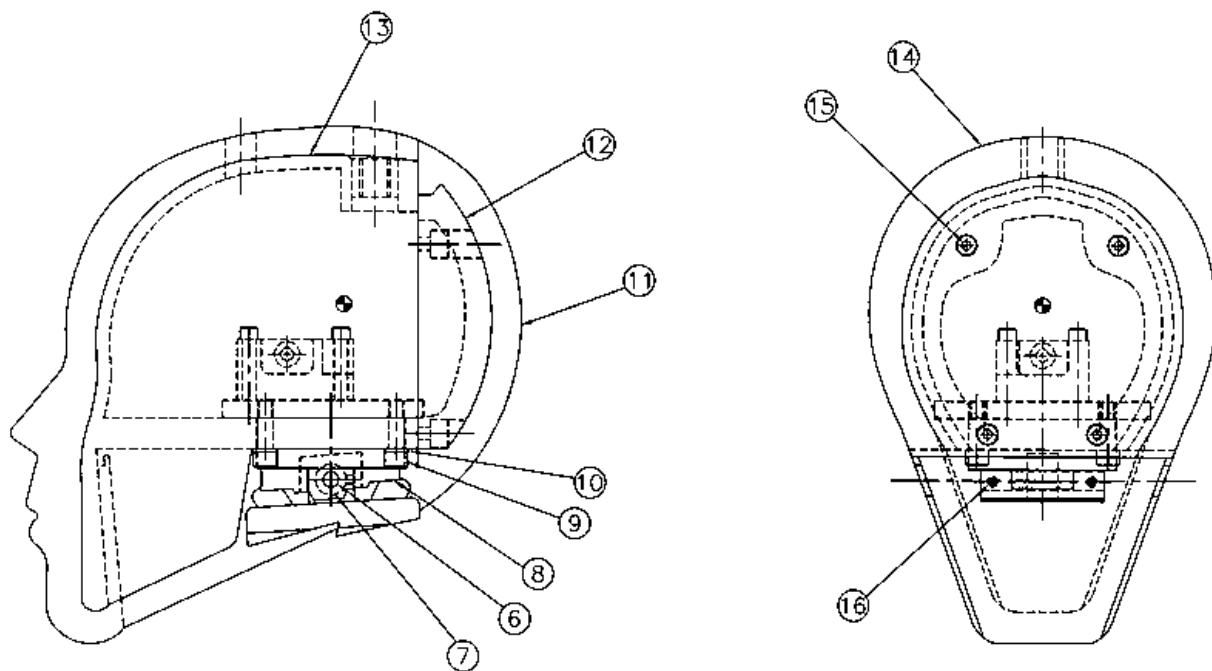


Figure 5 - Six-channel head

7.3.1 Head Disassembly

When the neck is detached from the head, the remaining components can be disassembled from the head assembly. Remove the four 1/4-28 x 7/8 SHCS (Item 9, Figure 5) from the six-channel load cell or structural replacement. To remove the six-channel neck load cell or structural replacement from the assembly, it is necessary to pull the load cell out from the inside of the head through the back of the head.

The head skin can be pulled off of the head assembly by lifting the skin away from the skull at the back of the skull and “peeling” the flesh from the assembly. The recommended head skin is shown in Figure 6 and Figure 7. This version’s design, with the filled chin, is intended to keep deploying airbags from getting between the back surface of the jaw flesh and the front surface of the neck.

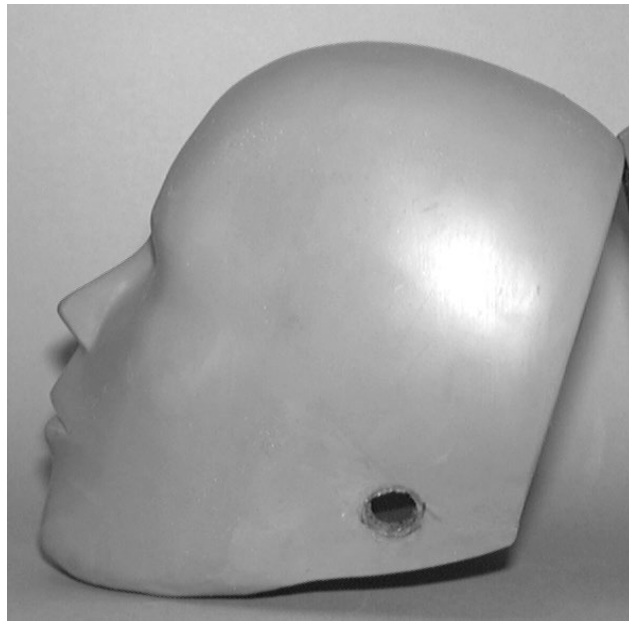


Figure 5 - Side view of head skin with filled chin

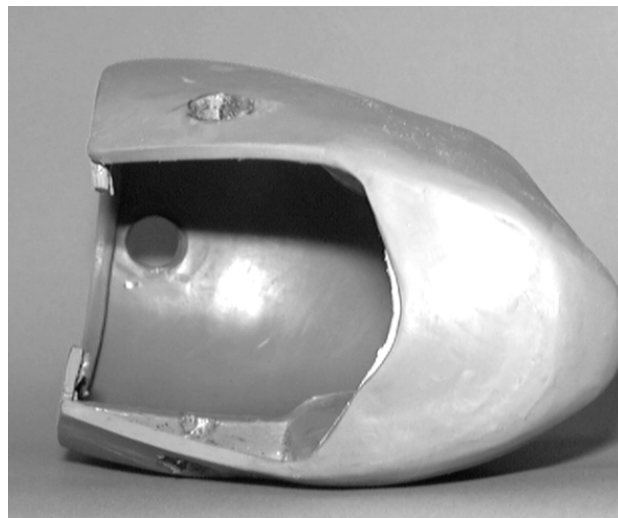


Figure 6 - Bottom view of head skin with filled chin

7.3.2 Head Reassembly

- Put the head skin back on the skull, paying close attention to the fit of the flesh around the skull, particularly in the forehead area.
- Reattach the six-channel load cell or structural replacement.

7.3.3 Inspection of the Head Components

- Check the head skin for cracks or tears. Repair the head skin as indicated in Appendix B. Do not repair damage in the forehead region as this will affect test results; instead, replace the head skin.
- If the head skin does not feel soft and pliable, re-certify or replace the head skin.
- Check the skull for cracks or dents. Replace the skull if structurally damaged in any way.

7.4 Neck

The Neck assembly consists of:

Nodding Joint	(880105-201)	Item 1, Figure 8
Neck Cable.....	(880105-206)	Item 2, Figure 8
Nodding Block	(78051-351).....	Item 3, Figure 8
Neck Bushing, Upper	(180-2004).....	Item 4, Figure 8
Neck Bushing, Lower	(180-2005).....	Item 5, Figure 8
Neck Molded Assembly.....	(880105-255)	Item 6, Figure 8
Hex Jam Nut, 1/2-20	(9000018).....	Item 8, Figure 8
FHCS, 10-24 x 5/8	(9000566).....	Item 9, Figure 8
Washer, 1.06 OD x .53 ID x.06	(90001260).....	Item 10, Figure 8
SHCS, 10-24 x 5/8	(9000224).....	Item 11, Figure 8

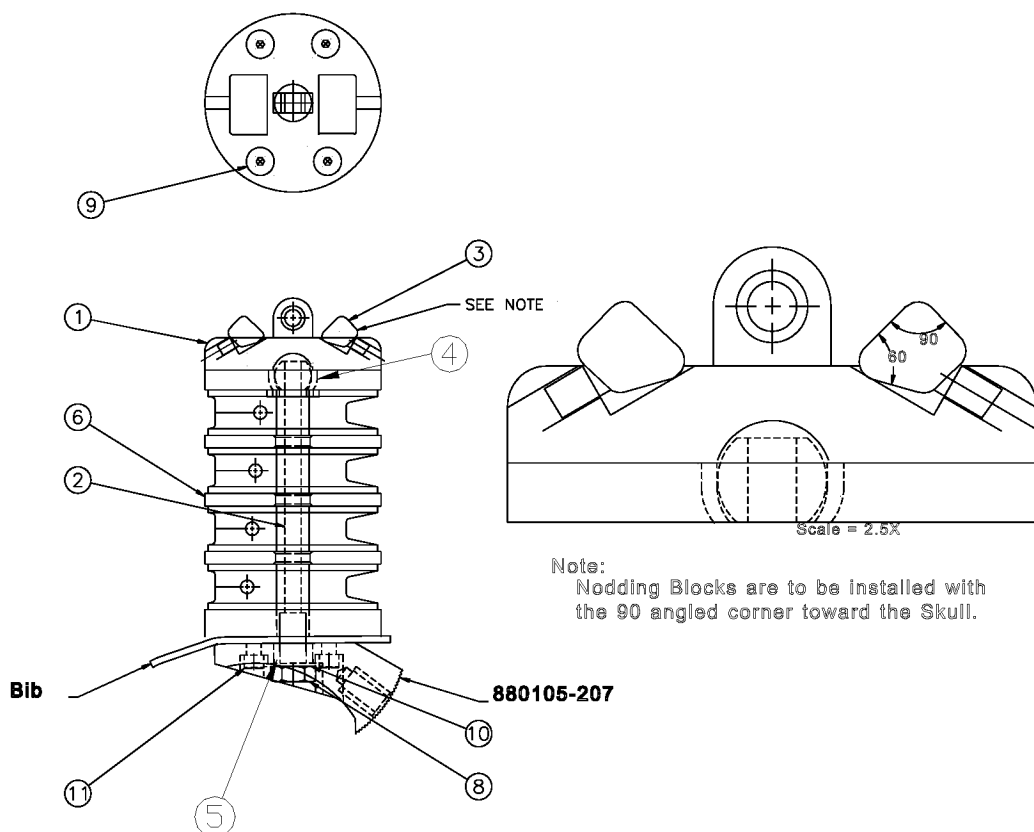


Figure 7 - Neck assembly

7.4.1 Neck Disassembly

To disassemble the neck assembly, remove the four 10-24 x 5/8 FHCS (Item 9, Figure 8) from the top of the nodding joint. With the joint removed, the neck cable (Item 2, Figure 8) can be pulled out of the neck. Remove the neck bushings (Items 4 and 5, Figure 8) from each end of the cable.

7.4.2 Neck Reassembly

- The upper end of the neck is machined to accept the ball end of the neck cable. During reassembly, make sure that this area is free of any extraneous rubber material before installing the cable. Put the neck bushings on each end of the cable. The neck cable (Item 2, Figure 8) must be inserted in the neck with the “ball” end seated in the cup at the upper end of the neck.
- The torque on the Hex Jam Nut (Item 8, Figure 8) should be $1.4 \text{ N}\cdot\text{m} \pm 0.2 \text{ N}\cdot\text{m}$ (12 in-lbf $\pm$ 2 in-lbf).
- Install the nodding joint to the neck using the four screws.
- The SAE has recommended the Flap Neck Shield described by Banglmaier et al. (2005). This neck shield is intended to prevent the airbag from getting into the slits in the rubber neck discs.

7.4.3 Inspection of Neck Components

- During reassembly, check the neck for deformation, tears, or breaks in the rubber. Replace the neck if these problems occur.
- Check the neck cable by observing the strands. If they are not tightly wound, frayed, or the cable seems larger in diameter on one end, replace the cable. If the cable cannot be properly torqued, replace the cable.
- It is crucial that the nodding blocks (Item 3, Figure 8) be installed so that the 90 degree angle is toward the base of the head and the 60 degree angle toward the nodding joint. If not, the blocks will exert a greater force on the joint and produce higher forces in the flexion or extension modes.
- Check the nodding blocks for deformation. Deformed nodding blocks will allow the head to rattle and will not provide proper loading of the nodding joint.
- Check the hardness of the nodding blocks often with a Shore "A" type Durometer. The specification is 80-90.

7.5 Upper Torso

The Upper Torso assembly consists of:

Lower Neck Bracket	(880105-208)	Item 1, Figure 9
Thoracic Spine Weldment	(880105-1000)	Item 2, Figure 9
Rear Rib Support	(880105-320)	Item 3, Figure 9
Upper Rib Stop Assembly	(880105-1015)	Item 4, Figure 9
Sternum Slider	(880105-1050)	Item 5, Figure 9
Front Rib End Threaded	(880105-323)	Item 6, Figure 9
Front Rib End Stiffener	(880105-324)	Item 7, Figure 9
Bib Assembly	(880105-1060)	Item 8, Figure 9
Clavicle Link Pivot Nut	(880105-340)	Item 9, Figure 9
Shoulder Bumper	(880105-341)	Item 10, Figure 9
Clavicle Link Pivot Washer (Delrin®)	(880105-342)	Item 11, Figure 9
Clavicle Link Pivot Washer (Urethane)	(880105-359)	Item 14, Figure 9
BHCS, 10-32 x 5/8	(9000025)	Item 15, Figure 9
SHCS, 1/4-20 x 5/8	(9000144)	Item 16, Figure 9
Shoulder Assembly	(880105-380[left], -381[right])	Item 17, Figure 9
Rib Set	(880105-361)	Item 18, Figure 9
Lower Rib Stop Assembly	(880105-1030)	Item 20, Figure 9
Adaptor Assembly Lumbar Thoracic	(880105-1085)	Item 21, Figure 9
Sternum Stop	(78051-9)	Item 22, Figure 9
Chest Deflection Transducer Assembly	(880105-1080)	Item 23, Figure 9
SHSS, 3/8 x 1	(9000074)	Item 24, Figure 9
BHCS, 10-32 x 3/4	(9001193)	Item 25, Figure 9
Washer, 1/4 Flat	(9000244)	Item 27, Figure 9
SHCS, 1/4-20 x 3/4	(9000454)	Item 28, Figure 9
SHCS, 5/16-18 x 1/2	(9000489)	Item 29, Figure 9
BHCS, 10-32 x 3/8	(9000538)	Item 30, Figure 9
SHSS, 3/8 x 1	(9000074)	Item 13, Figure 10

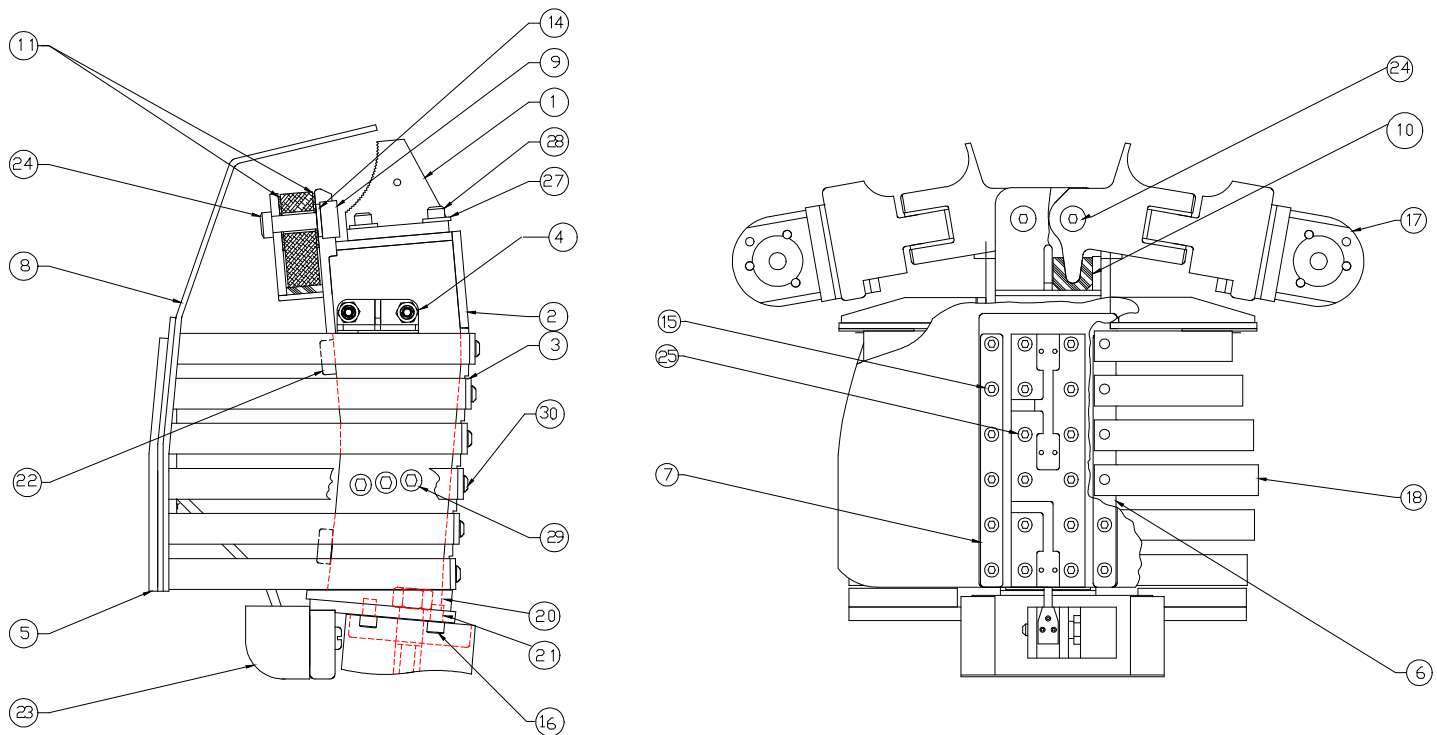


Figure 8 - Upper torso assembly

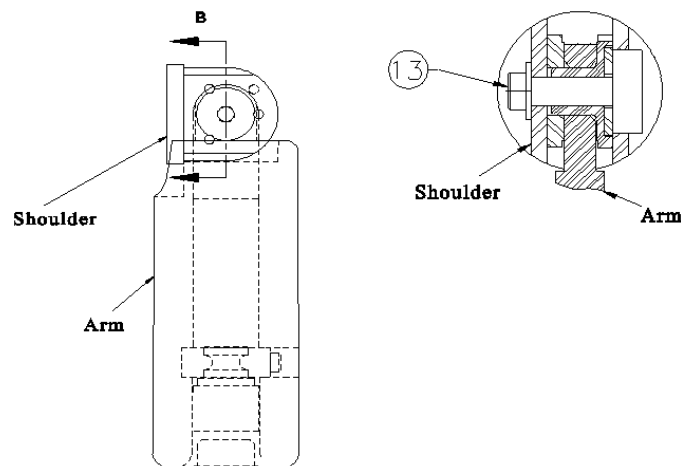


Figure 9 - Shoulder joint assembly

7.5.1 Upper Torso Disassembly

To begin the disassembly, take the arm assemblies off the upper torso. This is done by removing the two 3/8 x 1 SHSS (Item 13, Figure 10) which attach the arms to the shoulders. Pay close attention to placement of the washers in the shoulder joint. If any of the components are missing, the joint will not properly tighten to the 1 G suspended setting. With the arms off, the chest flesh and the abdomen can be removed.

The shoulder assembly is detached by removing the 3/8 x 1 SHSS (Item 24, Figure 9) from the front of the spine box and pulling the assembly up and away from the torso. When the shoulder is removed, the two Delrin® clavicle link pivot washers (Item 11, Figure 9), the urethane clavicle link pivot washer (Item 14, Figure 9), and the clavicle link pivot nut (Item 9, Figure 9) will fall from the assembly.

Once the shoulder is detached, you can remove the shoulder bumper, (Item 10, Figure 10) a "U" shaped, black rubber part. These bumpers provide tension and noise damping for the clavicle link.

With the shoulders removed, the lower neck bracket can be taken off the spine box. The lower neck bracket is held in place by four 1/4-20 x 3/4 SHCS (Item 28, Figure 9) and washers.

To completely disassemble the ribs (Item 18, Figure 9), start by detaching the bib assembly (Item 8, Figure 9) from the rib set. This is done by taking out the twelve 10-32 x 5/8 BHCS (Item 15, Figure 9) that hold it to the ribs. Inside the rib set are two front rib ends, threaded (Item 6, Figure 9) that will fall when these screws are removed. Now remove the twelve 10-32 x 3/8 BHCS (Item 30, Figure 9) at the rear of the spine box. At the rear of the thorax are six rib rear supports or rib stiffeners (Item 3, Figure 9). With the screws from the front and rear of the rib set removed, each rib can be pulled away from the thorax. As the ribs are pulled away, it will be necessary to pull them open. However, do not open them so wide that the shape of the rib is permanently changed. Permanently changing the shape of one rib can alter the dynamic characteristics of the rib set.

To detach the upper rib stops (Item 4, Figure 9), remove the two SHCS 10-32x1/2 on the left and right sides. The lower rib stops (Item 20, Figure 9) are not recommended to be removed, unless the Delrin® stop has been damaged.

From the bib assembly, remove the sternum slider (Item 10, Figure 13). This is done by removing the twelve 10-32 x 3/4 BHCS (Item 25, Figure 9) that hold the slider in place on the bib assembly, and then pulling the slider upward to allow the transducer arm ball to slide out of the groove on the rear side of the slider.

7.5.2 Upper Torso Reassembly

- Loosen and re-tighten the six 5/16-18 x 1/2 SHCS that hold the spine mounting assembly to the load cell simulator, according to Appendix B of J2915, "HIII5F Spine Box Update to Eliminate Noise." The SHCS can loosen over time, allowing the spine mounting assembly to slip and bottom out against the sides of the SHCS. This produces high amplitude, high frequency mechanical noise that is transmitted to the accelerometers. A proposed modification that eliminates the potential for noise resulting from the SHCS loosening is also documented in J2915.
- Install the transducer arm slider into the bib assembly.
- Reattach the upper rib stops if they have been removed.
- Reattach the ribs to the back of the spine box. Be sure that the 10-32 x 3/4 BHCS (Item 25, Figure 9) from the bib assembly are replaced in the front of the thorax and not the rear. The correct screws to mount the ribs in the rear are 10-32 x 3/8 BHCS (Item 30, Figure 9); they are not long enough to properly hold the assembly together in the front.
- Install the rear rib supports (Item 3, Figure 9) so the beveled ends of the supports face the ribs. If during reassembly these supports are reversed so that the bevels face away from the ribs, the stiffness of the rib set will be increased significantly. These supports are interchangeable.
- Reattach the bib assembly to the ribs. When reinstalling the front rib ends, threaded (Item 6, Figure 9), notice that the bars have a slight bend in the upper 1/3 of the bar. This bend is meant to conform to the natural curvature of the thorax and should be replaced in the same orientation relative to the rib set, with the curve facing backward. Be sure to replace the front rib end stiffeners (Item 7, Figure 9) during reassembly.
- Reattach the lower neck bracket.
- Install the shoulder bumpers, the Delrin® clavicle link pivot washers, urethane clavicle link pivot washer, and the clavicle link pivot nut. Take care to replace the washers in the shoulder joint as shown in Figure 10. The clavicle link pivot washers (Item 11, Figure 9) have a machined flat on the outside radius. This flat must mate with the other clavicle link pivot washer for the opposite shoulder assembly or the two shoulder bolts (Item 24, Figure 9) will not go in.

- Reattach the shoulder assembly to the spine box. During the reassembly of the shoulder joint, it is sometimes necessary to apply force to the bumper to compress it so the shoulder screw can be inserted. This is accomplished by using a small 75 to 100-mm (3 to 4 in) "C" clamp. The clamp should be placed so the centerline of the shoulder screw hole passes through the compression arm of the clamp. Do not apply too much pressure to the shoulder. It is made of cast aluminum and too much pressure could crack the end.
- Place the chest flesh on the upper torso.
- Reattach the arm assemblies to the upper torso.
- The sternum and spine box accelerometers must all have the same seismic mass location.

7.5.3 Inspection of Upper Torso Components

- Because of the malleable nature of the damping material of the ribs, take care to insure that they are not damaged. The ribs are manufactured from three components: the rib steel, the damping material, and the epoxy that bonds the steel and damping material components. Inspect the ribs for damage to the damping material and debonding of the damping material from the rib steel. Replace damaged ribs.
- Check to make sure the ribs have not deformed using the chest depth gage shown in Figure 12. As shown in Figure 11, with the rib cage fully assembled, insert the rod of the gage between rib #1 and rib #2. The rear flat on the handle (surface A) is held against the surface to which rib #1 is attached on the spine box. If the rod touches the front rib end, threaded, the chest depth at rib #1 has decreased below the acceptable range. To measure the chest depth at rib #6, insert the rod of the gage between rib #5 and rib #6, with the front flat on the handle (surface B) held against the surface to which rib #5 is attached on the spine box. If the rod touches the front rib end, threaded, the chest depth at rib #6 has decreased below the acceptable range.
- During reassembly, check the ribs and the rib damping material for cracks or warping of the damping material. Recertify and/or replace and recertify the ribs if they are damaged.
- Check the sternum stops for looseness. If they are loose, they can be glued back in place using epoxy cement. Be sure that when gluing them into position, they do not interfere with the chest deflection transducer assembly.

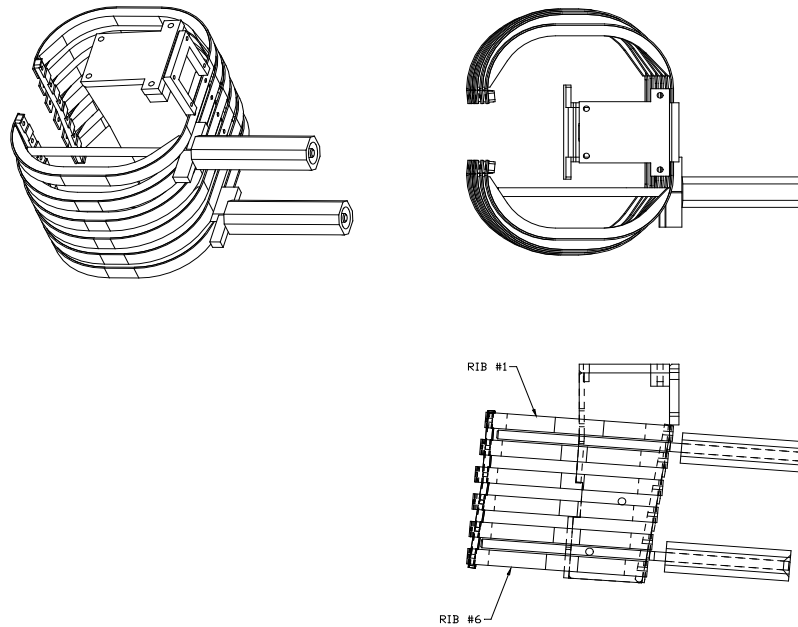


Figure 10 - Chest depth measurement setup

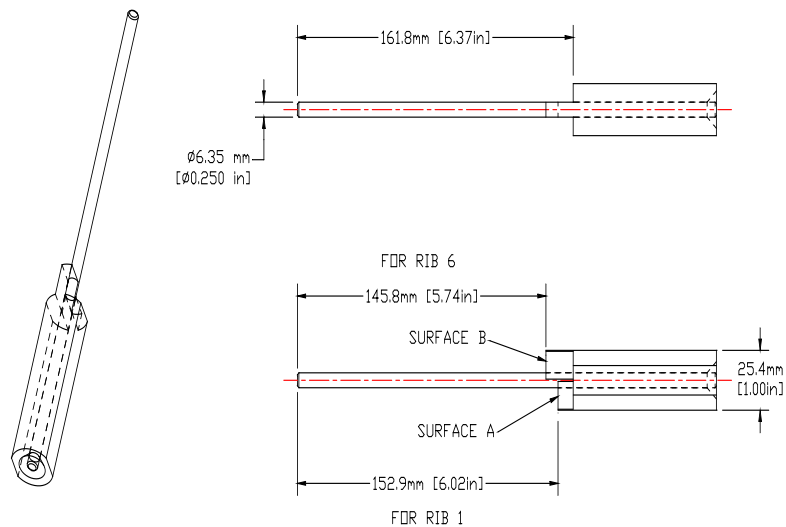


Figure 11 - Chest depth gage