SURFACE VEHICLE INFORMATION REPORT

J2862	FEB2015
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User's Manual for the Small Adult Female Hybrid III Test Dummy

RATIONALE

SAE J2862 replaced EA-25 in 2015. In addition to the format change and the correction of typographical and grammatical errors, the following changes were made to this Information Report:

References to SAE J211 were changed to J211-1 throughout the report

Joint adjustment changed from “1 – 2 G” to “1 G suspended adjustment” throughout the report

Section 1 SCOPE – added

Section 2 REFERENCES – added “SAE J211-1 – Instrumentation for Impact Test – Part 1 – Electronic Instrumentation”

Section 2 REFERENCES – added “SAE J2517 – Hybrid III Family Chest Potentiometer Calibration”

Section 2 REFERENCES – added “SAE J2878 – Low Speed Thorax Impact Test Procedure for the HIII 5th Dummy”

Section 2 REFERENCES – added “SAE J2915 – H-III5F Spine Box Update to Eliminate Noise”

Section 2 REFERENCES – added “SAE J2921 – H-III5F Chest Jacket Harmonization”

Section 2 REFERENCES – added “Banglmaier, R.F., Pecararo, 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.”

Section 3 DEFINITIONS AND ABBREVIATIONS and throughout the document – changed “Calibration Test” to “Certification Test” for all tests that are conducted for the purpose of assuring that the dummy responds within the specifications outlined in this document

Section 4 PART NUMBERS – updated source for 49 CFR, Part 572, Subpart O drawings

Section 7 DISASSEMBLY AND REASSEMBLY PROCEDURES – added “TABLE 1 – TORQUE SPECIFICATIONS” and indexed all other table numbers accordingly.

Section 7 DISASSEMBLY AND REASSEMBLY PROCEDURES – changed “sternum bib” to “bib assembly” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.3 Head – corrected the part number of the head skin

Section 7.4 Neck – changed the description of part number 180-2004 from “neck cable insert, upper” to “neck bushing, upper” and changed the description of part number 180-2005 from “neck cable insert, lower” to “neck bushing, lower” for consistency with 49 CFR, Part 572, Subpart O parts list

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http://www.sae.org/technical/standards/J2862_201502

Section 7.4 Neck – changed the description of part number 880105-255 from “molded rubber neck” to “neck molded assembly” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.5 Upper Torso – changed the description of part number 880105-1000 from “spine weldment” to “thoracic spine weldment” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.5 Upper Torso – changed the description of part number 880105-323 from “behind rib strips” to “front rib end, threaded” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.5 Upper Torso – changed the description of part number 880105-324 from “stiffener strip” to “front rib end stiffener” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.5 Upper Torso – changed the description of part number 880105-340 from “nut” to “clavicle link pivot nut” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.5 Upper Torso – changed the description of part number 880105-342 from “clavicle link washer” to “”clavicle link pivot washer (Delrin)” for consistency with the NHTSA PADI, dated June 10, 2002

Section 7.5 Upper Torso – changed the description of part number 880105-359 from “washer sternum” to “”clavicle link pivot washer (Urethane)”for consistency with the NHTSA PADI, dated June 10, 2002

Section 7.5 Upper Torso – changed the description of part numbers 880105-380[left], -381[right] from “shoulders” to “shoulder assembly” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.5 Upper Torso – corrected the part number of the rib set

Section 7.5 Upper Torso – changed the description of part number 880105-1085 from “adaptor assembly” to “adaptor assembly lumbar thoracic” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.5 Upper Torso – changed the description of part number 8801205-1080 from “chest transducer assembly” to “chest deflection transducer assembly” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.5.1 Upper Torso Disassembly – changed “one G adjustment” to “1 G suspended setting”

Section 7.5.2 Upper Torso Reassembly – added directions to re-tighten the SHCS to eliminate mechanical noise caused by slippage between the spine mounting assembly and the load cell simulator

Section 7.6 Chest Deflection Transducer – corrected the part numbers of the molded stop assembly, chest accelerometer mount, and chest potentiometer for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.6 Chest Deflection Transducer – changed the description of part number 880105-328 from “thoracic spine load cell structural replacement” to “thoracic spine load cell simulator” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.6 Chest Deflection Transducer – changed the description of part number SA572-S51 from “potentiometer” to “chest potentiometer” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.6.1 Chest Deflection Transducer Disassembly – Added “Once calibrated according to J2715, “Hybrid III Family Chest Potentiometer Calibration Procedure” the chest potentiometer assembly consisting of the transducer arm assembly (Item 5, Figure 13), chest potentiometer (Item 12, Figure 13), potentiometer bracket (Item 13, Figure 13) and arm connector (Item 14, Figure 13) should not be mechanically adjusted or further disassembled.”

Section 7.7 Clavicle – changed description of part number 880105-344 from “shoulder pivot stop assembly” to “rubber stop assembly” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.7 Clavicle – changed description of part number 880105-348 from “shoulder bushing” to “shoulder yoke pivot bushing” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.7 Clavicle – changed description of part number 880105-349 from “yoke pivot washer” to “shoulder yoke pivot washer” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.7 Clavicle – changed description of part number 880105-367 from “flat washer” to “clavicle link washer” for consistency with the NHTSA PADI, dated June 10, 2002

Section 7.7 Clavicle – changed description of part number 880105-351 from “spring washer” to “shoulder joint spring washer” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.7 Clavicle – changed description of part number 880105-357 from “link bushing” to “clavicle and clavicle link bushing” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.8 Lower Torso – changed the description of part number 880105-440 from “pelvic molded assembly” to “molded pelvic assembly” for consistency with the NHTSA PADI, dated June 10, 2002

Section 7.8 Lower Torso – changed the description of part number 880105-404 from “spine cable” to “lumbar spine cable” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.8 Lower Torso – changed the description of part number 1200056 from “accelerometer mount” to “pelvic accelerometer mount” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.8 Lower Torso – corrected the part number of the femur bumper

Section 7.8 Lower Torso – Figure 20 number and caption were added. All subsequent figures were indexed by one number.

Section 7.9 Arms – changed the description of part number 880105-351 from “washer” to “shoulder joint spring washer” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.9 Arms – changed the description of part number 880105-700 from “upper arm molded” to “upper arm molded assembly” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.9 Arms – changed the description of part number 880105-705 from “upper arm lower part” to “upper arm, lower part weldment” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.9 Arms – changed the description of part number 880105-708 from “washer” to “upper arm and elbow pivot washer” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.9 Arms – changed the description of part number 880105-709 from “bushing” to “upper arm and elbow pivot bushing” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.9 Arms – changed the description of part number 880105-711 from “washer” to “upper arm pivot washer” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.9 Arms – changed the description of part number 880105-718 from “wrist rotation” to “wrist rotation assembly” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.9 Arms – changed the description of part number 880105-712 from “lower arm molded” to “lower arm molded assembly” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.9 Arms – changed the description of part number 880105-710 from “nut” to “upper arm pivot nut” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.9 Arms – changed the description of part numbers 880105-722[left] and 880105-723[right] from “hand” to “hand molded assembly” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.10 Legs – changed the description of part number 880105-622 from “knee clevis” to “knee clevis weld assembly” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.10 Legs – changed the description of part number A-1887 from “bolt” to “ankle to leg attachment bolt” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.10 Legs – changed the description of part number 880105-660 from “ankle” to “ankle assembly” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.10 Legs – changed the description of part numbers 880105-502 [left] and 880105-503 [right] from “upper leg structural” to “upper leg weldment” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.10 Legs – changed the description of part number 78051-391 from “load cell replacement” to “femur load cell simulator” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.10 Legs – changed the description of part number 880105-631 from “ankle bumper” to “ankle bumper assembly” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.11 Lower Legs – changed the description of part number 880105-622 from “knee clevis” to “knee clevis weld assembly” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.11 Lower Legs – changed the description of part numbers 880105-650 [left] and 880105-651 [right] from “foot” to “foot assembly” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.11 Lower Legs – changed the description of part number 880105-660 from “ankle” to “ankle assembly” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.11 Lower Legs – changed the description of part number 880105-527 from “shoulder screw” to “shoulder bolt, sliding knee” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.11 Lower Legs – changed the description of part number 880105-511 from “knee insert” to “knee flesh insert” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.13 Ankle and Foot – changed the description of part number 880105-609 from “upper shell” to “ankle, upper shell” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.13 Ankle and Foot – changed the description of part number 880105-633 from “lower shell” to “ankle, lower shell” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.13 Ankle and Foot – changed the description of part numbers 880105-652 [left] and 880105-653 [right] from “foot weldment” to “foot bone weldment” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 7.13 Ankle and Foot – changed the description of part number A-1887 from “bolt” to “ankle to leg attachment bolt” for consistency with 49 CFR, Part 572, Subpart O parts list

Section 8.1 Head Drop Test – added metric equivalent of surface finish to paragraph (C) for consistency with 49 CFR, Part 572, Subpart O, §572.132 (c) (4)

Section 8.1 Head Drop Test – added one significant digit to the drop height and tolerance in paragraph (E)(6) for consistency with 49 CFR, Part 572, Subpart O, §572.132 (c) (3)

Section 8.1 Head Drop Test (F)(3) – added “zero to peak” for consistency with 49 CFR, Part 572, Subpart O, §572.132 (b)

Section 8.2 Neck Tests (D)(7) – added one significant digit to the English equivalent of the jam nut torque for consistency with 49 CFR, Part 572, Subpart O, §572.133 (c) (2)

Section 8.2 Neck Tests (E)(1) – added “at the instant of contact with the honeycomb” consistency with 49 CFR, Part 572, Subpart O, §572.133(c) (4)(i)

Section 8.2 Neck Tests (E)(4) – changed the English equivalent of the positive moment decay for consistency with 49 CFR, Part 572, Subpart O, §572.133 (b) (1)

Section 8.2 Neck Tests (F)(1) – added “at the instant of contact with the honeycomb” for consistency with 49 CFR, Part 572, Subpart O, §572.133(c) (4)(i)

Section 8.2 Neck Tests (F)(4) – changed performance specifications for peak moment and the English equivalents of the positive moment decay for consistency with 49 CFR, Part 572, Subpart O, §572.133 (c) (2)

Section 8.2 Neck Tests (F)(5) – changed the performance specification for the maximum rotation of the D-plane for consistency with 49 CFR, Part 572, Subpart O, §572.133 (b) (2)

Section 8.3 Thorax Impact Test (A) – changed the description of the clothing for consistency with 49 CFR, Part 572, Subpart O, §572.134 (c) (1)

Section 8.3 Thorax Impact Test (B) – added the mass of 1/3 of the suspension cable length to the probe mass and added specification of the mass moment of inertia of the probe for consistency with 49 CFR, Part 572, Subpart O, §572.137 (a)

Section 8.3 Thorax Impact Test (D)(6) – changed the tolerance of the probe centerline alignments relative to the mid-sagittal plane and the centerline of rib number 3 for consistency with 49 CFR, Part 572, Subpart O, §572.134 (c)(4)

Section 8.3 Thorax Impact Test (E)(1) – added one significant digit to the performance specifications for maximum sternum-to-spine displacement and English equivalents for consistency with 49 CFR, Part 572, Subpart O, §572.134 (b)(1)

Section 8.3 Thorax Impact Test (E)(2) – changed English equivalent of the peak force for consistency with 49 CFR, Part 572, Subpart O, §572.134 (b)(1)

Section 8.3 Thorax Impact Test (E)(3) – changed the performance specifications for peak probe force for consistency with 49 CFR, Part 572, Subpart O, §572.134 (b)(1)

Section 8.4 Knee Impact Test (B) – changed the edge radius specification of the probe for consistency with 49 CFR, Part 572, Subpart O, §572.137 (b)

Section 8.4 Knee Impact Test (D)(1) – narrowed the specification of the soak temperature for consistency with other certification tests

Section 8.4 Knee Impact Test (E)(1) – added one significant digit to the performance specifications for peak impact force and English equivalents for consistency with 49 CFR, Part 572, Subpart O, §572.136 (b)

Section 8.5 Knee Slider Test (D)(2) – narrowed the specification of the soak temperature for consistency with other certification tests

Table 2 – corrected the metric specification for Head Back to Backline measurement

Section 9.6 Torso Flexion Test (C)(1) – narrowed the specification of the soak temperature for consistency with the certification tests

Section 9.6 Torso Flexion Test (C)(2) – changed the torque specification for the lumbar spine cable jam nut for consistency with the NHTSA PADI, dated June 10, 2002

Section 9.6 Torso Flexion Test (C)(6) – changed the specification for the angle of the pelvic surface relative to horizontal for consistency with 49 CFR, Part 572, Subpart O, §572.135, Figure O4

Section 9.6 Torso Flexion Test (C) – added steps 8, 9, 14 and 15 for consistency with 49 CFR, Part 572, Subpart O, §572.135 (c)

Section 9.6 Torso Flexion Test (C)(13) – added tolerance to flexion angle for consistency with 49 CFR, Part 572, Subpart O, §572.135 (b)(1)

Section 9.6 Torso Flexion Test (D) – changed force specifications for consistency with 49 CFR, Part 572, Subpart O, §572.135 (b)(1)

Section 9.6 Torso Flexion Test (D) – added return angle specifications for consistency with 49 CFR, Part 572, Subpart O, §572.135 (b)(2)

Section 9.7 Low-speed Thorax Impact Test – added as an inspection test

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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 5th 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.

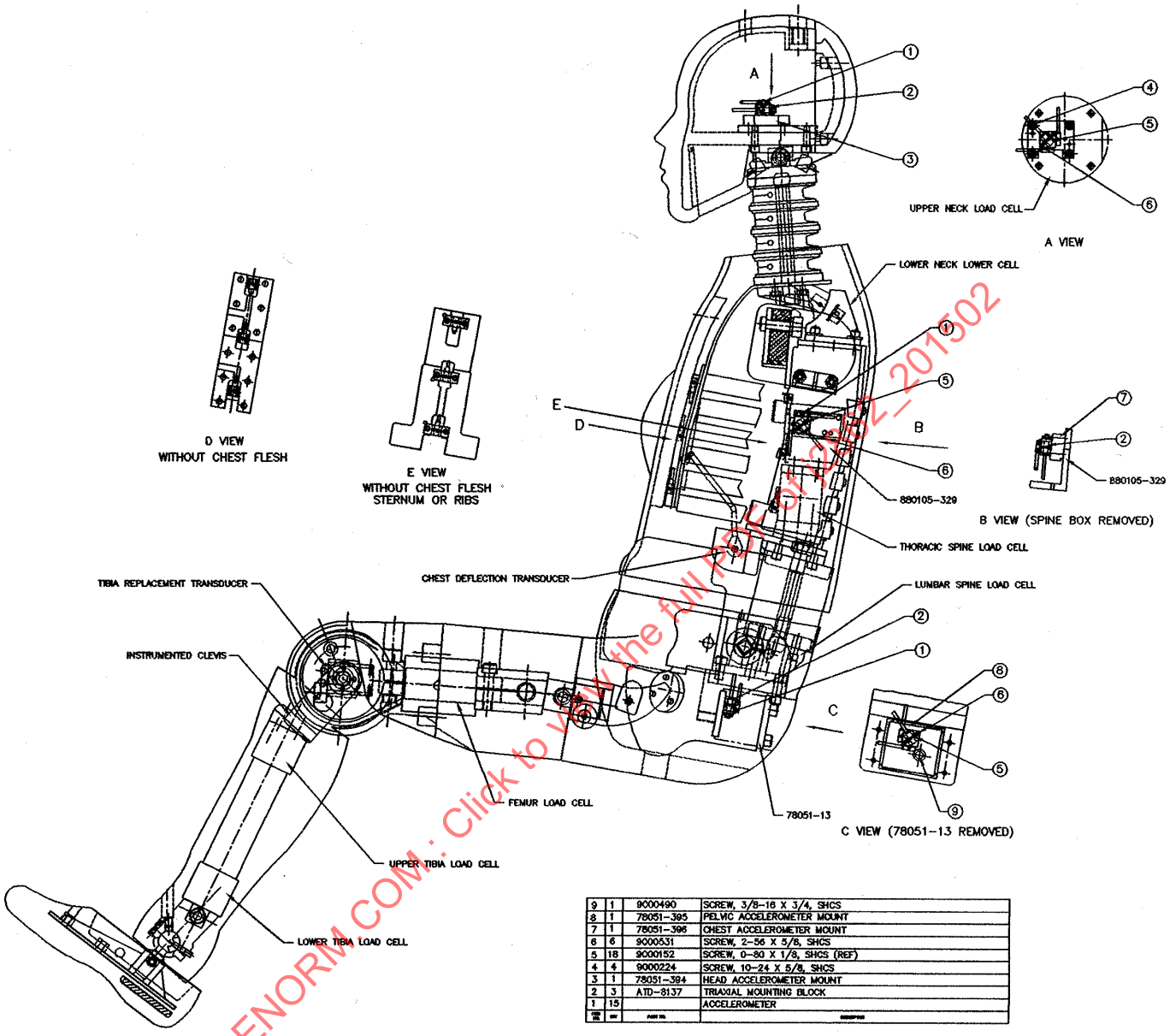
The standard model has a "seated" pelvis construction. A "sit/stand" pelvis version is optional as are a neck covering for airbag testing, a deformable face for steering wheel rim testing, and a deformable abdomen for lap belt submarining and steering wheel rim evaluations.

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)



9	1	9000490	SCREW, 3/8-16 X 3/4, SHCS
8	1	78051-395	PELVIC ACCELEROMETER MOUNT
7	1	78051-396	CHEST ACCELEROMETER MOUNT
6	6	9000531	SCREW, 2-56 X 5/8, SHCS
5	18	9000152	SCREW, 0-80 X 1/8, SHCS (REF)
4	4	9000224	SCREW, 10-24 X 5/8, SHCS
3	1	78051-394	HEAD ACCELEROMETER MOUNT
2	3	ATD-8137	TRIAXIAL MOUNTING BLOCK
1	15		ACCELEROMETER

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.

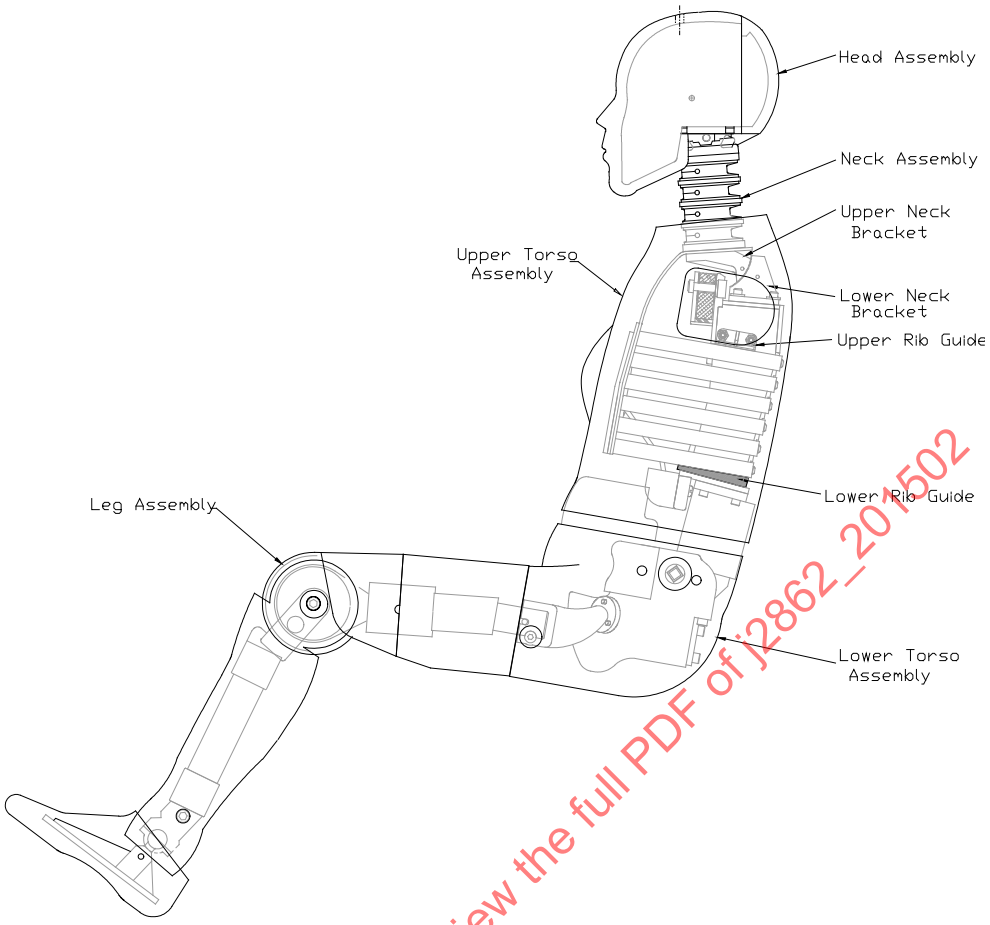


Figure 2 - Complete anthropomorphic test device

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

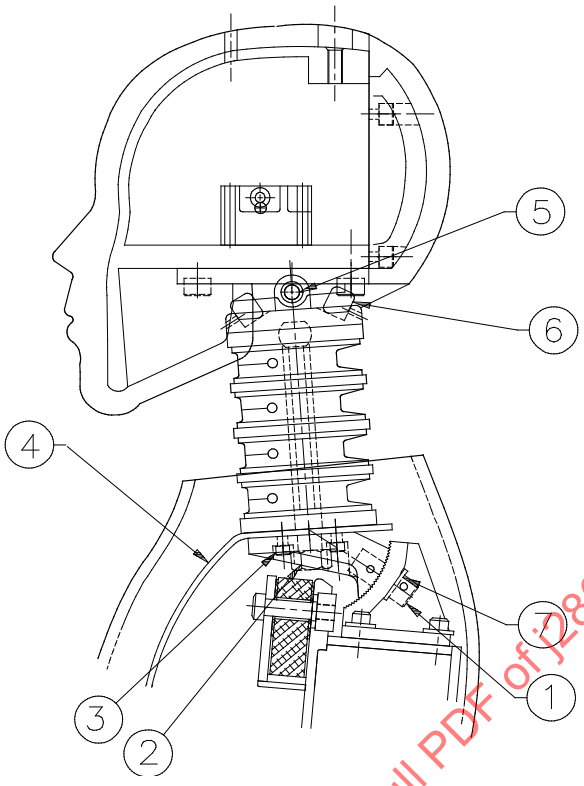


Figure 3 - Head and neck assembly

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.

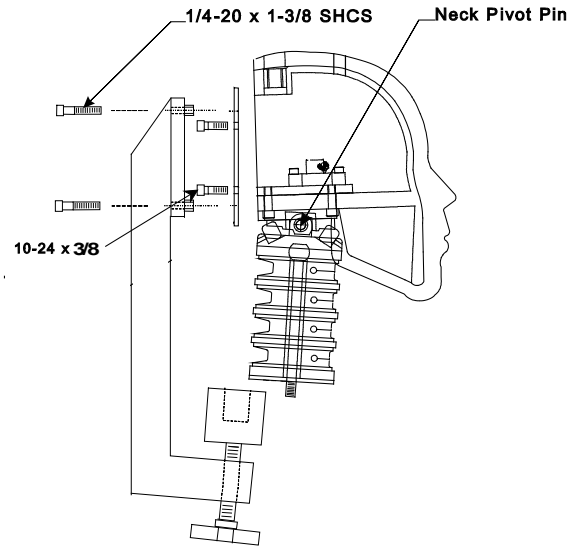


Figure 4 - Neck compression tool

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, ¼-28 x 7/8	(9000264)	Item 9, Figure 5
Washer, ¼ 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 ½	(9000624)	Item 15, Figure 5
SSCP, 8-32 x ¼	(9000452)	Item 16, Figure 5

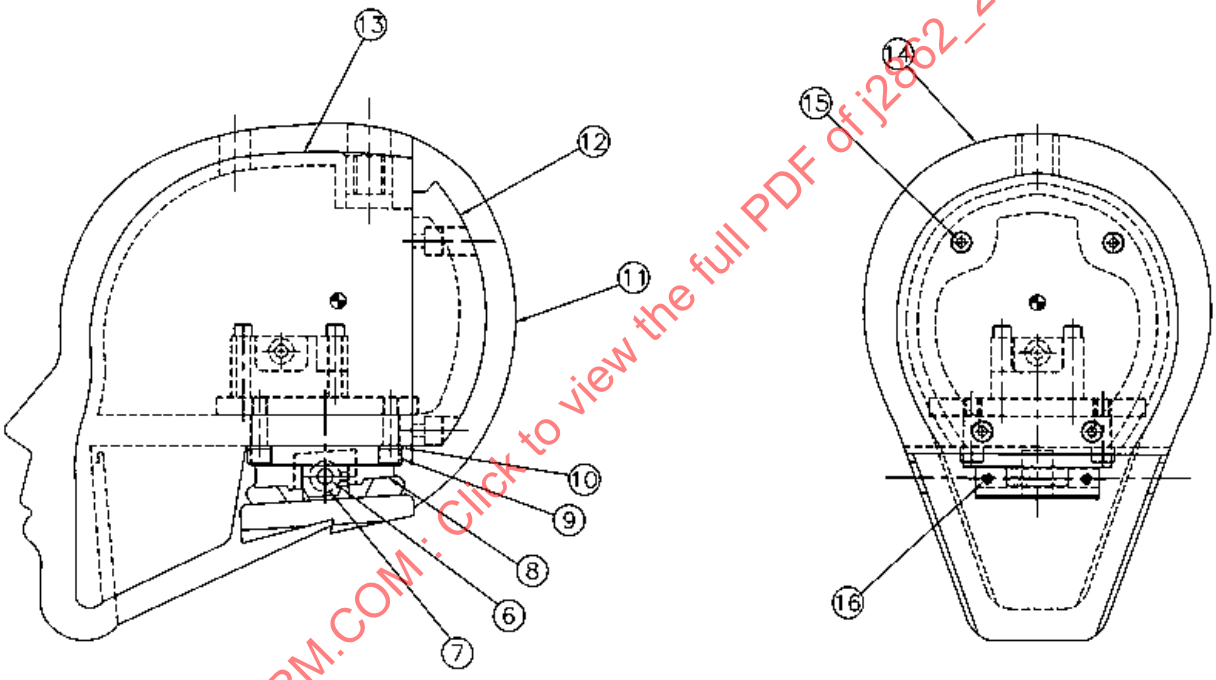


Figure 5 - Six-channel head

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

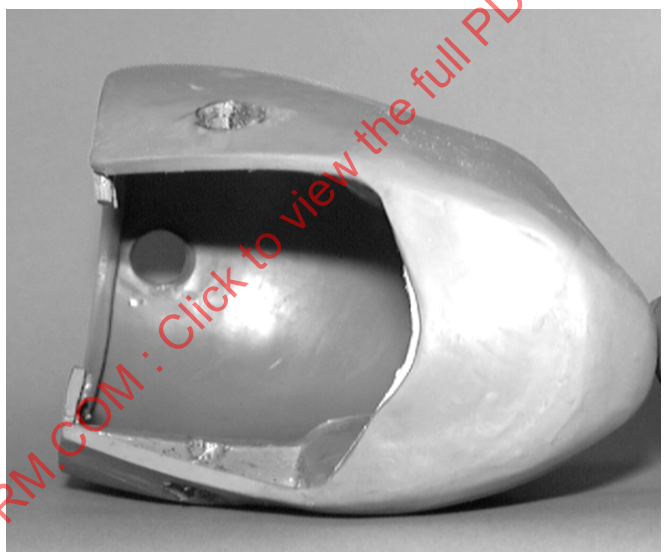


Figure 6 - Bottom view of head skin with filled chin

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, ½-20 .....(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

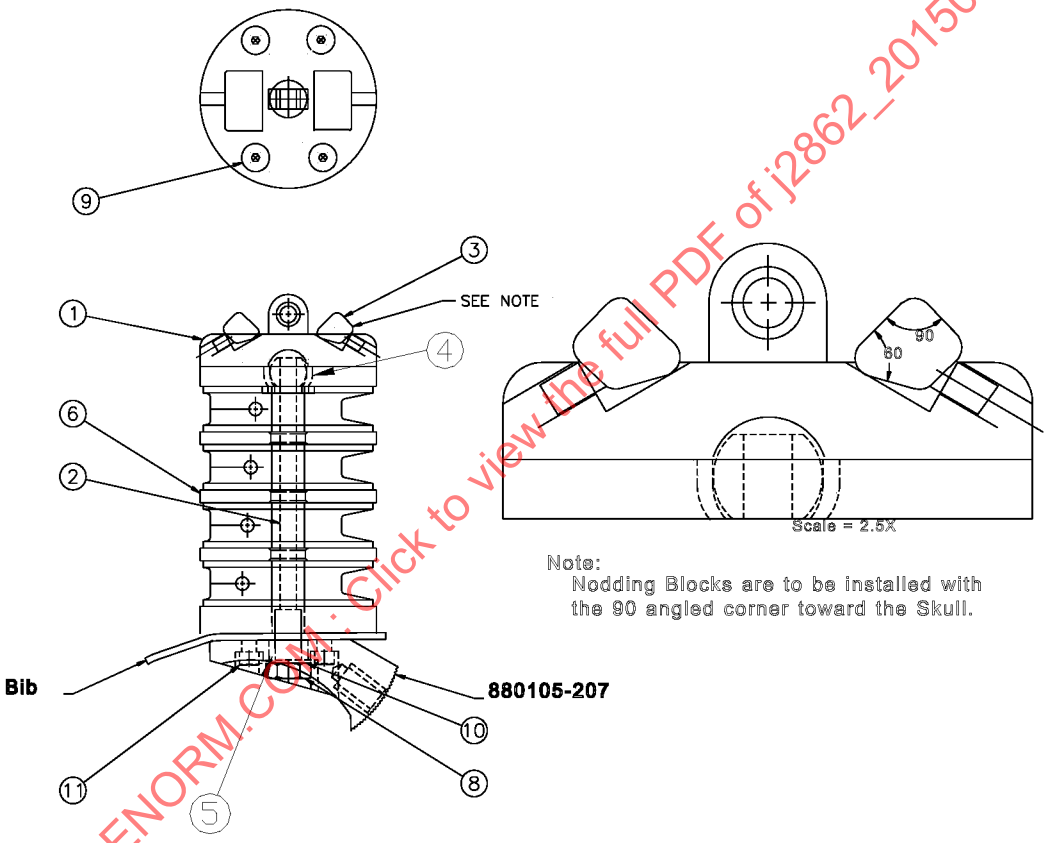


Figure 7 - Neck assembly

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 N·m ± 0.2 N·m (12 in-lbf ± 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, ¼-20 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 ¾	(9001193)	Item 25, Figure 9
Washer, ¼ Flat	(9000244)	Item 27, Figure 9
SHCS, ¼-20 x ¾	(9000454)	Item 28, Figure 9
SHCS, 5/16-18 x ½	(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

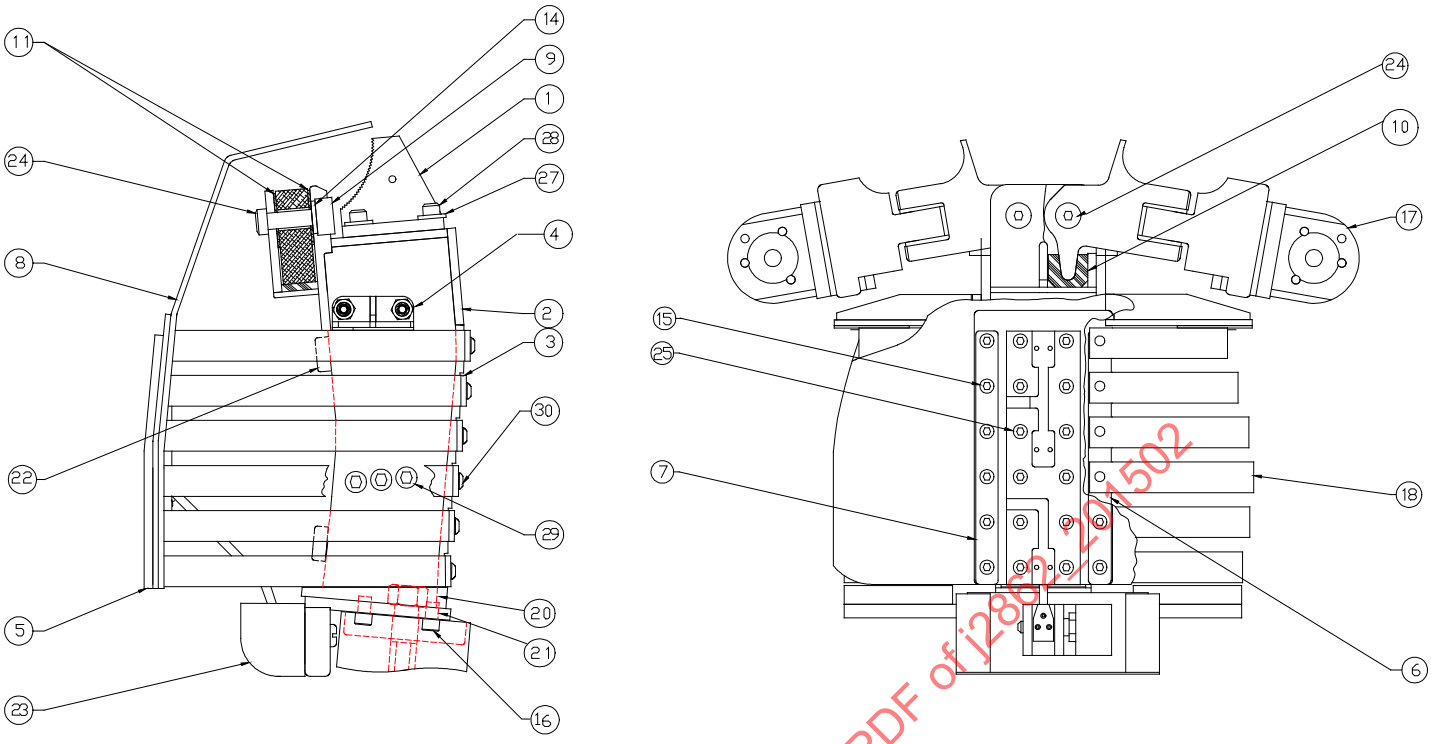


Figure 8 - Upper torso assembly

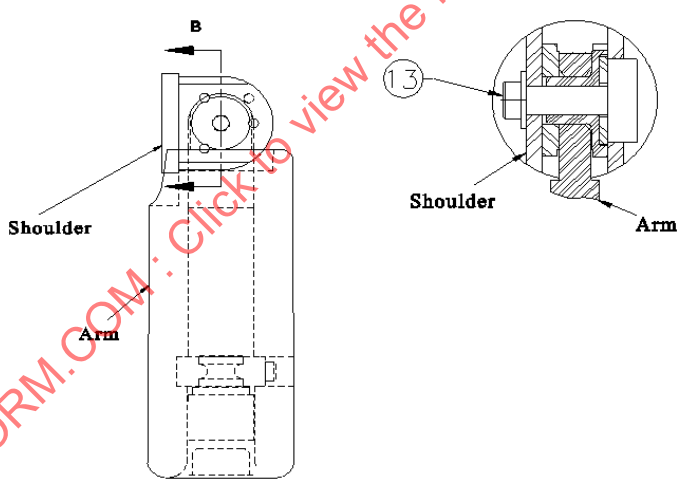


Figure 9 - Shoulder joint assembly

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 10Figure 9) 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 ½ 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 SCHS can loosen over time, allowing the spine mounting assembly to slip and bottom out against the sides of the SCHS. 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.

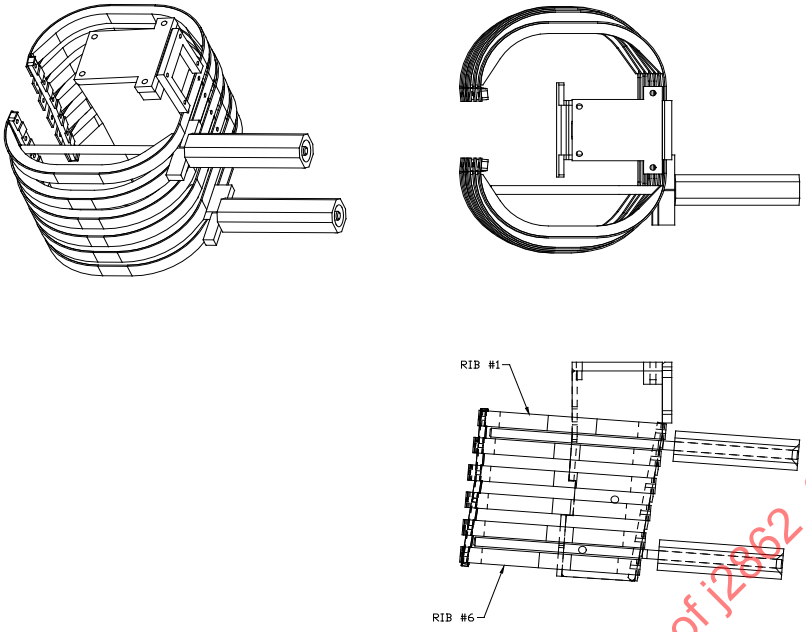


Figure 10 - Chest depth measurement setup

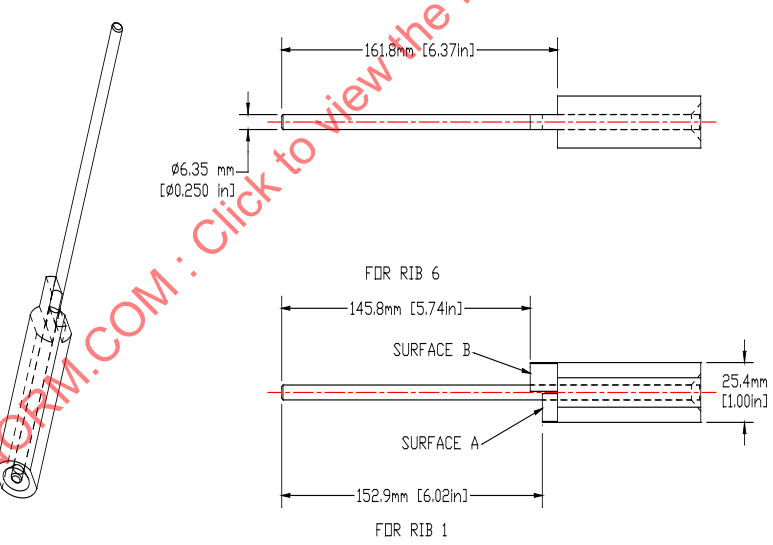


Figure 11 - Chest depth gage

7.6 Chest Deflection Transducer

Spine Mounting Assembly	(880105-1040)	Item 1, Figure 13
Load Cell Mount	(880105-326)	Item 2, Figure 13
Thoracic Spine Load Cell Simulator	(880105-328)	Item 3, Figure 13
Chest Accelerometer Mounting Bracket	(880105-329)	Item 4, Figure 13
Transducer Arm Assembly	(880105-1071)	Item 5, Figure 13
Molded Stop Assembly Torso Flexion	(78051-85)	Item 6, Figure 13
Chest Accelerometer Mount	(H350-1006)	Item 7, Figure 13
Jam Nut	(78051-334)	Item 8, Figure 13
Sternum Slider	(880105-1050)	Item 10, Figure 13
Set screw	(78051-334)	Item 11, Figure 13
Chest Potentiometer	(SA572-S51)	Item 12, Figure 13
Potentiometer Bracket	(78051-354)	Item 13, Figure 13
Arm Connector	(78051-355)	Item 14, Figure 13
SHCS, 10-24 x 5/16	(9000031)	Item 15, Figure 13
SHCS, 5/16-18 x ½	(9000489)	Item 18, Figure 13
BHCS, ¼-20 x ½	(9000407)	Item 19, Figure 13

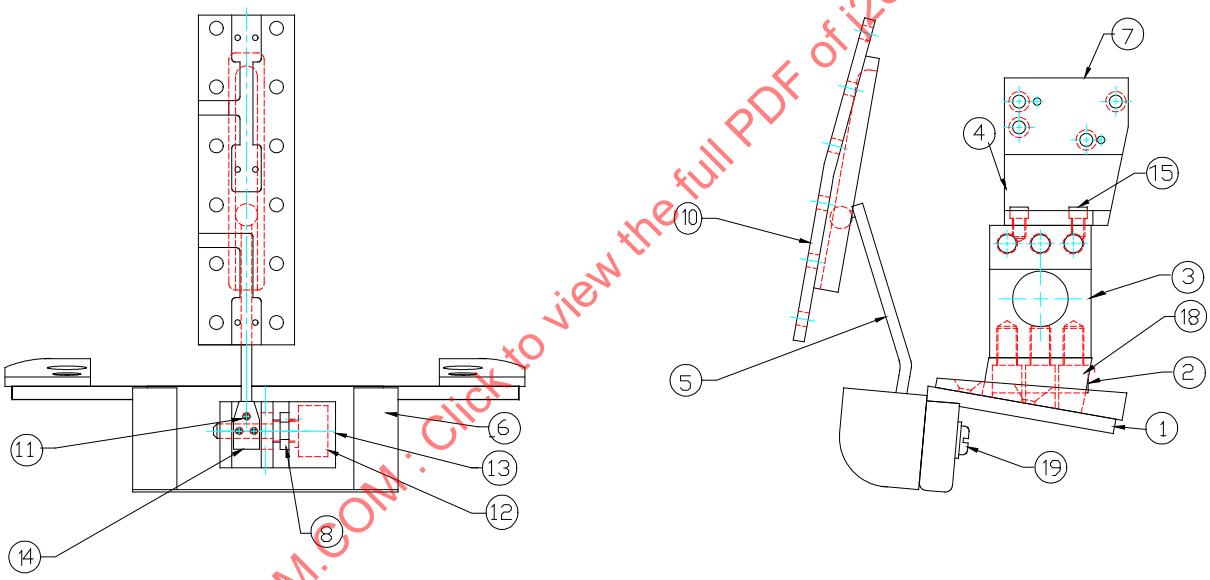


Figure 12 - Chest deflection assembly

7.6.1 Chest Deflection Transducer Disassembly

Separate the thorax from the lower torso by removing the four 1/4-20x5/8 SHCS (Item 16, Figure 9) at the top of the lumbar spine mount assembly. Lift the thorax off the lower torso. Then remove six 5/16-18 x ½ SHCS (Item 29, Figure 9) (three on each side of the spine box). Remove the chest accelerometers if they are installed. Pull the adapter assembly out of the spine box. With the adapter assembly out of the spine box, the load cell simulator, load cell mount and the accelerometer mount bracket are accessible. Disassemble the adapter assembly by removing the four 5/16-18 x 1/2 SHCS (Item 18, Figure 13) that hold the load cell mount to the load cell simulator. These screws are accessible through the holes in the base of the adapter. To remove the chest accelerometer mounting bracket from the load cell simulator, remove the four 10-24 x 5/16 SHCS (Item 15, Figure 13) screws at the upper surface of the adapter.

To remove the chest potentiometer from the adapter assembly, take out the 1/4-20 x 1/2 BHCS (Item 19, Figure 13) that holds the potentiometer bracket (Item 13, Figure 13) in place. Once calibrated according to J2715, "Hybrid III Family Chest Potentiometer Calibration Procedure" the chest potentiometer assembly consisting of the transducer arm assembly (Item 5, Figure 13), chest potentiometer (Item 12, Figure 13), potentiometer bracket (Item 13, Figure 13) and arm connector (Item 14, Figure 13) should not be mechanically adjusted or further disassembled.

If necessary, the transducer arm assembly (Item 5, Figure 13) can be pulled out of the assembly by loosening the 4-40 SSCP on the potentiometer connector. With the transducer arm disconnected, remove the bracket with the potentiometer from the dummy. Next, loosen the jam nut (Item 8, Figure 13) that holds the potentiometer in place and slide the potentiometer out of the bracket.

7.6.2 Chest Deflection Transducer Reassembly

- Slide the potentiometer into the bracket and tighten the jam nut. When reassembling unit, be sure that the roll pin, which is used to keep the potentiometer body from turning, is properly positioned on the potentiometer body so as not to damage the transducer.
- Reattach the potentiometer bracket.
- Reattach the transducer arm to the arm connector.
- Reattach the bracket to the adaptor assembly.
- Reattach the chest accelerometer mounting bracket to the load cell simulator.
- Install the adapter assembly to the load cell mount and load cell simulator. When installing the thoracic spine load cell, position the transducer so the cables leaving the body are toward the rear of the spine box. There could be some binding when the adapter assembly is replaced in the spine box and this may damage the cables if they are not positioned toward the rear.
- Put the adapter assembly into the spine box.
- Replace the accelerometers if needed.
- Place the thorax on the lower torso, and attach using the four fasteners to the lumbar spine mount assembly.

7.6.3 Inspection of Chest Deflection Transducer

- Check for the presence of and condition of the sternum stops. If they are missing or damaged, replace them using epoxy cement.
- Inspect the chest deflection potentiometer by rotating the pot arm through its range of motion. It should move freely without restriction. If it does not move freely, have it inspected by an electronics technician.
- Depending upon the stack up of tolerances and how far the potentiometer bracket (Item 13, Figure 13) pivot bearing is pressed into the spine mounting assembly (Item 1, Figure 13), the transducer arm (Item 5, Figure 13) may contact the spine weldment before the sternum contacts the sternum stops. This is not acceptable. When the transducer arm (Item 5, Figure 13) is removed from the chest deflection transducer slider (Item 10, Figure 13), make sure it can be moved back to within 13 mm (1/2 inch) of the sternum stops without contacting the spine weldment. See Figure 14.

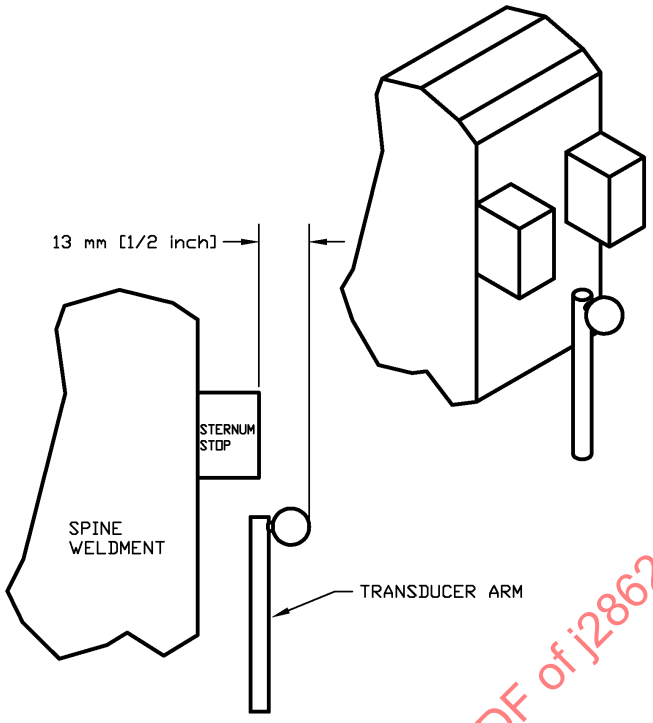


Figure 13 - Transducer arm clearance check

7.7 Clavicle

The Clavicle Assembly (880105-380 [left] and -381 [right] consists of:

Clavicle Link	(880105-334 [left] and -335 [right])	Item 1, Figure 15
Machined Clavicle	(880105-336 [left] and -337 [right])	Item 2, Figure 15
Clavicle Spring Stop	(880105-338)	Item 3, Figure 15
Clavicle Spacer	(880105-339)	Item 4, Figure 15, Figure 16
Rubber Stop Assembly	(880105-344)	Item 7, Figure 15
SHCS, 10-24 x 3/8	(9000487)	Item 15, Figure 15
Shoulder Yoke Assembly	(880105-343)	Item 5, Figure 16
Steel Stop	(880105-346)	Item 6, Figure 16
Shoulder Yoke Pivot Bushing	(880105-348)	Item 8, Figure 16
Shoulder Yoke Pivot Washer	(880105-349)	Item 9, Figure 16
Clavicule and Clavicle Link Bushing	(880105-357)	Item 10, Figure 16
Clavicle Link Washer	(880105-367)	Item 11, Figure 16
Shoulder Yoke Washer	(880105-350)	Item 12, Figure 16
Shoulder Joint Spring Washer	(880105-351)	Item 13, Figure 16
Shoulder Yoke Retaining Washer	(880105-352)	Item 14, Figure 16
Clavicle and Clavicle Link Bushing	(880105-357)	Item 16, Figure 16
SHCS, 6-32 x ½	(9000119)	Item 17, Figure 16
Lock Nut	(9000656)	Item 18, Figure 16

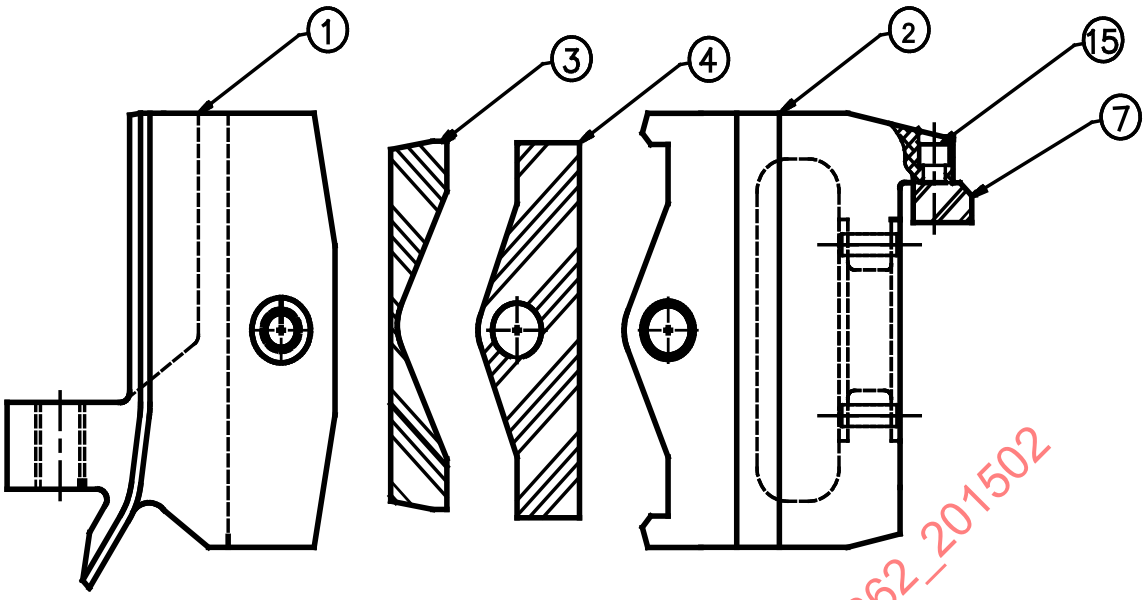


Figure 14 - Clavicle assembly

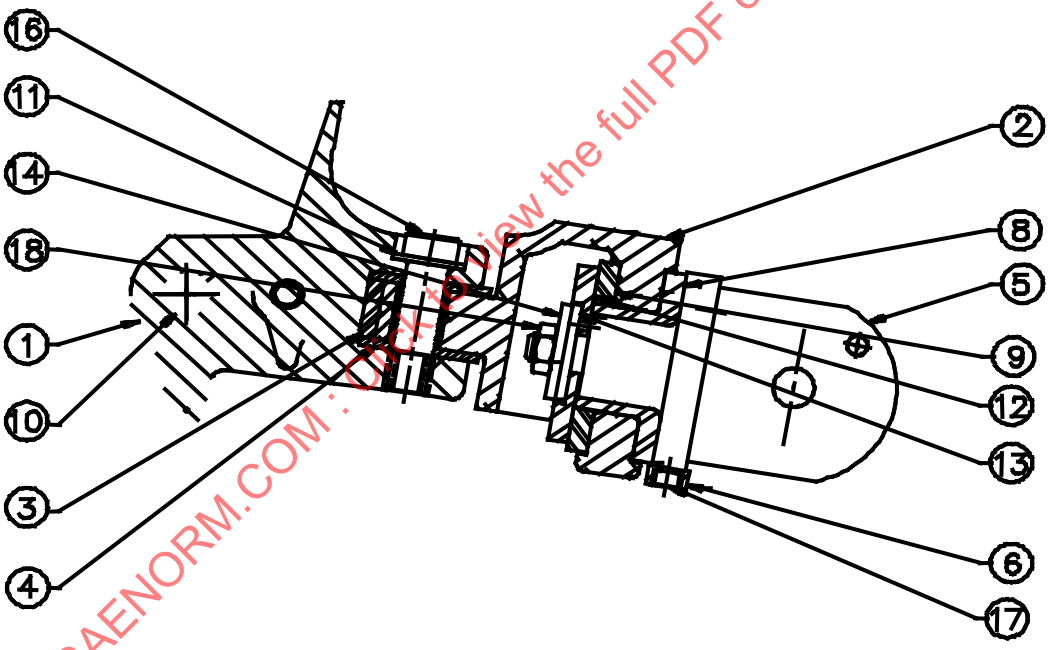


Figure 15 - Section view of clavicle

7.7.1 Clavicle Disassembly

The clavicle link is separated from the clavicle by removing the 3/8 x 1 SHSS (Item 16, Figure 16) from the upper side of the link assembly. When the two sections are pulled apart, two Delrin® clavicle spacers (Item 4, Figure 15) and a urethane clavicle stop spring (Item 3, Figure 15) will be free to drop from the assembly. The rubber stop assembly (Item 7, Figure 15) acts as a limiting device for the arm upward or 'Z' motion. The rubber stop assembly is held in place by a 10-24 x 3/8 SHCS.

Once the clavicle link and the clavicle are detached, the shoulder yoke (Item 5, Figure 16) can be removed from the assembly. To remove these parts, take off the 5/16-18 lock nut (Item 18, Figure 16) located inside of the machined clavicle. With the nut removed, pull the shoulder yoke retaining washer (Item 14, Figure 16) away from the urethane shoulder joint spring washer (Item 13, Figure 16) and the steel shoulder yoke washer (Item 12, Figure 16).

To remove the shoulder yoke pivot washer (Item 9, Figure 16) it may be necessary to use a small screwdriver to pry it away from the clavicle due to the close tolerances used in manufacturing the part. Be sure not to damage the friction surfaces (i.e. inside diameter, faces). Notice the two dowel pins pressed into the clavicle, which are used to locate and retain the bushing in its proper position.

The last component that can be removed from the shoulder yoke is the steel stop (Item 6, Figure 16). This stop is held in place with two 6-32 x 1/2 Nylok® SHCS. The steel stop is used with the stop assembly to limit the range of motion of the arm.

7.7.2 Clavicle Reassembly

- Fasten the steel stop to the shoulder yoke.
- Install the inside shoulder yoke bushing.
- Replace the shoulder yoke retaining washer, urethane spring washer and steel shoulder yoke washer into the machined clavicle. The steel retaining washer should be placed closest to the lock nut and the urethane spring washer next to the large steel washer.
- Reattach the shoulder yoke to the assembly.
- Reattach the clavicle to the clavicle link; remember to replace the two Delrin® washers and the urethane spring stop.

7.7.3 Inspection of Clavicle Components

- Examine the shoulder casting for cracks due to too much compression during assembly. Replace the casting if it is cracked.
- Because it is rubber, check the stop assembly for damage and replace it if necessary.

7.8 Lower Torso

The Lower Torso consists of:

Molded Pelvic Assembly.	(880105-440)	Item 1, Figure 17
Molded Lumbar Spine	(880105-1095)	Item 2, Figure 17, Figure 18
Lumbar Spine Cable	(880105-404)	Item 3, Figure 17
Lumbar-Thorax Adapter	(880105-405)	Item 4, Figure 17
Lumbar-Pelvic Adapter	(880105-1094)	Item 5, Figure 17, Figure 18
Abdominal Insert	(880105-434)	Item 6, Figure 17
SHCS, 5/16-18 x 5/8	(9000142)	Item 7, Figure 17
SHCS, ¼-20 x 7/8	(9000144)	Item 8, Figure 17
SHCS, 5/16-18 x 7/8	(9000476)	Item 9, Figure 17
Jam Nut, ½-20	(9000018)	Item 10, Figure 17, Figure 18
Accelerometer Mount	(1200056)	Item 11, Figure 17
SHCS, 10-24 x ½	(9000624)	Item 12, Figure 17
Pelvic Plunger Set Screw	(1200050)	Item 13, Figure 17
Femurs	(880105-420[left],-421[right])	Item 14, Figure 17
Modified Screw	(880105-1101)	Item 15, Figure 17
Anterior Superior Iliac Spine Load Cell Simulator	(880105-432[-1 left][-2 right])	Item 16, Figure 17
SHCS, 3/8-24 x 3/4	(9000750)	Item 17, Figure 17
Lumbar Cable Insert, Upper	(180-2004)	Item 18, Figure 18
Lumbar Cable Insert, Lower	(180-2005)	Item 19, Figure 18
Femur Bumper	(880105-426[left],-427[right])	Item 20, Figure 17

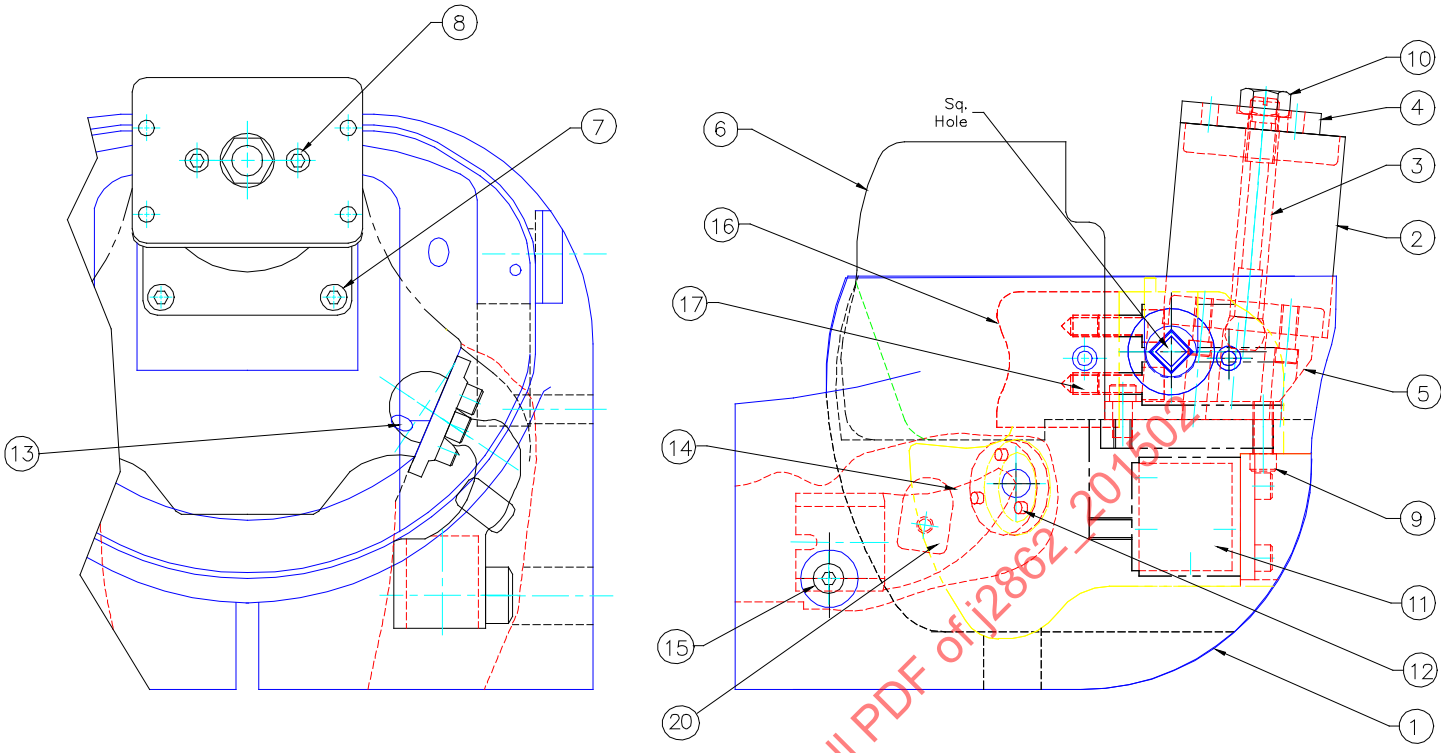


Figure 16 - Lower torso assembly

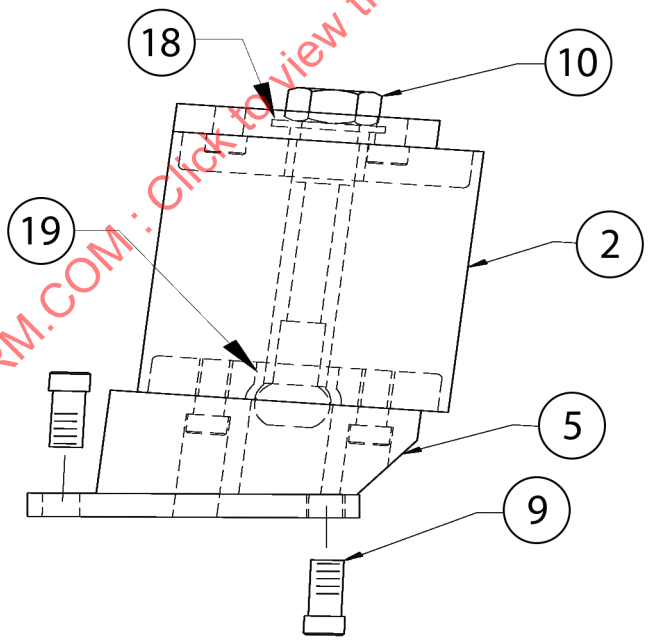


Figure 17 - Lumbar spine assembly

7.8.1 Removal of the Lumbar Spine

The lumbar-thorax adapter, lumbar spine, lumbar spine cable and the lumbar-pelvic adapter can be removed from the lower torso as one single assembly. Remove the two 5/16-18 x 5/8 SHCS (Item 7, Figure 17) from the abdominal insert area at the base of the lumbar spine. Then remove the two 5/16-18 x 7/8 SHCS (Item 9, Figure 17) from inside the instrument cavity port at the rear of the pelvis. With those four screws extracted, the entire assembly will lift out of the pelvis.

7.8.2 Lumbar Spine Reassembly

- Install the lumbar-thorax adapter, lumbar spine, lumbar spine cable, and the lumbar-pelvic adapter into the lower torso.

- Fasten the lumbar-thorax adapter, lumbar spine, lumbar spine cable, and the lumbar-pelvic adapter to the lower torso with the fasteners in the instrument cavity port. Finish attaching using fasteners at the base of the lumbar spine.

NOTE: The lumbar spine cable nut should not be left torqued when the dummy is in storage. This will cause permanent deformation to the lumbar spine.

7.8.3 Inspection of the Lumbar Spine

- Look for cracks in the lumbar spine rubber.

7.8.4 Pelvis Disassembly

To remove the femurs (Item 14, Figure 17), first loosen the femur plunger set screw (Item 13, Figure 17) in the abdominal insert area near the base of the lumbar-pelvic assembly. This will allow the femurs to move freely. If you remove the plunger, notice on one end of the part a Nylon® rod inserted into the screw. The nylon is what actually pushes down on the femur when the set screw is tightened and supplies the friction necessary to adjust the joint to the 1 G suspended setting for testing. Now remove the three 10-24 x 1/2 SHCS Nylok® (Item 12, Figure 17) that hold the femur flange against the pelvis bone. To remove these screws, insert a long "T- hex wrench" into the access holes on each side of the pelvis. To make the job somewhat easier, insert a small flashlight into the upper leg port. By looking through one of the access holes on the side, the wrench tip can be viewed and guided into the socket head.

Following the removal of all three screws, the femur can be pulled out of the pelvis flesh. The femur will be difficult to pull out; using a rod machined to fit like an upper leg bone in the femur will make it easier (Figure 19).

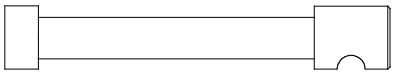


Figure 18 - Femur removal tool

The anterior superior iliac spine load cell simulators (Item 16, Figure 17) are also found in this region of the pelvis. These simulators are located on the front edge of the iliac wings and are attached with four 3/8-24 x 3/4 SHCS (Item 17, Figure 17) inserted into access ports at the rear of the iliac wings. To install the anterior superior iliac spine transducers, remove the simulators and replace them with the actual transducers using the same four 3/8-24 x 3/4 SHCS.

The ‘H’ Point for the pelvis structure can be measured from the centerline of the square hole provided in the lumbar bracket. An access hole is positioned directly in the path of the square hole to allow for this measurement. The dummy ‘H’ point is a reference location for the centerline of both left and right hip sockets. This point is frequently used in positioning the dummy relative to specific points in a vehicle or seat.

To find the ‘H’ Point on the Hybrid III small female pelvis, measure forward from the Square Hole center (toward the dummy’s front) 68 mm (2.69 in) and down 59 mm (2.33 in) toward the seating surface. The “Square Hole” is provided to allow insertion of a Pelvic Angle Gage (78051-532) to measure the angle of the pelvis.

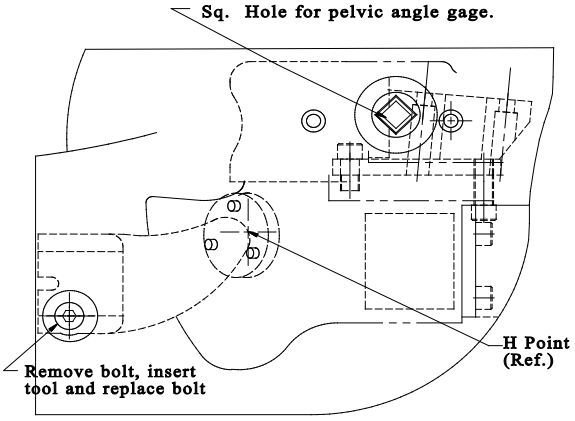


Figure 19 – "H" Point location

The rubber lumbar spine assembly can be detached from the lumbar-pelvis adapter (Item 5, Figure 18) by removing the four 1/4-20 x 3/4 SHCS. The lumbar-pelvis adapter is the component that is replaced if the small female lumbar spine transducer is used. To disassemble the rubber lumbar spine, remove the two 1/4-20 x 5/8 SHCS (Item 8, Figure 17) from the top surface of the lumbar-thorax adapter (Item 4, Figure 17) and then remove the jam nut (Item 10, Figure 18) on the spine cable. After removing the jam nut and screws from the upper part of the assembly, remove the spine cable for inspection or replacement. Remove the inserts (Items 18 and 19, Figure 18) from each and of the cable.

NOTE: The jam nut (Item 10, Figure 18) must be torqued to 1.24 N·m ± 0.1 N·m (11 in-lbf ± 1 in-lbf) during assembly and should be checked before using the dummy for testing.

7.8.5 Pelvis Reassembly

- Reassemble the lumbar spine.
- Reattach the lumbar spine to the lumbar-pelvis adapter.
- Install the anterior superior iliac spine transducers in place of the simulators if necessary.
- Insert the femurs in to the pelvis flesh and fasten with the three screws that hold the femur flange to the pelvis bone.
- Install the femur plunger set screws.

7.8.6 Inspection of Pelvis Components

- Look for tears in the pelvis vinyl.
- Look for broken metal pieces or stripped screws or threads.

7.9 Arms

The Arm Assemblies consist of:

Shoulder Joint Spring Washer	(880105-351)	Item 1, Figure 21
Upper Arm Molded Assembly	(880105-700)	Item 2, Figure 21
Upper Arm, Lower Part Weldment	(880105-705)	Item 3, Figure 21
Upper Arm and Elbow Pivot Washer	(880105-708)	Item 4, Figure 21
Upper Arm and Elbow Pivot Bushing	(880105-709)	Item 5, Figure 21
Upper Arm Pivot Washer	(880105-711)	Item 6, Figure 21
Wrist Rotation Assembly	(880105-718)	Item 7, Figure 21
Lower Arm Molded Assembly	(880105-712)	Item 8, Figure 21
Upper Arm Pivot Nut	(880105-710)	Item 9, Figure 21
Hand Molded Assembly	(880105-722[left], -723[right])	Item 10, Figure 21
SHSS, 5/16 x 3/4	(9000578)	Item 11, Figure 21
SHSS, 3/8 x 1	(9000074)	Item 12, Figure 21
SHCS, 3/8-16 x 1	(9000079)	Item 13, Figure 21
SHSS, 5/16 x 1-¼	(9000248)	Item 14, Figure 21

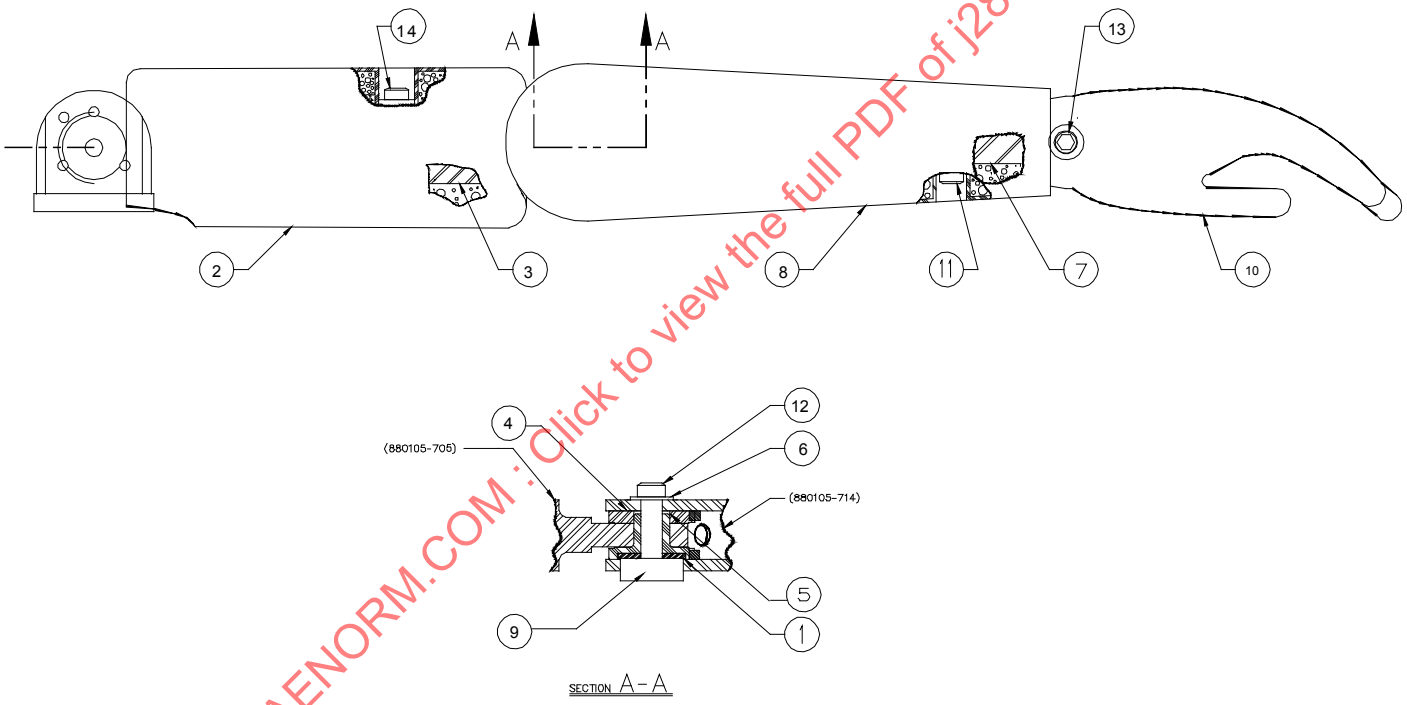


Figure 21 - Arm assembly

7.9.1 Arm Disassembly

To detach the upper arm from the lower arm, remove the 3/8 x 1 SHSS (Item 12, Figure 21) from the elbow joint. The upper arm and shoulder bushing (Item 5, Figure 21) in the joint is made of Delrin®.

The lower part of the upper arm provides the capability for the lower arm to rotate. To remove this part, take out the 5/16 x 1-1/4 SHSS (Item 14, Figure 21) and pull the upper arm lower part weldment (Item 3, Figure 21) away from the upper arm molded assembly (Item 2, Figure 21).

The hand is removed by taking out the 3/8-16 x 1 SHCS (Item 13, Figure 21) that joins the wrist rotation assembly and the hand molded assembly (Item 10, Figure 21). The wrist rotation assembly (Item 7, Figure 21) is detached from the lower arm by taking out the 5/16 x 3/4 SHSS (Item 11, Figure 21) located toward the hand end of the lower arm.

7.9.2 Arm Reassembly

- Reattach the wrist rotation assembly to the lower arm.
- Reattach the hand to the wrist rotation assembly.
- Reattach the lower part of the upper arm to the upper arm.
- Reattach the lower arm to the upper arm. There are two washers at the elbow; one is a standard steel flat washer (Item 6, Figure 21) and the other is made of Neoprene® (Item 1, Figure 21). These two washers must be replaced during reassembly or the joint will not perform properly. Take care not to damage the Delrin® bushing (Item 5, Figure 21) while attempting to insert the shoulder bolt. Damage to this area may affect the friction of the joint.

7.9.3 Inspection of Arm Components

- Check the arms for flesh rips or tears. If damaged, repair according to Appendix B. If the flesh on an arm has been seriously damaged, it can be returned to the manufacturer and remolded.
- Check the washers in each elbow joint. If any washer is damaged, replace it.

7.10 Legs

The Legs (880105-560-1[left] -2[right]) consist of:

Upper Leg Flesh	(880105-530L [left] –530R[right])	Item 1, Figure 22
Knee Clevis Weld Assembly	(880105-622)	Item 2, Figure 22
SHCS, ¼-28 x ½	(9000115)	Item 3, Figure 22
Lower Leg Flesh	(880105-601)	Item 4, Figure 22
Foot Assembly	(880105-650[left]-651[right])	Item 5, Figure 22
Ankle to Leg Attachment Bolt	(A-1887)	Item 6, Figure 22
Ankle Assembly	(880105-660)	Item 7, Figure 22
SHCS, 3/8-16 x1-3/4	(9000449)	Item 8, Figure 22
FHCS, 10-32 x 3/8	(9000249)	Item 9, Figure 22
SHCS, 3/8-16 x1-½	(9000479)	Item 10, Figure 22
Upper Leg Weldment	(880105-502 [left] –503 [right])	Item 11, Figure 22
Lower Leg Weldment	(880105-628)	Item 12, Figure 22
Femur Load Cell Simulator	(78051-319)	Item 13, Figure 22
Ankle Bumper Assembly	(880105-631)	Item 14, Figure 22

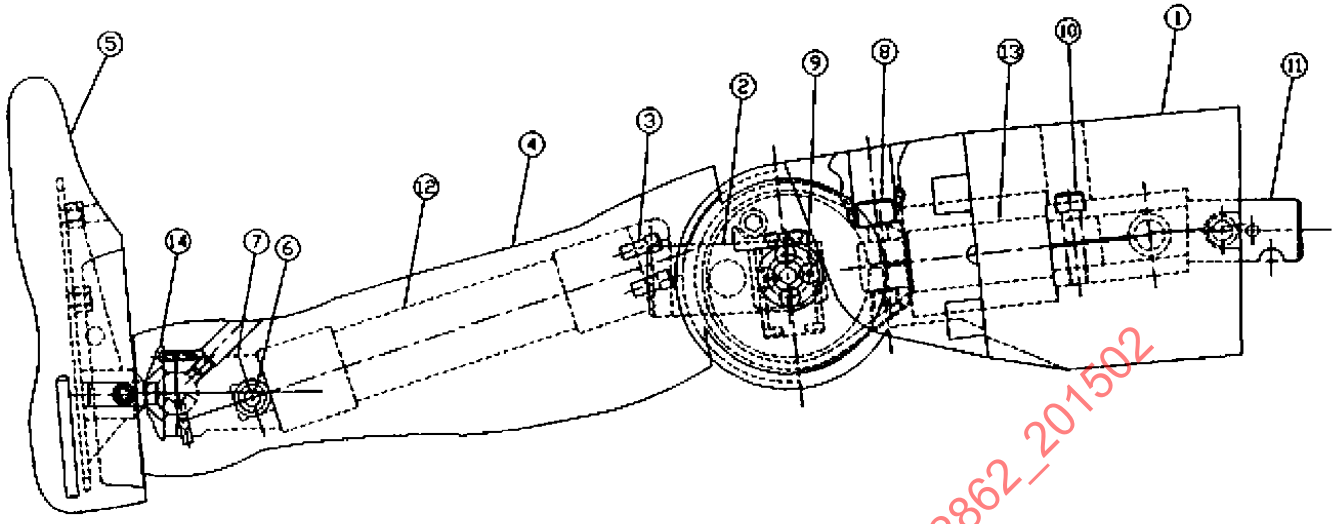


Figure 22 - Leg assembly

7.10.1 Leg Disassembly

To detach the lower leg from the upper leg, remove the eight 10-32 x 3/8 FHCS (Item 9, Figure 22) that attach the lower leg to the knee slider. Once the screws are removed, pull the lower leg from the upper leg assembly. To remove the upper leg flesh from the bone, remove the knee and pull the flesh off from the knee end of the upper leg. Sometimes this can be quite difficult because of adhesion of the flesh to the bone, but it can be done without damaging the parts.

7.10.2 Leg Reassembly

- To install the femur load cell, remove the two 3/8-16 SHCS (Items 8 and 10, Figure 22) at each end of the femur load cell replacement (Item 13, Figure 22).
- Take the femur load cell replacement out of the leg by pulling the knee away from the upper leg. With the femur load cell replacement out of the assembly, insert the load cell into the replacement's position and reinsert the two 3/8-16 SHCS at each end.
- Be careful to replace the longer bolt (3/8-16 x 1-3/4 SHCS [Item 8, Figure 22]) at the end nearest the knee. Torque the two screws to 40.7 N·m (30 ft-lbf) to prevent slippage in the joint during testing.
- Replace the leg flesh.
- Replace the eight 10-32 x 3/8 FHCS to attach the lower leg to the upper leg.

7.10.3 Inspection of Leg Components

- Check the leg for flesh rips or tears. If damaged, repair according to Appendix B. If flesh on a limb has been seriously damaged, it can be returned to the manufacturer and remolded.

7.11 Lower Legs

The Lower Leg assembly consists of:

Knee Clevis Weld Assembly	(880105-622)	Item 2, Figure 23
Foot Assembly	(880105-650[left], -651[right])	Item 5, Figure 23
Ankle Assembly	(880105-660)	Item 7, Figure 23
Lower Leg Weldment	(880105-628)	Item 12, Figure 23
Shoulder Bolt, Sliding Knee	(880105-527)	Item 14, Figure 23
Inboard Slider	(880105-513)	Item 15, Figure 23
Knee Flesh Insert	(880105-511)	Item 16, Figure 23
Pot, Shaft Pin	(79051-19)	Item 17, Figure 23
RHMS, 1-72 x 5/8	(9000340)	Item 18, Figure 23

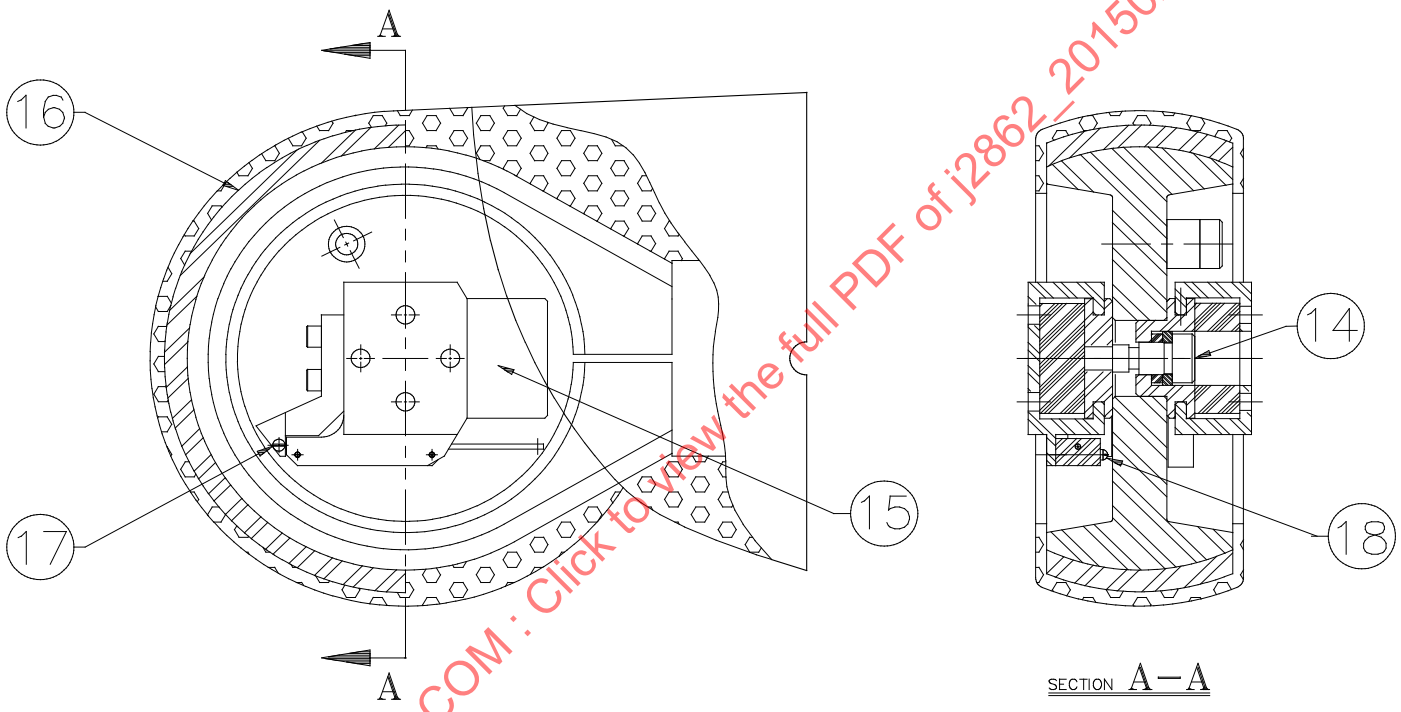


Figure 23 - Knee with slider

7.11.1 Lower Leg Disassembly

Take the knee assembly apart by removing the modified shoulder bolt (Item 14, Figure 23) from the knee slider assembly (Item 15, Figure 23). This screw is also used to adjust the tibia-femur joint friction. When removing this screw, be careful not to lose the two washers in the outboard slider. One washer is stainless steel and the other is Neoprene®; the stainless steel washer is located closest to the head of the shoulder screw. The knee insert (Item 16, Figure 23) is used to adjust femur loads into the proper load corridor. The machined knee can be separated from the knee flesh by rotating the large radius of the machined knee away from the knee flesh.

The optional potentiometer that is installed on the inboard knee slider is a 1000 ohm linear potentiometer. Two screws are used to hold it in position, 1-72 x 5/8 RHMS (Item 18, Figure 23).

To remove the tibia bone from the flesh, take off the ankle-foot assembly by removing the ankle to leg attachment bolt (A-1887) (Item 6, Figure 22) at the ankle-tibia joint. Grasp the tibia at the knee clevis and pull the bone from the flesh. This will require considerable force as the fit of the two parts is quite snug, but it can be done without damaging the flesh.

To separate the knee clevis from the lower leg remove the four ¼-28 x ½SHCS (Item 3, Figure 22) from the inside surface of the clevis (Item 2, Figure 22).

To remove the ankle from the foot, take out the SHSS ¼ x 5/8 (Item 10, Figure 23) in the foot and pull the two parts away from each other. The parts should separate easily; if not, there is probably damage to the "through-hole" or the ankle shaft itself.

7.11.2 Lower Leg Reassembly

- Reattach the foot to the ankle using the modified shoulder bolt.
- If the flesh was removed from the tibia, use a small amount of talcum powder to act as a lubricant when assembling the parts again.
- Bolt the knee clevis to the lower leg, then reattach the ankle to the tibia at the ankle-tibia joint with a modified shoulder bolt.
- To install the potentiometer, start by tightening the two 1-72 screws on the potentiometer body. Then check that the shaft runs smoothly through the potentiometer shaft support; if it does not, you can adjust the clearance, slightly, by loosening the two 8-32 x ½SHCS that hold the potentiometer shaft support. Once the shaft can run easily through the support, install the potentiometer shaft pin (Item 17, Figure 23).
- Install the knee insert and knee flesh. The insert is to be positioned on the knee so that it rests inside the cavity on the knee flesh. If not, there will be too much tension on the knee flesh and knee insert and thus inhibit the human-like response of the design. Install the knee slider assembly.

7.11.3 Inspection of Lower Leg

- Check the machined knee. Scratches in the machined knee show improper assembly, bent rotation stop arms, or possibly overloading of the femur load cell.
- Check all limbs for flesh rips or tears. If damaged, repair according to Appendix B. If flesh on the knee has been seriously damaged, it can be returned to the manufacturer and remolded.

7.12 Instrumented Lower Leg

The Instrumented Lower Leg consists of:

Knee Clevis Transducer ..... Figure 24
Lower Tibia Transducer ..... Figure 24
Upper Tibia Transducer ..... Figure 24
30-Foot Transducer Cable ..... Figure 24
Button Head Shoulder Screw (Modified)

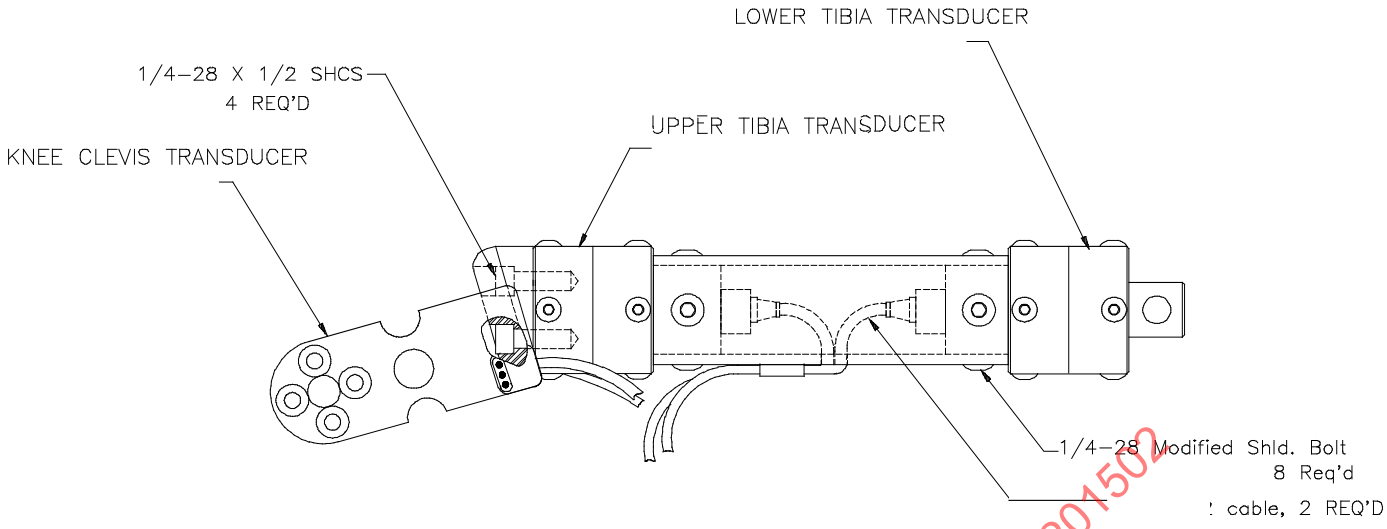


Figure 24 - Instrumented lower leg

7.12.1 Instrumented Lower Leg Disassembly

Occasionally the instrumented lower leg may have to be disassembled for calibration, repair, or replacement of one or more of the components.

To detach the knee clevis, simply remove the four ¼-28 x ½SHCS found inside the clevis yoke at the top of the assembly.

To remove the two tibia transducers, first loosen the cable clamp holding the cable where it exits the tibia bone. Then, take out the four modified ¼-28 BHSS that hold the transducers at each end of the tibia bone. Loosen only one transducer at a time. Be sure to only use these specially modified bolts in this location; any other bolt can damage the load cell.

Be sure that the cable can freely move into the tibia bone so no unnecessary stress will be put on the cable or the connector. Pull the transducer from the bone just enough to gain access to the cable connector.

Disconnect the connector from the transducer by lifting the sliding outer wall of the connector away from the transducer. The instrument is now free to be completely taken off the assembly.

7.12.2 Instrumented Lower Leg Reassembly

- Install the tibia transducers and bolt the knee clevis back together.
- To install the Instrumented Lower Leg, slide the transducer package into the lower leg flesh in place of the original tibia-clevis assembly. To make it somewhat easier, try putting a small amount of talcum powder in the leg flesh before attempting to push the bone in.
- When replacing the lower tibia load cell, be aware that the load cell can be installed in two different orientations. One orientation measures forces in the forward direction, the other measures forces in the lateral direction.

7.13 Ankle and Foot

The Ankle and Foot Assembly consists of:

Ankle, Upper Shell	(880105-609)	Item 1, Figure 25
Ankle, Lower Shell	(880105-633)	Item 2, Figure 25
Ankle Shaft	(880105-615)	Item 3, Figure 25
Foot Weldment	(880105-652[Left], -653[Right])	Item 4, Figure 25
Stop Pin Retainer	(880105-626)	Item 5, Figure 25
Dowel Pin, 3/16x3/8	(9000044)	Item 6, Figure 25
Ankle Friction Pad	(A-1888)	Item 7, Figure 25
SSCP, 5/16-18 x 3/8	(9000073)	Item 8, Figure 25
Ankle to Leg Attachment Bolt	(A-1887)	Item 9, Figure 25
SHSS, ¼ x 5/8	(9000619)	Item 10, Figure 25
BHCS, 6-32 x ½	(9000247)	Item 11, Figure 25
Set Screw,8-32 x ¼	(9000452)	Item 12, Figure 25
SSCP, 5/16-18 x 3/8	(9000073)	Item 13, Figure 25
FHCS 6-32 x ½	(9001279)	Item 14, Figure 25

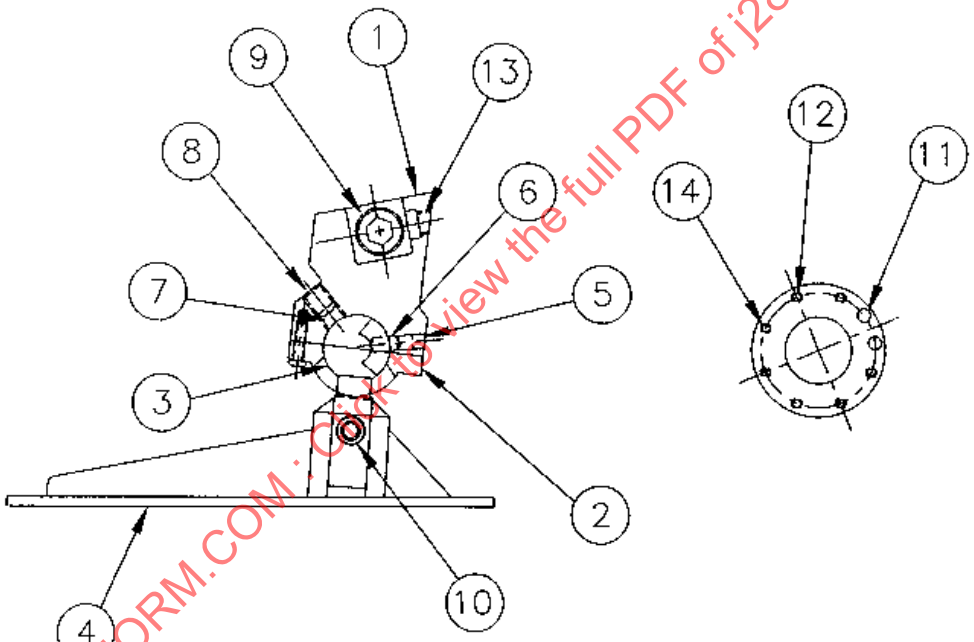


Figure 25 – Ankle and foot assembly

7.13.1 Ankle and Foot Disassembly

To take apart the ankle, start by loosening the 5/16-18 x 3/8 set screw (Item 8, Figure 25). This will release the tension on the joint. By removing the two 8-32 x ¼SSCP set screws (Item 12, Figure 25), the stop pin retainer and dowel pin (Items 5 and 6, Figure 25) can be removed. The dowel pin limits the rotation of the ankle shaft (Item 3, Figure 25) and can be pulled out of the upper ankle shell (Item 1, Figure 25) to release the shaft and allow it to be removed from the assembly. Remove the seven 6-32 x ½BHCS screws (Item 11, Figure 25) and 6-32 x ½ FHCS screws (Item 14, Figure 25) which hold the upper and lower ankle shells together; this will allow access to the ankle shaft.

7.13.2 Ankle and Foot Reassembly

Attach the upper and lower ankle shells together.

Install the dowel pin, then the stop pin retainer in the upper ankle shell.

Insert and fasten the set screws.

7.13.3 Ankle and Foot Inspection

Check stop pin retainer (ankle bumper) for damage.

8. CERTIFICATION TESTS

Certification tests are specified for dummy responses that could affect dummy measurements that are used by governments and safety engineers to assess occupant injury potential. Certification tests are performed by the dummy manufacturer to assure that a new component or assembly meets the SAE specified response requirements. The crash dummy user will periodically perform the certification tests to assure the dummy is maintained at the SAE specified performance levels.

8.1 Head Drop Test

A. The test measures the forehead response to frontal impacts with a hard surface.

B. The head assembly consists of:

- head assembly (880105-100X), including the head-to-neck pivot pin (78051-339)
- 6-channel neck transducer (SA572-S11) or a structural replacement (78051-383X)
- three accelerometers (SA572-S4)

The mass of the head assembly is 3.74 kg ± 0.045 kg (8.25 lb ± 0.1 lb).

C. The test fixture consists of a structure to suspend the head assembly and a rigidly supported, flat, horizontal, steel plate. The plate should be 610 mm ± 10 mm (24 in ± 0.4 in) square with a thickness of 50.8 mm ± 2 mm (2.0 in ± 0.08 in), and have a smooth surface finish of 203.2 x 10^{-6} to 2032.0 x 10^{-6} mm (8 to 80 microinches/inch) rms. A surface finish close to 203.2 x 10^{-6} mm (8 microinch/inch) rms is preferred. The suspension system and accelerometer cable masses should be as light as possible to minimize the external forces acting on the head.

D. The Data Acquisition System, including transducers, must conform to the requirements of the latest revision of SAE Recommended Practice J211-1. Filter all data channels using Channel Class 1000 phaseless filters.

E. Test Procedure

1. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if abrasions or cuts to the frontal area are more than superficial. Torque the 10-24 skull cap screws to 7.5 N·m (66 in-lbf) and the 10-24 accelerometer mount cap screws to 7.5 N·m (66 in-lbf).

2. Soak the head assembly in a controlled environment with a temperature of 18.9 to 25.6 °C (66 to 78 °F) and a relative humidity from 10 to 70% for at least 4 hours prior to a test. The test environment should have the same temperature and humidity requirements as the soak environment.

3. Mount the accelerometers in the head on the horizontal transverse bulkhead so the sensitive axes intersect at the Center of Gravity point as defined by 880105-100. One accelerometer is aligned with the sensitive axis perpendicular to the horizontal bulkhead in the midsagittal plane (Z-axis). The second axis is parallel to the horizontal bulkhead in the midsagittal plane (X-axis). The third accelerometer is aligned with the sensitive axis parallel to the horizontal bulkhead and perpendicular to the midsagittal plane (Y-axis). Ensure that all transducers are properly installed, oriented, and calibrated.

4. Prior to the test, clean the impact surface of the head skin and the impact plate surface with isopropyl alcohol or equivalent. The impact surface and the head skin must be clean and dry for testing.

5. Suspend the head assembly in a manner similar to that shown in Figure 26. The lowest point on the forehead is 12.7 mm ± 1 mm (0.5 in ± 0.04 in) below the lowest point on the dummy's nose when the midsagittal plane is vertical. The 1.57 mm (0.062 in) diameter holes located on either side of the dummy's head are used to ensure that the head is level with respect to the impact surface.

6. Drop the head assembly from a height of 376.0 mm ± 1.0 mm (14.8 in ± 0.04 in) by a means that ensures a smooth, instant release onto the impact surface.

7. Wait at least 2 hours between successive tests on the same head assembly.

8. Time-zero is defined as the point of contact between the head and the impact surface. All data channels should be at the zero level at this time.

F. Performance Specifications

1. The peak resultant acceleration should be between 250 and 300 G, inclusive.

2. The resultant acceleration versus time history curve should be unimodal; oscillations occurring after the main pulse should be less than 10% of the peak resultant acceleration.

3. The lateral acceleration should not exceed 15 G (zero to peak).

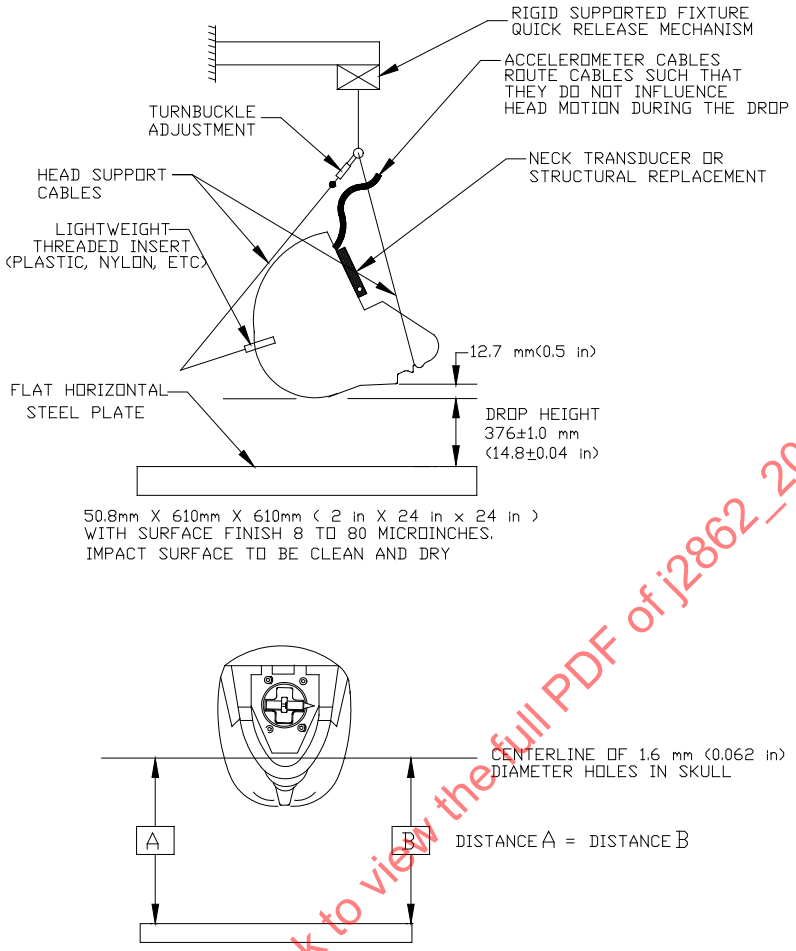


Figure 26 - Head drop test setup specifications

8.2 Neck Tests

A. The components required for the neck tests are:

- head assembly (880105-100X)
- neck assembly (880105-250)
- bib simulator (880105-371)
- upper neck adjusting bracket (880105-207)
- lower neck adjusting bracket (880105-208)
- six-channel neck transducer to measure the x-axis force and y-axis moment (SA572-S11)
- transducers to measure the rotation of the D-plane (horizontal plane through the base of the skull) with respect to the pendulum's longitudinal centerline
- three accelerometers (SA572-S4) or their mass equivalent as specified in (880105-100X) in the head to maintain the proper weight and center of gravity location; data from the accelerometers are not required
- Neck pendulum accelerometer (SA572-S4)

B. The test fixture pendulum arm with specifications appears in Figure 27. The aluminum honeycomb material is commercial grade, 152.4 mm (6.0 in) thick, 0.8 kg (1.8 lb) per cu ft with 19 mm (0.75 in) diameter cells. Mount the accelerometer with its sensitive axis aligned with the arc formed at a radius 1657.4 mm (65.25 in) from the pivot point.

C. The Data Acquisition System, including transducers, must conform to the requirements of the latest revision of SAE Recommended Practice J211-1. Filter the neck force data channel using Channel Class 1000, the neck moment data channel using Channel Class 600, the pendulum acceleration data channel using Channel Class 180, and the neck rotation data channels using Channel Class 60. All filters should be phaseless.

NOTE: Phaseless or equal phase filters must be used when signals of different frequency classes are combined, such as the F_x and M_y signals for calculating the moment about the occipital condyles.

D. Test Procedure

1. Soak the neck assembly in a controlled environment at a temperature between 20.6 and 22.2 °C (69 to 72 °F) and a relative humidity of 10 to 70% for at least 4 hours prior to a test. The test environment should have the same temperature and humidity requirements as the soak environment. Monitor the temperature of the neck by placing a thermo-sensor into one of the holes in the neck.

2. Inspect the neck assembly for cracks, cuts and separation of the rubber from the metal segments.

3. Inspect the nodding blocks (78051-351) for deterioration and replace as necessary. The durometer should be 80 to 90 Shore A. Ensure that the nodding blocks are installed correctly as shown on Drawing 880105-250 and in Figure 8.

4. Inspect the nodding joint washers, Drawing 78051-253, for an interference fit. Adjust or replace as required.

5. Mount the head-neck assembly on the pendulum so the midsagittal plane of the head is vertical. As shown in Figure 29 for the Flexion test and Figure 28 for the Extension test, the midsagittal plane should coincide with the plane of motion of the pendulum's longitudinal centerline.

6. Install the transducers or other devices for measuring the D-plane rotation with respect to the pendulum longitudinal centerline. These measurement devices should be designed to be as light as possible to minimize their influence on the performance of the head-neck assembly.

7. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 N·m ± .2 N·m (12.0 in-lbf ± 2.0 in-lbf) before each test on the same neck.

8. The number of cells in the honeycomb material which are required to produce the pendulum input pulse will be different for the flexion and extension tests. The number of cells required may also vary for each sheet and/or batch of material. If necessary to achieve the deceleration pulse, pre-crush the honeycomb material prior to the test by lightly impacting it with the pendulum so the desired honeycomb surface contacts the pendulum striker plate.

9. With the pendulum resting against the honeycomb material, adjust the neck bracket until the longitudinal centerline of the pendulum is perpendicular ±1 degree to the D-plane on the dummy's head.

10. Wait at least 30 minutes between successive tests on the same neck.

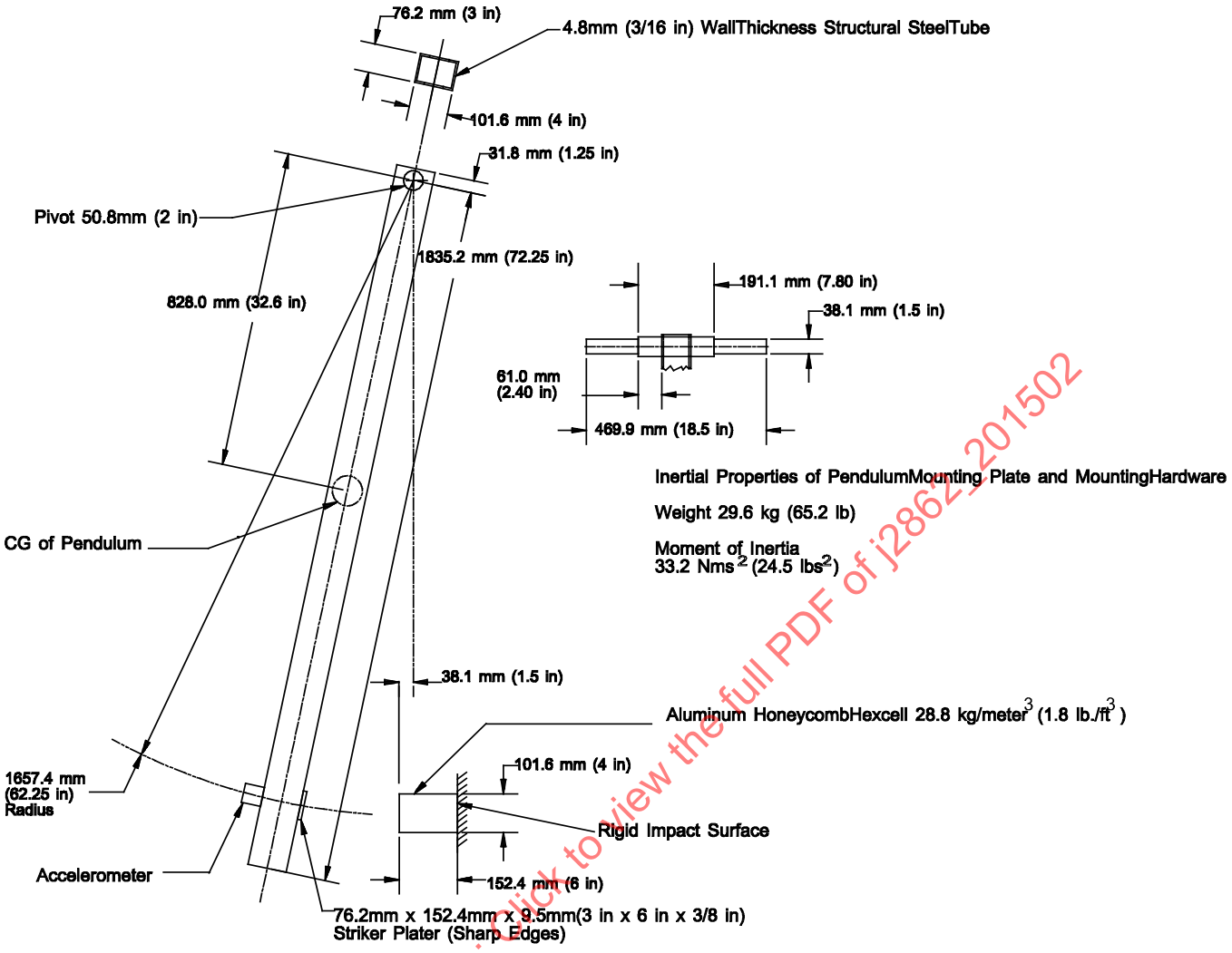


Figure 27 - Neck pendulum arm specifications

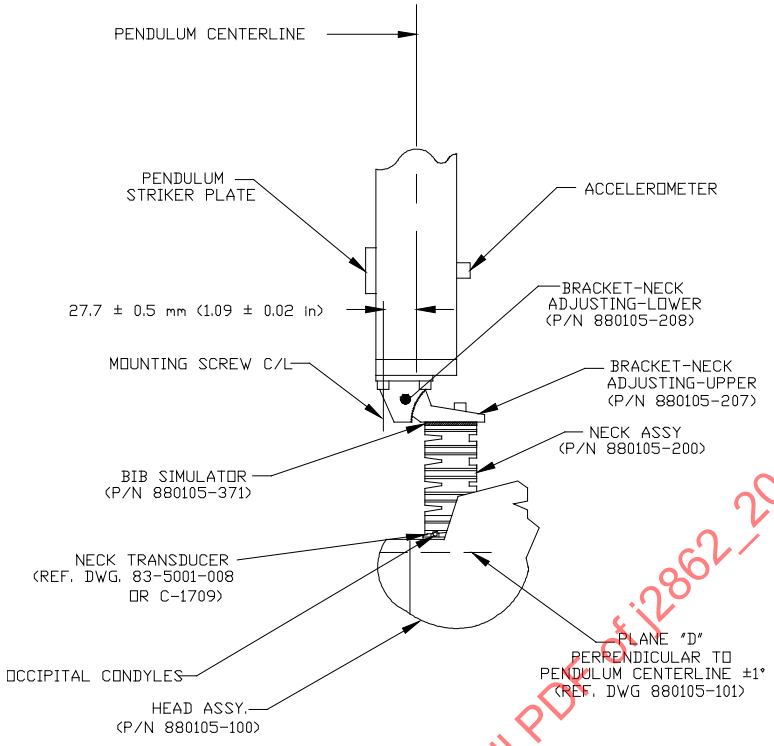


Figure 28 - Neck extension setup specifications

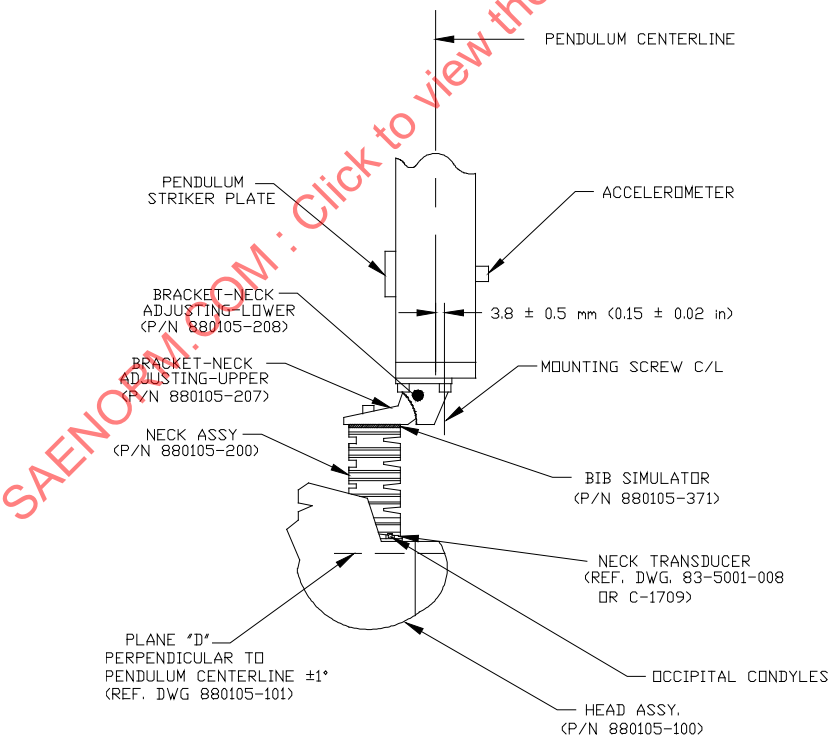


Figure 29 - Neck flexion setup specifications

11. Calculate the moment about the occipital condyles for both flexion and extension tests using the formulae:

    For a six-channel neck transducer:

    Metric Units
    Moment (N·m) = [M_y (N·m)] - [0.01778m] [F_x (N)]

    English Units
    Moment (ft-lbf) = [M_y (ft-lbf)] - [0.05833 ft] [F_x (lbf)]

NOTE: The formulae are based on the sign convention contained in SAE Recommended Practice J211-1, latest revision, Instrumentation for Impact Test.

E. Performance Specifications - Neck Flexion

1. Release the pendulum and allow it to fall freely from a height to achieve an impact velocity of 7.01 m/s ± 0.12 m/s (23.0 ft/s ± 0.4 ft/s) measured at the center of the pendulum accelerometer at the instant of contact with the honeycomb.

2. Time-zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. All data channels should be at the zero level at this time.

3. Stop the pendulum from the initial velocity with an acceleration versus time pulse which meets the velocity change as specified below. Integrate the pendulum acceleration data channel to obtain the velocity versus time curve.

TIME	PENDULUM IMPULSE	
ms	m/s	ft/s
10	2.1 - 2.5	6.9 - 8.2
20	4.0 - 5.0	13.1 - 16.4
30	5.8 - 7.0	19.0 - 23.0

4. During the time interval while the rotation is within the corridor specified in Section 5, the peak moment about the "Y" axis of the head, measured with respect to the occipital condyles, shall be not less than 69 N·m (51 ft-lbf) and not more than 83 N·m (61 ft-lbf). The positive moment shall decay for the first time to 10 N·m (7.4 ft-lbf) between 80 and 100 ms after time-zero (T_0).

5. The maximum rotation of the D-plane of the head should be 77 to 91 degrees with respect to the pendulum.

F. Performance Specifications - Neck Extension

1. Release the pendulum and allow it to fall freely from a height to achieve an impact velocity of 6.07 m/s ± 0.12 m/s (19.9 ft/s ± 0.4 ft/s) measured at the center of the pendulum accelerometer at the instant of contact with the honeycomb.

2. Time-zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. All data channels should be at the zero level at this time.

3. Stop the pendulum from the initial velocity with an acceleration versus time pulse which meets the velocity change as specified below. Integrate the pendulum acceleration data channel to obtain the velocity versus time curve.

TIME	PENDULUM IMPULSE	
ms	m/s	ft/s
10	1.5 - 1.9	4.9 - 6.2
20	3.1 - 3.9	10.2 - 12.8
30	4.6 - 5.6	15.1 - 18.4

4. During the time interval while the rotation is within the corridor specified in Section 5, the peak moment about the "Y" axis of the head, measured with respect to the occipital condyles, shall be not less than -65 N·m (-48 ft-lbf) and not more than -53 N·m (-39 ft-lbf). The positive moment shall decay for the first time to -10 N·m (-7.4 ft-lbf) between 94 and 114 ms after time-zero (T_0).

5. The maximum rotation of the D-plane of the head should be 99 to 114 degrees with respect to the pendulum.

8.3 Thorax Impact Test

A. The complete assembled dummy 880105-000 is required, including the clothing (snug-fitting, cotton knit, short sleeve shirt and above-the-knee pants) but without the shoes.

B. The fixture consists of a smooth, clean, dry, steel seating surface and a rigid test probe. The test probe mass is 13.97 kg ± 0.023 kg (30.8 lb ± 0.05 lb) including instrumentation, rigid attachments, and the lower 1/3 of the suspension cable mass. The mass of the attachments and 1/3 of the suspension cable length must not exceed 5% of the total mass of the test probe. The mass moment of inertia in yaw and pitch shall be at least 3646 kg-cm^2 (3.22 lbs-in-sec^2). The diameter of the impacting face is 152.4 mm ± 0.25 mm (6.00 in ± 0.01 in) and has a flat, right-angle face with an edge radius of 7.6 to 12.7 mm (0.3 to 0.5 in). Mount an accelerometer (SA572-S4) to the probe with its sensitive axis in line with the longitudinal centerline of the test probe.

C. The data acquisition system, including transducers, must conform to the specifications of the latest revision of SAE Recommended Practice J211-1. Filter all data channels using Channel Class 180 phaseless filters.

D. Test Procedure

1. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions etc. Pay particular attention to the rib damping material (880105-358-1 through 880105-358-6), chest displacement transducer assembly (880105-1080), and the rear rib supports (880105-320). Torque the spine cable to 1.1 to 1.4 N·m (10 to 12 in-lbf).

2. Soak the test dummy in a controlled environment with a temperature of 20.6 to 22.2 °C (69 to 72 °F) and a relative humidity from 10 to 70% for at least 4 hours prior to a test. The test environment should have the same temperature and humidity requirements as the soak environment.

3. Check that all transducers are properly installed, oriented and calibrated.

4. Seat the dummy (without the chest skin) on the test fixture surface. The surface must be long enough to support the pelvis and outstretched legs.

5. Align the upper and lower neck bracket index marks to the zero position.

6. Place the arm assemblies horizontal ±2 degrees and parallel to the midsagittal plane. Secure the arms by tightening the adjustment nut that holds the arm yoke to the clavicle assembly (880105-336, 337).

   Level the ribs both longitudinally and laterally ±0.5 degree and adjust the pelvis angle to 7 degrees ± 2 degrees. The ribs may be measured at the third rib using flat stock as a fixture for the level. A special tool, which inserts into the pelvic structure and extends outward beyond the pelvic skin surface, may be used to determine the pelvis angle.

   The midsagittal plane of the dummy is vertical ±1 degree and within 2 degrees of being parallel to the centerline of the test probe. The longitudinal centerline of the test probe is centered on the midsagittal plane of the dummy within ±2.5 mm (±0.1 in). Align the test probe so its longitudinal centerline is 12.7 mm ± 1.1 mm (0.5 in ± 0.04 in) below the horizontal centerline of the No. 3 rib and is within 0.5 degrees of a horizontal line in the dummy's midsagittal plane.

After completing the initial setup, record reference measurements from locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure that the dummy remains in the same position after installing the chest skin. When using a cable-supported test probe, the dummy must be moved rearward from the test probe to account for the thickness of the chest skin, so the probe will impact at the lowest point on its arc of travel. The test set up appears in Figure 30.

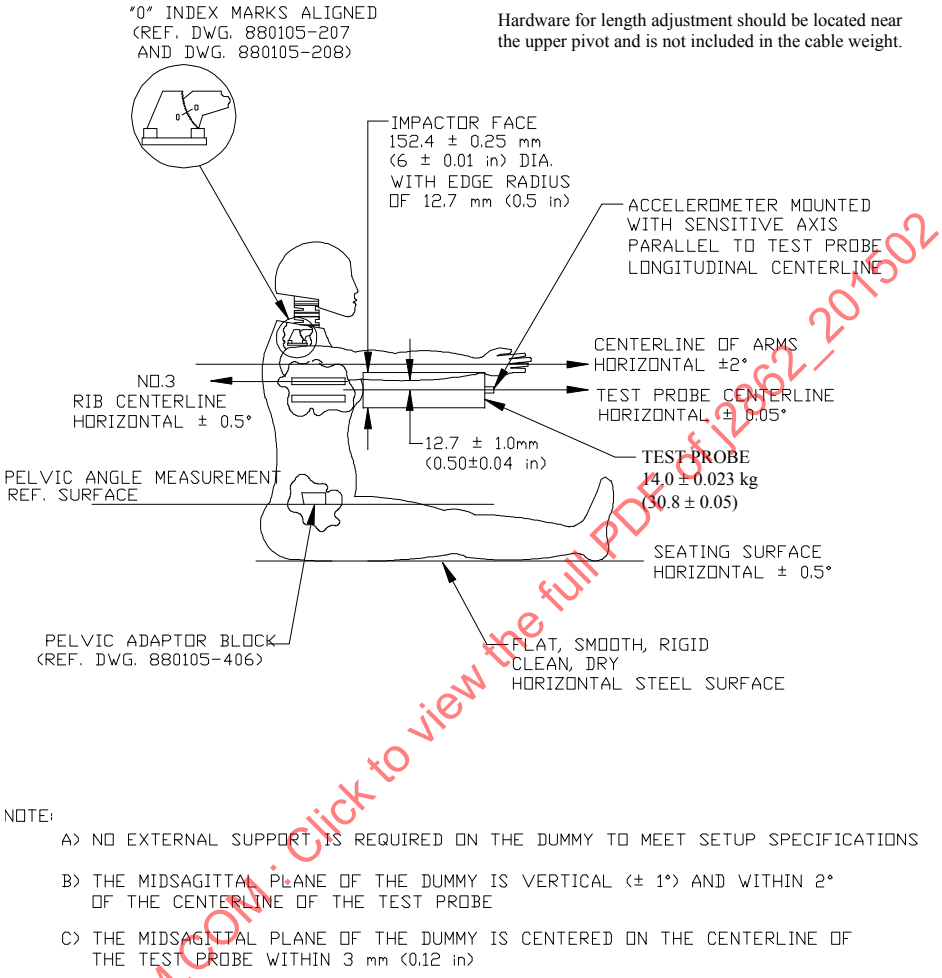


Figure 30 - Thorax impact test setup specification

7. Install the chest skin and reposition the dummy as described in the preceding paragraph using the recorded reference measurements. The reference locations must be accessible after installation of the chest skin, so it may be necessary to leave the chest skin unzipped until the references are checked, and then fasten it just prior to the test.

8. Impact the thorax with the test probe so the probe's longitudinal centerline is within 2 degrees of a horizontal line in the dummy's midsagittal plane at the moment of impact.

9. Guide the probe so no significant lateral, vertical or rotational motion takes place during the impact.

10. The test probe velocity at the time of impact is 6.71 m/s ± 0.12 m/s (22 ft/s ± 0.4 ft/s).

11. Time-zero is defined as the time of initial contact between the test probe and the chest skin. All data channels should be at the zero level at time-zero.

12. Wait at least 30 minutes between successive tests on the same thorax.

E. Performance Specifications

1. The maximum sternum-to-spine displacement, as measured by the chest displacement transducer, should lie between 50.0 and 58.0 mm (1.97 and 2.30 in).

2. During the time interval while the deflection is within the corridor specified in Section 1, the peak force shall be not less than 3.9 kN (876 lbf) and not more than 4.4 kN (989 lbf). Calculate this force by multiplying the test probe acceleration by its mass.

3. The peak force (test probe acceleration multiplied by its mass) shall not exceed 4.6 kN after 18.0 mm (0.71 in) of sternum displacement and prior to reaching the minimum sternum required displacement of 50.0 mm (1.97 in) .

4. The internal hysteresis should be greater than 69% but less than 85%. The hysteresis, determined from the force versus deflection curve, is the ratio of the area between the loading and unloading portions of the curve to the area under the loading portion of the curve as shown in Figure 31.

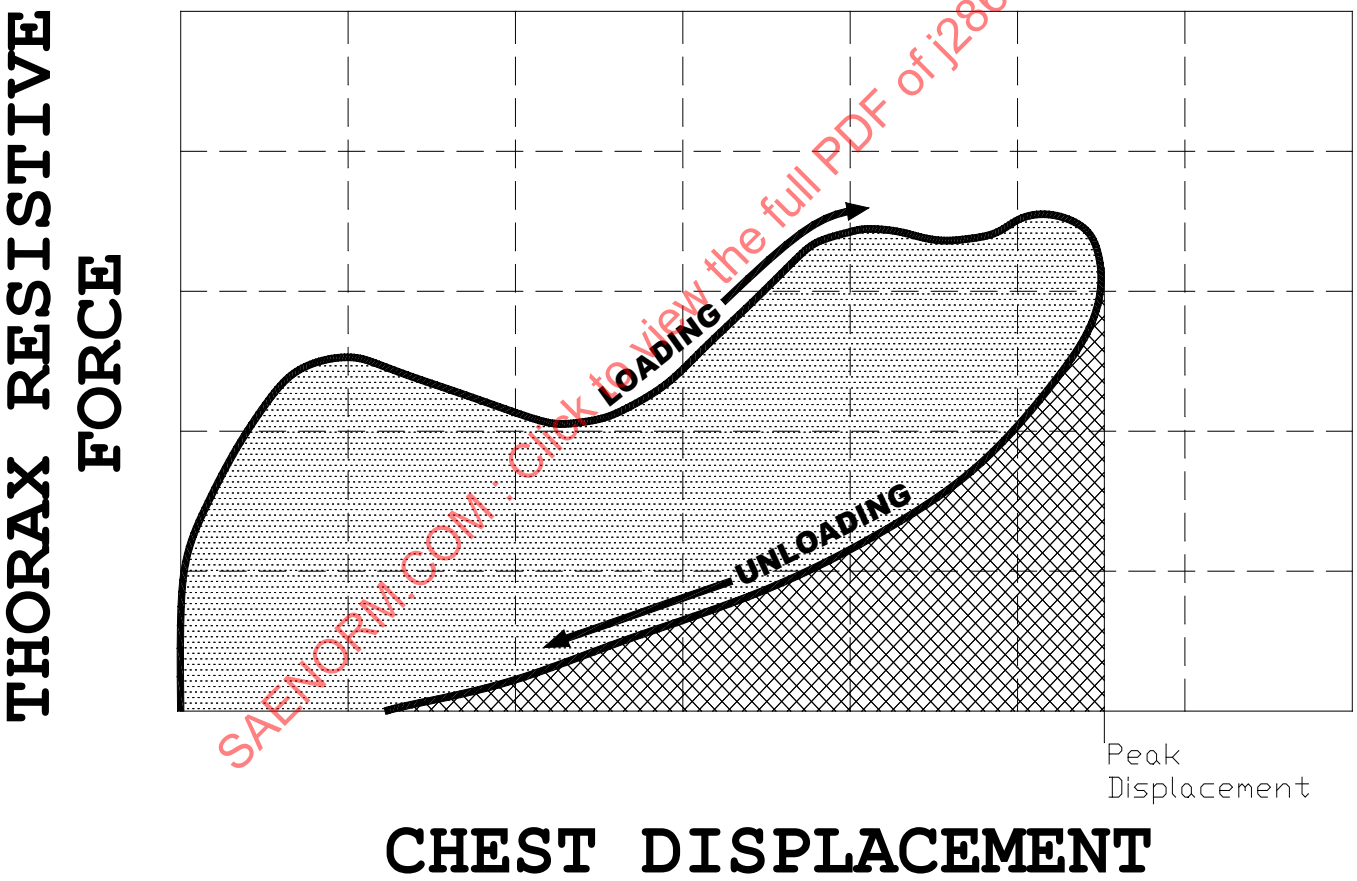


Figure 31 - Hysteresis definition

8.4 Knee Impact Test

A. The components required for the knee impact test include:

- knee cap (880105-510)
- knee flesh and skin assembly (880105-508)
- knee insert (880105-511)
- knee slider assembly (optional)
- lower leg assembly (optional)
- femur load cell (SA572-S14) or structural replacement (78051- 319)

B. The fixture consists of a rigid test probe and a method to rigidly support the knee and lower leg assembly. The test probe mass is 2.99 kg ± 0.023 kg (6.6 lb ± 0.05 lb), including instrumentation, rigid attachments, and the lower 1/3 of the suspension cable mass. The impacting face has a diameter of 76.2 mm ± 0.25 mm (3.00 in ± 0.01 in) and has a flat, right-angle face with an edge radius of 7.6 to 12.7 mm (0.3 to 0.5 in). Mount an accelerometer (SA572-S4) to the probe with its sensitive axis in line with the longitudinal centerline of the test probe.

C. The Data Acquisition System, including transducers, must conform to the requirements of the latest revision of SAE Recommended Practice J211-1. Filter all data channels using Channel Class 600 phaseless filters.

D. Test Procedure

1. Inspect the knee assembly for cracks, cuts, abrasions, etc. Repair or replace damaged components.
2. Soak the knee in a controlled environment with a temperature between 20.6 to 22.2 °C (69 to 72 °F) and a relative humidity from 10 to 70% for at least 4 hours prior to a test. The test environment should have the same temperature and humidity requirements as the soak environment.
3. Mount the knee assembly to the fixture using a femur load cell or load cell simulator. Torque the load cell simulator bolts to 40.7 N·m (30 ft-lbf) to prevent slippage of the assembly during the impact. If using the lower leg assembly, adjust the lower leg so the line between the knee and ankle pivots is at an angle of 24 degrees ± 1 degree rearward of vertical. Do not let the tibia or foot contact any exterior surface. The test set up is shown in Figure 32.
4. Align the longitudinal centerline of the test probe so it is collinear within 2 degrees with the longitudinal centerline of the load cell simulator at the time of impact.
5. Guide the probe so no significant lateral, vertical or rotational motion occurs at time-zero.
6. Time-zero is defined as the time of the initial contact between the test probe face and the knee skin. All data channels should be at zero level at this time.
7. Impact the knee so the longitudinal centerline of the test probe is within 0.5 degree of a horizontal line parallel to the load cell simulator at time-zero.
8. The test probe velocity at the time of impact is 2.1 m/s ± 0.03 m/s (6.9 ft/s ± 0.1 ft/s).
9. Wait at least 30 minutes between successive tests on the same knee.

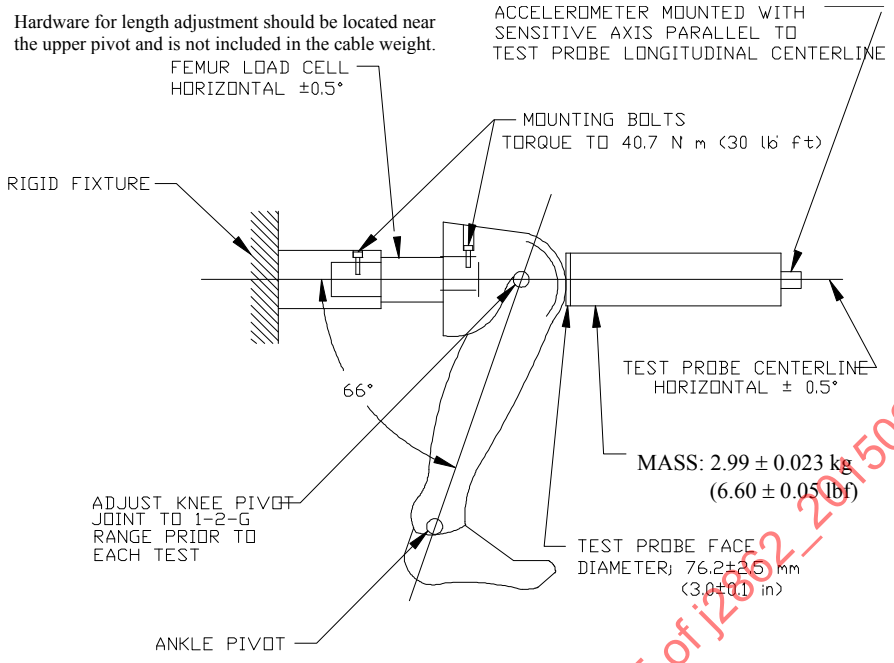


Figure 32 - Knee impact test setup specifications

E. Performance Specifications

1. The peak impact force (defined as the product of the test probe mass and the deceleration) should lie between 3.45 and 4.06 kN (776 and 913 lbf).

8.5 Knee Slider Test

A. The components required for the knee slider test are:

- left and right knee assemblies (880105-529 left and right)
- displacement transducer
- femur load cell or structural replacement (78051-319)

B. The fixture consists of a rigid test probe and a method of rigidly supporting the knee assembly. The test probe mass is 7.26 kg ± 0.09 kg (16.0 lb ± 0.2 lb) including instrumentation, rigid attachments, and the lower 1/3 of the suspension cable mass. The diameter of the impacting face is 76.2 mm ± 0.25 mm (3.00 in ± 0.01 in) and has a flat, right angle face with an edge radius of 0.5 mm (0.02 in). A load distribution bracket is required to transmit the impact energy into the slider assembly, as seen in Figure 33.

C. The Data Acquisition System, including transducers, must conform to the specifications of the latest revision of SAE Recommended Practice J211-1. Filter the displacement data channel using Channel Class 180.

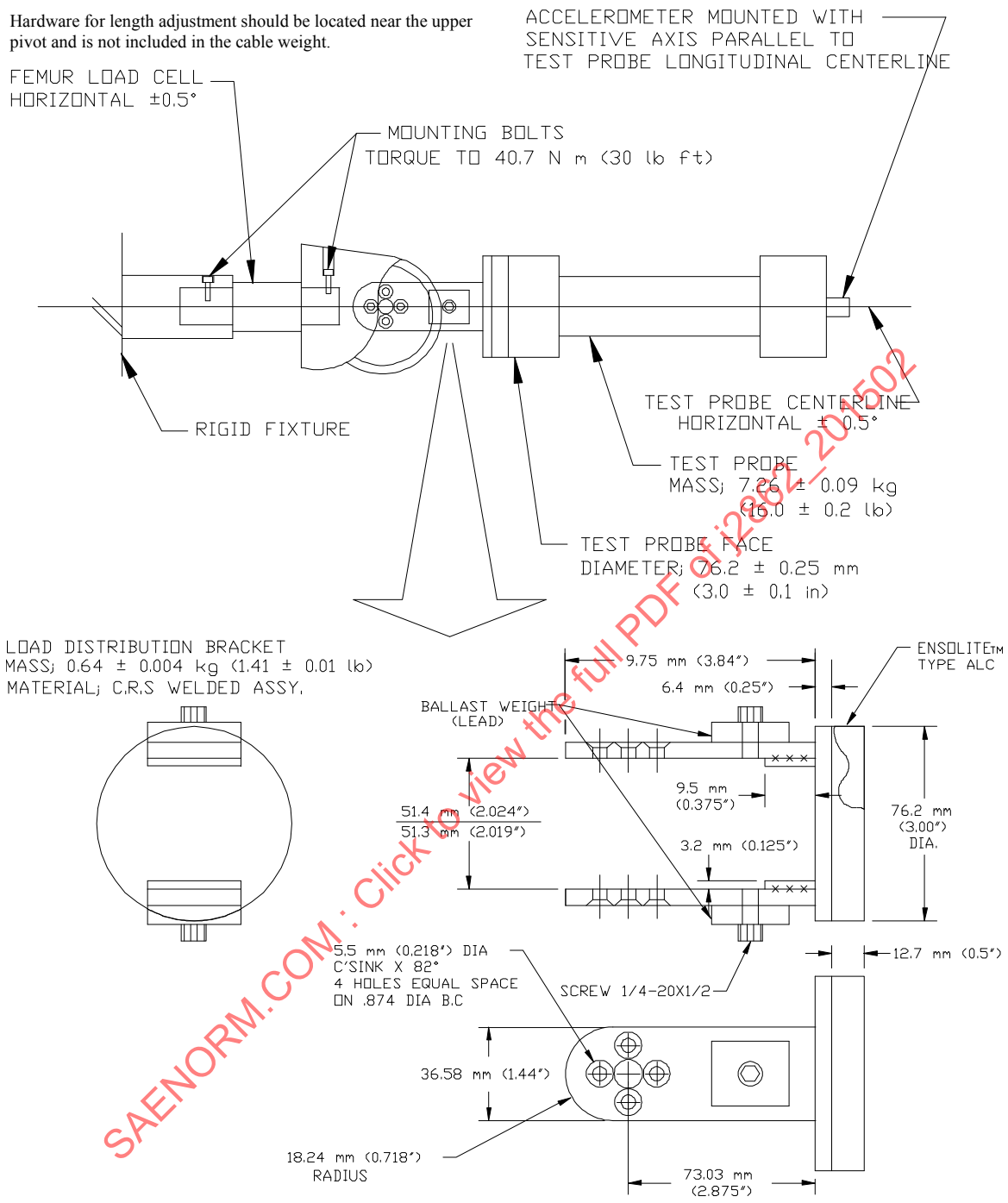


Figure 33 - Knee slider test setup specifications

D. Test Procedure

1. Inspect the knee assembly for damage. Pay particular attention to the left and right side slider assemblies to ensure the tracks are clean and free from damage that could affect the operation.

2. Soak the knee assembly in a controlled environment with a temperature of 20.6 and 22.2 °C (69 to 72 °F) and a relative humidity of 10 to 70% for at least 4 hours prior to a test. The test environment should have the same temperature and humidity requirements as the soak environment.

3. Check that all transducers are properly installed, oriented and calibrated.

4. Mount the knee assembly to the fixture using a femur load cell or load cell simulator (78051-319). Torque the two mounting bolts to 40.7 N·m (30 ft-lbf) to prevent slippage of the assembly during impact. Attach the load distribution bracket to the slider assembly. The bracket is attached to the inboard and outboard slider assemblies (880105-512-01 and 880105-522-01) in the same manner as the knee clevis.

5. Align the longitudinal centerline of the test probe so at the time of impact, it is collinear (within 2 degrees) with the longitudinal centerline between the load cell and the load distribution bracket. The test probe longitudinal centerline should be horizontal within 0.5 degree. The test setup is shown in Figure 33.

6. Guide the probe so no significant lateral, vertical or rotational motion occurs at the time of contact between the test probe face and the load distribution bracket.

7. The test probe velocity at the time of impact is 2.75 m/s ± 0.05 m/s (9.02 ft/s ± 0.18 ft/s).

8. Time-zero is defined as the time of initial contact between the test probe and the load distribution bracket.

9. Wait at least 30 minutes between successive tests on the same knee slider assembly.

E. Performance Specifications

1. The peak deflection should lie between 12.7 to 15.5 mm (0.50 to 0.61 in).

9. INSPECTION TESTS

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.

9.1 External Measurements

A. Remove the dummy's chest skin and abdominal insert.

B. Place the dummy on a flat, rigid, smooth, clean, dry, horizontal surface as shown in Figure 34. The seating surface must be at least 406 mm (16 in) wide and 406 mm (16 in) deep, with a vertical section at least 406 mm (16 in) wide and 914 mm (36 in) high attached to the rear of the seating fixture. The dummy's midsagittal plane is vertical and centered on the test surface.

C. Remove the four socket head cap screws that attach the lumbar spine to the thoracic spine. Torque the spine cables to 1.13 to 1.35 N·m (10 to 12 in-lbf).

NOTE: At this point, inspect the thorax for damage. If required, remove the thorax displacement transducer for calibration. Use extreme caution to avoid damaging the instrumentation cables.

D. Reassemble the lumbar spine to the thoracic spine.

E. Secure the dummy to the test fixture so the button head screws (that attach the top rib to the thoracic spine) and the mounting plates (that connect the thoracic spine to the lumbar spine) are against the vertical surface of the fixture. The rear surface of the buttocks now contacts the fixture.

F. Position the dummy's H-point so it is 83.8 mm ± 2.5 mm (3.3 in ± 0.1 in) above the seat surface and 147.3 mm ± 2.5 mm (5.8 in ± 0.1 in) forward of the rear vertical surface of the fixture. The H-point is located 68.6 mm (2.7 in) forward and 58.4 mm (2.3 in) downward from the center of the pelvic angle reference hole.

G. Extend the dummy's neck so the base of the skull is level, both fore and aft and side to side, within 0.5 degree. The rear surface of the skull cap should be 45.7 mm ± 2.5 mm (1.8 in ± 0.1 in) from the vertical surface of the test fixture.

H. Position the upper and lower legs parallel to the midsagittal plane so the centerline between the knee pivot and the screw attaching the ankle to the lower tibia is vertical.

I. Position the feet parallel to the dummy's midsagittal plane with the bottoms horizontal and parallel to the seating surface.

J. Position the upper arms downward vertically so the centerline between the shoulder and elbow pivots is parallel to the rear vertical surface of the fixture.

K. Position the lower arms horizontally so the centerline between the elbow and wrist pivots is parallel to the seat surface.

L. Record the following dimensions. (The symbols and description for each measurement are indicated in Figure 34.) They should conform to the specifications listed in Table 2.

A - Total Sitting Height - Seat surface to highest point on top of the head.

B - Shoulder Pivot Height - Centerline of shoulder pivot bolt to the seat surface.

C - Hip Pivot Height above seat-surface (Reference).

D - Hip Pivot from Backline from seat rear vertical surface (Reference).

E - Shoulder Pivot from Backline - Center of the shoulder clevis to the fixture's rear vertical surface.

F - Thigh Clearance - Seat surface to the highest point on the upper femur segment.

G - Back of Elbow to Wrist Point - The back of the elbow flesh to the wrist.

H - Head Back from Backline to seat rear vertical surface (Reference).

I - Shoulder to Elbow Length - The highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow, in line with the elbow pivot bolt.

J - Elbow Rest Height - The flesh below the elbow pivot bolt to the seat surface.

K - Buttock to Knee Length - The most forward surface of the knee flesh to the rear surface of the buttocks, in line with the knee pivot and hip pivot.

L - Popliteal Height - Seat surface to the horizontal plane of the bottom of the feet.

M - Knee Pivot Height - Knee pivot bolt to horizontal plane of the bottom of the feet.

N - Buttock Popliteal Length - The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for measurement "K".

O - Chest Depth without Jacket - Measured 304.8 mm ± 5.1 mm (12 in ± 0.20 in) above the seat surface (AA).

P - Foot Length - Tip of toe to rear of heel.

R - Buttock to Knee Pivot Length - The rear surface of the buttocks to the knee pivot bolt.

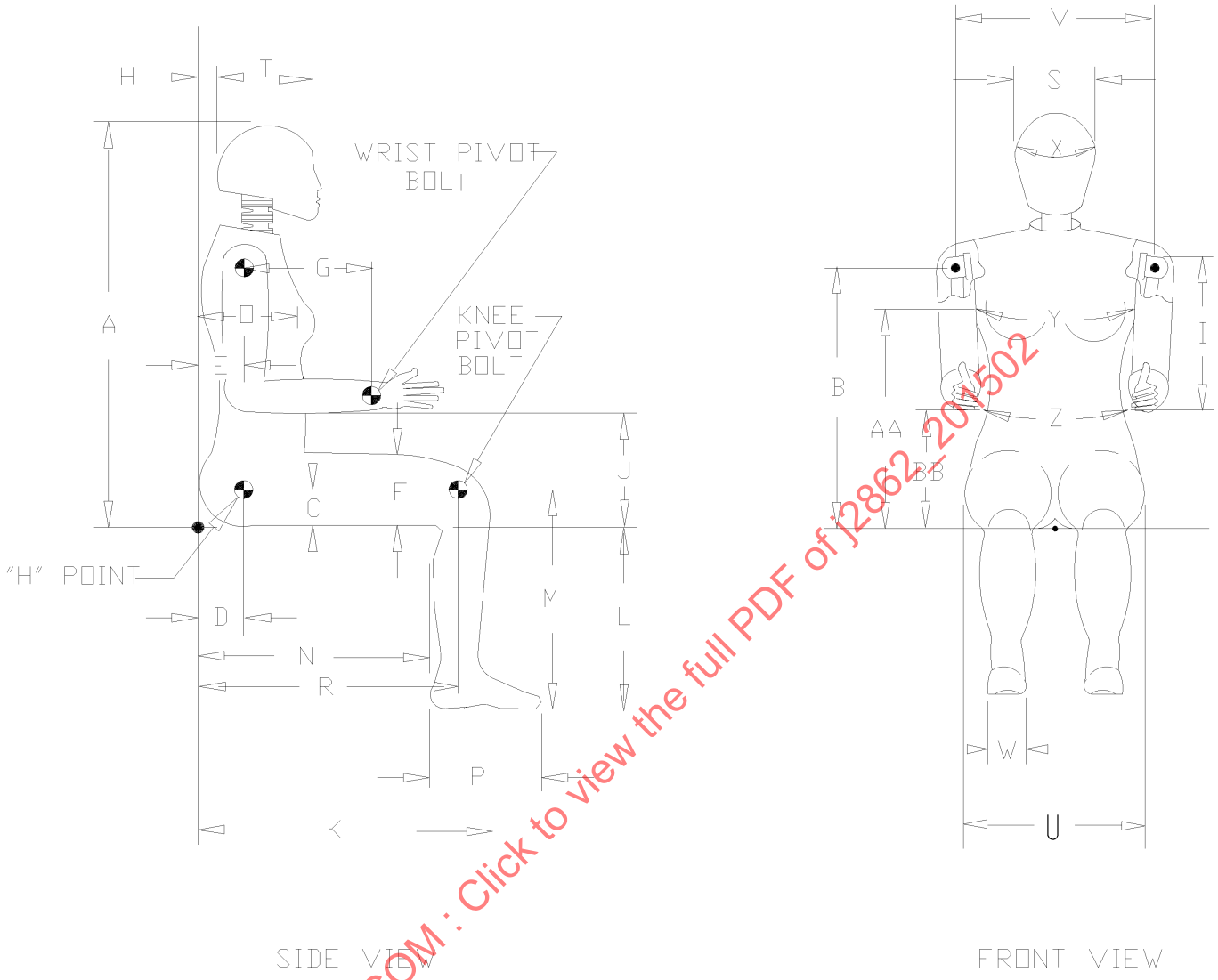


Figure 34 - External dimensions setup specification

Table 2 - Hybrid III small adult female external dimensions

Dimension	Definition	Specification (in)	Specification (mm)
Total Sitting Height	A	31.00 ± 0.50	787.4 ± 12.7
Shoulder Pivot Height	B	17.50 ± 0.50	444.5 ± 12.7
Hip Pivot Height	C	3.30 ± 0.10	83.8 ± 2.5
Hip Pivot Forward from Backline	D	5.80 ± 0.10	147.3 ± 2.5
Shoulder Pivot from Backline	E	3.00 ± 0.30	76.2 ± 7.6
Thigh Clearance	F	5.00 ± 0.30	127.0 ± 7.6
Back of Elbow to Wrist Point	G	9.90 ± 0.30	251.5 ± 7.6
Head Back to Backline	H	1.80 ± 0.10	45.7 ± 2.5
Shoulder to Elbow Length	I	11.30 ± 0.40	287.0 ± 10.2
Elbow Rest Height	J	7.60 ± 0.40	193.0 ± 10.2
Buttock to Knee Length	K	21.00 ± 0.50	533.4 ± 12.7
Popliteal Height	L	14.40 ± 0.40	365.8 ± 10.2
Knee Pivot Height	M	16.00 ± 0.50	406.4 ± 12.7
Buttock Popliteal Height	N	16.80 ± 0.50	426.7 ± 12.7
Chest Depth without Jacket	O	7.20 ± 0.30	182.9 ± 7.6
Foot Length	P	8.90 ± 0.30	226.1 ± 7.6
Buttock to Knee Pivot Length	R	18.50 ± 0.50	469.9 ± 12.7
Head Breadth	S	5.60 ± 0.20	142.2 ± 5.1
Head Depth	T	7.20 ± 0.20	182.9 ± 5.1
Hip Breadth	U	12.10 ± 0.30	307.3 ± 7.6
Shoulder Breadth	V	14.10 ± 0.30	358.1 ± 7.6
Foot Breadth	W	3.40 ± 0.30	86.40 ± 7.6
Head Circumference	X	21.20 ± 0.40	538.5 ± 10.2
Chest Circumference with Jacket	Y	34.10 ± 0.60	866.1 ± 15.2
Waist Circumference	Z	30.50 ± 0.60	774.7 ± 15.2
Reference Location for Chest Circumference	AA	12.00 ± 0.20	304.8 ± 5.1
Reference Location for Waist Circumference	BB	6.50 ± 0.20	165.1 ± 5.1

S - Head Breadth - The widest part of the head.

T - Head Depth - Back of the head to the forehead.

U - Hip Breadth - The widest part of the hip.

V - Shoulder Breadth - Between outside edges of shoulder clevises.

W - Foot Breadth - The widest part of the foot.

X - Head Circumference - The circumference of the head measured at the point as in measurement “T”.

M. Install the chest skin and abdominal insert. Reposition the dummy on the test fixture. You do not need to level the head as specified for the previous measurements.

N. Mark the locations and record the chest and waist circumference dimensions.

Y - Chest Circumference - Measured 304.8 mm ± 5.1 mm (12 in ± 0.20 in) above the seat surface (AA).

Z - Waist Circumference - Measured 165.1 mm ± 5.1 mm (6.5 in ± 0.20 in) above the seat surface (BB).

9.2 Mass Measurements

A. Check the masses of the various dummy segment assemblies on initial inspection. They should conform to the masses specified in Table 3.

B. After replacing parts or accelerometers, recheck the mass of the pertinent segment.

C. The segments are separated along the interfaces according to the following list:

Head - Includes all items shown in Head Assembly (Figure 5) plus an accelerometer mount and accelerometers.

Neck - Includes items 1, 2, 3, 6, 7, 9, 10, and 11 shown in Neck Assembly (Figure 8) and items 1, 2 and 7 shown in the Head and Neck Assembly (Figure 3).

Upper Torso with Torso Jacket - Includes all items shown in The Upper Torso (Figure 9), Chest Deflection (Figure 13), and Clavicle Assemblies (Figure 15, Figure 16), plus item 13 from the Shoulder Joint Assembly (Figure 10). Figure 10 also shows two Delrin® bushings, a spring washer, and threaded nut in section B-B that are not labeled but should be included in the upper torso mass measurement. The accelerometer mount and accelerometers should also be included.

Lower Torso - Includes all items in Lower Torso Assembly (Figure 17) plus the accelerometer mount and accelerometers.

Upper leg - Includes items 1, 8, 10, 11, and 13 from the Complete Leg Assembly (Figure 22), item 16 from the Knee with Slider Assembly (Figure 23), the knee flesh, and machined knee.

Lower leg - Includes items 2, 3, 4, 6, 7, and 12 from the Complete Leg Assembly (Figure 22), items 14, 15, 17, and 18 from the Knee with Slider Assembly (Figure 23), two washers on item 14 from Figure 23, outboard knee slider, knee slider pot with screws, and the ankle bumper.

Foot - Includes item 5 from Complete Leg Assembly (Figure 22) and item 10 from Foot-Ankle Assembly (Figure 25).

Upper arm - Includes items 2, 3, and 14 from Arm Assembly (Figure 21).

Lower arm - Includes items 1, 4, 5, 6, 7, 8, 9, 11, 12, and 13 from Arm Assembly (Figure 21).

Hand - Includes item 10 from Arm Assembly (Figure 21)

Table 3 - Hybrid III small adult female total and segment masses

Segment	Specification (lbs)	Specification (kg)
Head Assembly	8.23 ± 0.10	3.73 ± 0.05
Neck Assembly	2.00 ± 0.20	0.91 ± 0.09
Upper Torso Assembly with Torso Jacket	26.50 ± 0.30	12.02 ± 0.14
Lower Torso Assembly	29.2 0 ± 0.30	13.25 ± 0.14
Upper Arm, Left or Right	2.60 ± 0.10	1.18 ± 0.05
Lower Arm, Left or Right	1.98 ± 0.10	0.90 ± 0.05
Hand, Left or Right	0.62 ± 0.10	0.28 ± 0.05
Upper Leg, Left or Right	6.90 ± 0.20	3.13 ± 0.09
Lower Leg, Left or Right	7.20 ± 0.20	3.27 ± 0.09
Foot, Left or Right	1.75 ± 0.10	0.79 ± 0.05
Total Dummy Mass	108.03 ± 2.50	49.00 ± 1.13