

Measurement Procedure:  
Chest Jacket Dimensions,  
Hybrid III 5th Percentile Female Test Dummy

National Highway Traffic Safety Administration

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## Table of Contents

|   |    |
|---|----|
| <b>I. Background</b> .....  | 1  |
| <b>II. Measurements on an Unworn Jacket</b> .....                 | 2  |
| <b>III. External Jacket Measurements as Worn on a Dummy</b> ..... | 7  |
| <b>Appendix. SAE J2921, HIII-5F - Jacket Drawings</b> .....       | 10 |

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## I. Background

NHTSA has begun use of a new chest jacket design for the Hybrid III Fifth Percentile Adult Female Crash Test Dummy (HIII-5F). This jacket design is referred to herein as the "SAE" jacket because it is the product of an SAE Task Force devoted to creating a single jacket design that would fit dummies manufactured by FTSS and Denton. It is sometimes referred to as the "harmonized" or "Humanetics" jacket since it represents a unification of the FTSS and Denton brands. The two companies merged to become "Humanetics Innovation Solutions" (HIS) in 2007, and the SAE jacket is also designed to fit new dummies manufactured by HIS. The breast contours on the original FTSS and Denton jackets differ slightly from each other, and with the SAE jacket.

The findings of the Task Force effort are described in Information Report No. SAE J2921. This report also contains three SAE engineering drawings that describe the new jacket:

- 880105-355-H, Rev B, Chest Flesh Assembly, Sheet 1
- 880105-355-H, Rev B, Chest Flesh Assembly, Sheet 2
- 880105-356-H, Rev C, Sternum Pad

Note: these drawings do not appear in the current set of Part 572 Subpart O drawings. See the Appendix for reprints of the SAE drawings.

NPRM Published. An NPRM was published on December 24, 2019 proposing to adopt new specifications for the SAE jacket. The NPRM proposed to specify jacket dimensions and tolerances. Separate sets of dimensions and tolerances were proposed for the unworn jacket (on a table top) and the jacket as worn by an actual HIII-5F dummy. The nominal dimensions and tolerances proposed in the NPRM were derived from a sample of jackets measured by NHTSA. Most of the nominal dimensions are listed herein.

The purpose of the measurement exercise described herein is to measure new SAE jackets fitted to HIII-5F units, including new units built by HIS and older units built by FTSS and Denton. These measurements are needed to assess the uniformity of SAE jackets worn by various dummies and to help determine the appropriate jacket dimensions and tolerances to be specified in the Final Rule.

This procedure was developed for information-gathering purposes only. It should not be construed as a proposed requirement for conformity with Part 572 Subpart O, nor should it be construed as a configuration requirement for use of the dummy in NCAP or any FMVSS.

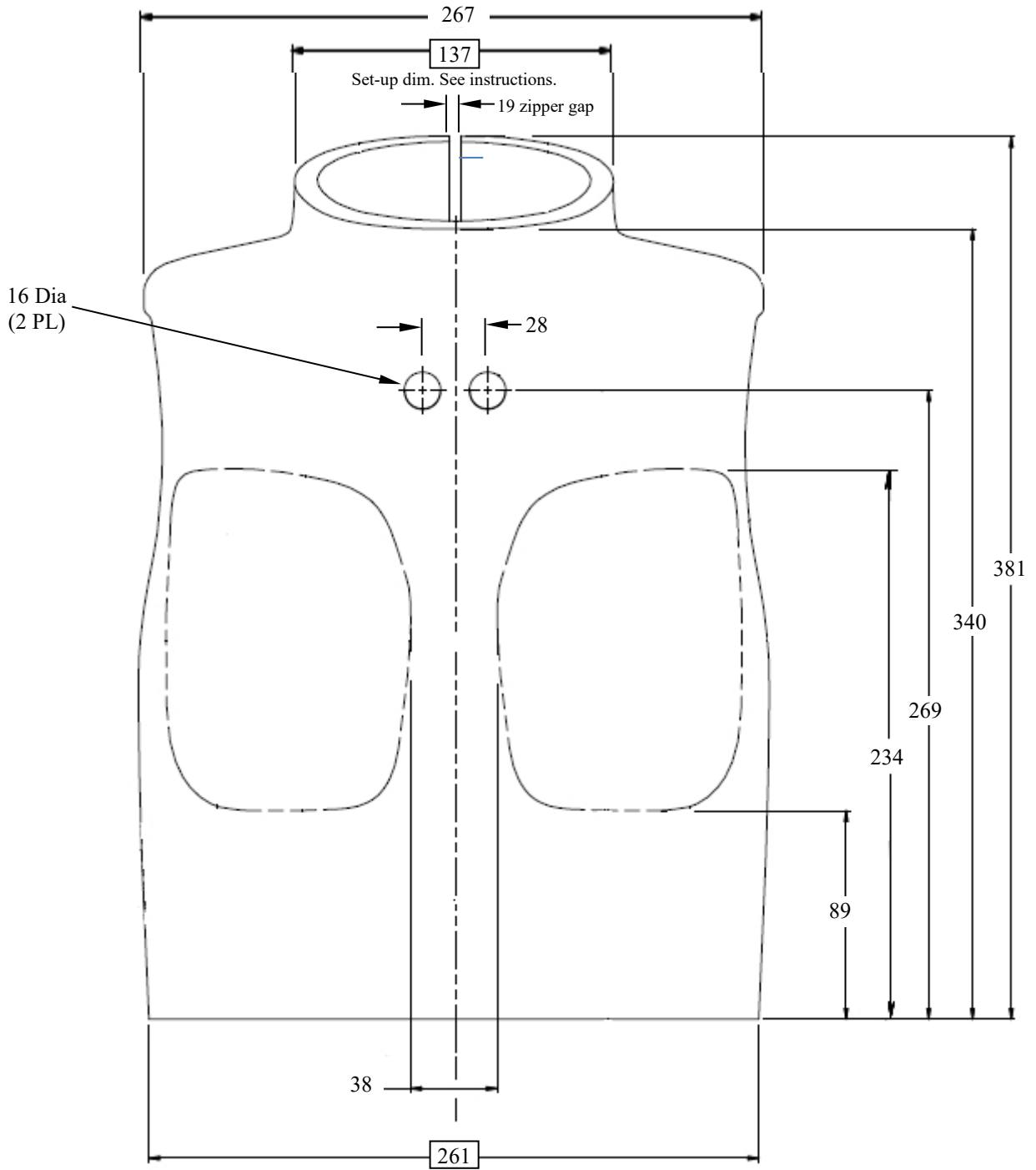
## II. Measurements on an unworn jacket.

Instructions: Measurements shall be taken on a tabletop with the jacket removed from the dummy.

1. Set-up: adjust the jacket so that the width at the lower edge is set at 261 mm (10.3 inches) and the depth at the lower edge is set at 211 mm (8.3 inches). Also, set the neckline dimension, shown on the front view, at 137 mm (5.4 inches). Jigs, stops, or another method of maintaining the jacket in this configuration while taking measurements may be necessary.
2. Record the dimensions of all other measurements shown in the Table 1 and 2.
3. Sternal pad dimensions. Measure the sternal pad dimensions in Table 3 by referring to the SAE drawing in the appendix. These dimensions are taken on the pad adhered to the inner surface of the jacket. Flatten the jacket as needed to record the measurements. Set-up dimensions (step 1) do not apply.

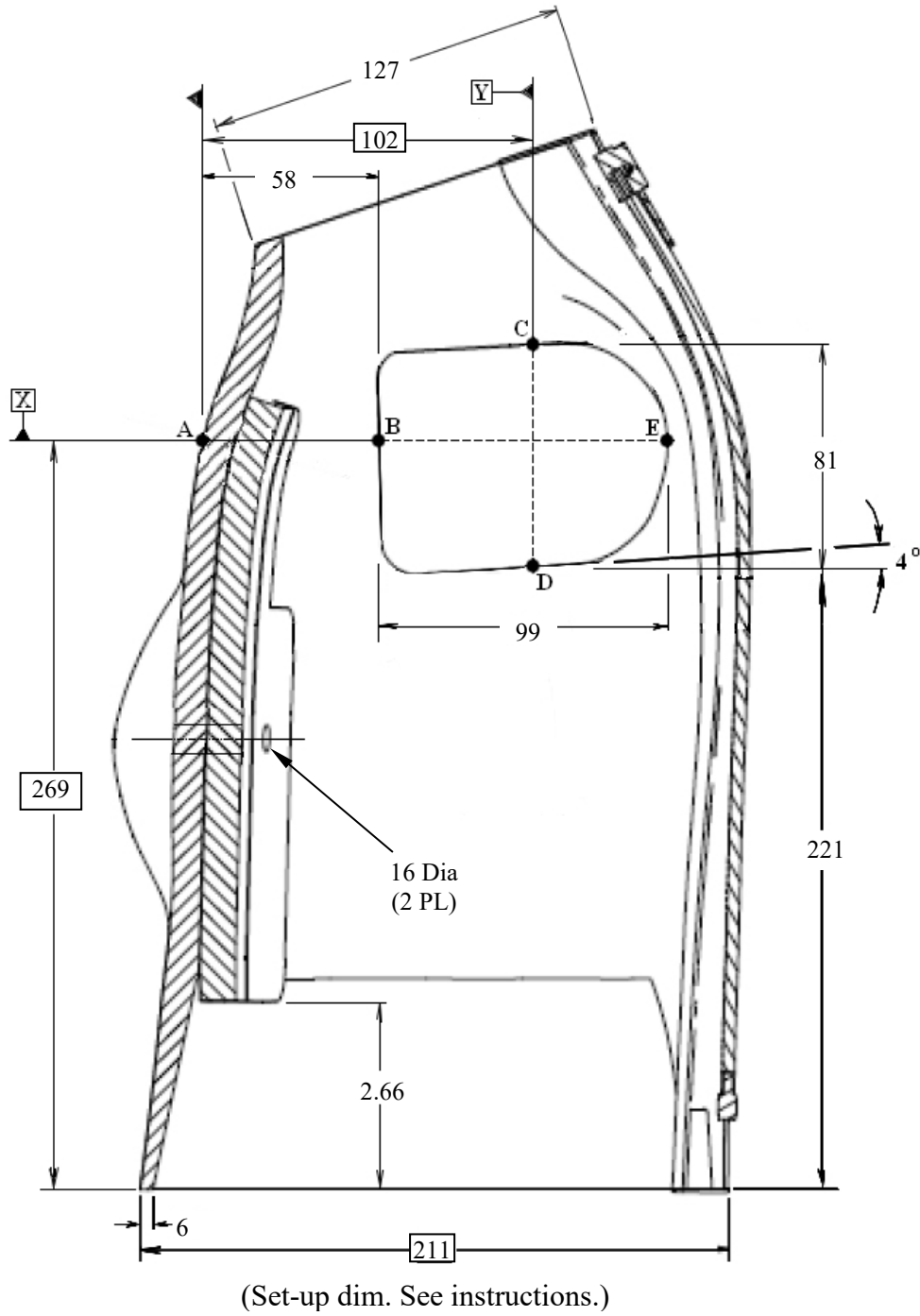
**Note: Dimension for the unworn jacket are given in English units on the SAE Task Force drawings (see appendix). In the front and side views provided herein (Figs. 1 and 2), nominal dimensions are given in metric units and should be recorded using metric units.**

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| NOTE: ALL NOMINAL DIMENSIONS SHOWN IN THE FIGURES AND LISTED IN THE TABLES ARE FOR REFERENCE ONLY. ACTUAL JACKET MEASUREMENTS MAY VARY. |
|---|



(Set-up dim. See instructions.)

**Figure 1. Front View Dimensions (mm)**



**Figure 2. Side View Dimensions (mm)**

**Table 1. Jacket measurements and dimensions, front view.**

| Measurement                        | Nominal Dim. |        |
|------------------------------------|--------------|--------|
|                                    | mm           | (in)   |
| Breadth at shoulder                | 267          | (10.5) |
| Height - rear midsagittal          | 381          | (15.0) |
| Height -front midsagittal          | 340          | (13.4) |
| Height of left access hole center  | 269          | (10.6) |
| Height of right access hole center | 269          | (10.6) |
| Minimum cleavage                   | 38           | (1.5)  |
| Left superior breast location      | 234          | (9.2)  |
| Left inferior breast location      | 89           | (3.5)  |
| Right superior breast location     | 234          | (9.2)  |
| Right inferior breast location     | 89           | (3.5)  |
| Access hole center spacing         | 28           | (1.10) |
| Left access hole diameter          | 16           | (0.62) |
| Right access hole diameter         | 16           | (0.62) |
| Zipper gap                         | 19           | (0.75) |
| Chest flesh assembly weight (lbs)  | 5.2 lbs      |        |

**Table 2. Jacket measurements and dimensions, side view.**

| Measurement                        | Nominal Dim. |        |
|------------------------------------|--------------|--------|
|                                    | mm           | (in)   |
| Depth at neck opening, midsagittal | 127          | (5.0)  |
| Thickness at lower edge            | 6            | (0.25) |
| Left arm slot horiz. clearance     | 99           | (3.9)  |
| Left arm slot vert. clearance      | 81           | (3.2)  |
| Left arm hole vertical location    | 221          | (8.7)  |
| Left arm hole horizontal location  | 58           | (2.3)  |
| Left air hole diameter             | 16           | (0.62) |
| Right arm slot horiz. clearance    | 99           | (3.9)  |
| Right arm slot vert. clearance     | 81           | (3.2)  |
| Right arm hole vertical location   | 221          | (8.7)  |
| Right arm hole horizontal location | 58           | (2.3)  |
| Right air hole diameter            | 16           | (0.62) |
| Sternal pad, lower edge height     | 68           | (2.66) |
| Left arm slot attitude (degrees)   | 4°           |        |
| Right arm slot attitude (degrees)  | 4°           |        |

**Table 3. Sternal Pad dimensions.**

| <b>Measurement</b>     | <b>Nominal Dim.</b> |             |
|------------------------|---------------------|-------------|
|                        | <b>mm</b>           | <b>(in)</b> |
| Air hole center height | 95                  | (3.74)      |
| Overall pad length     | 219                 | (8.63)      |
| Overall pad width      | 203                 | (8.00)      |
| Reduced section length | 143                 | (5.63)      |
| Reduced section width  | 127                 | (5.00)      |
| Nominal pad thickness  | 13                  | (0.50)      |
| Alignment of air holes | Yes                 |             |

Notes.

1. The datums for each arm hole slot is defined as follows:

Horizontal location: Point A is the point on the outer jacket surface at the midline and 269 mm from the bottom edge. From Point A, move horizontally inward until reaching “air” (Point B). Nominal distance is 58 mm.

Vertical clearance: Starting from Point A, move horizontally inward exactly 102 mm (4 inches). This marks the location of vertical Plane Y. Measure the arm hole clearance along the Plane Y (i.e., the distance between Points C and D). Nominal clearance is 81 mm.

Horizontal clearance: Point A also marks the location of horizontal Plane X. Measure the arm hole clearance along Plane X (i.e., the distance between Points B and E). Nominal clearance is 99 mm.

Vertical location: Measure the vertical distance from the bottom edge of the jacket to Point D. Nominal distance is 221 mm.

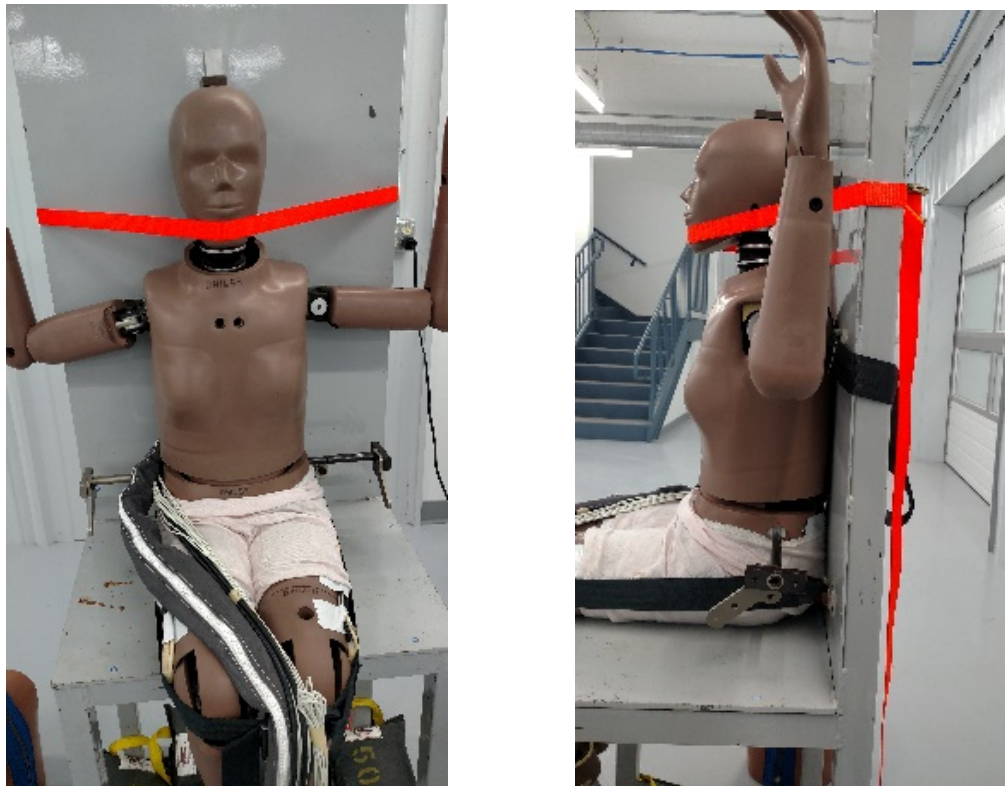
2. When measuring to the center of the access holes or using them as a datum, it may be advantageous or even necessary to fill them with plugs having center-marks to provide a more definitive reference point.



### III. External jacket measurements as worn on a dummy.

Instructions (adapted from HIII-5F PADI, page 81). Measurements shall be recorded on the jacket as worn on a dummy positioned on the same flat-back bench as what is currently shown in the PADI (Fig. 107) and in the assembly drawing. 800105-000, Complete assembly, 5th female, Rev. J, Sheet 5.

1. Seat the dummy on a flat, rigid, smooth, clean, dry, horizontal surface. The seating surface must be at least 406 mm (16 in) wide and 406 mm (16 in) deep, with a vertical section at least 406 mm (16 in) wide and 914 mm (36 in) high attached to the rear of the seating fixture. The dummy's midsagittal plane is vertical and centered on the test surface.
2. Position the dummy's H-point so it is  $83.8 \pm 2.5$  mm ( $3.3 \pm 0.1$  in) above the horizontal seating surface and  $147.3 \pm 2.5$  mm ( $5.8 \pm 0.1$  in) forward of the rear vertical surface of the fixture. (Note: the H-point is located 68.6 mm (2.7 in) forward and 58.4 (2.3 in) downward from the center of the square hole in the pelvis.)
3. Extend the dummy's neck so that the base of the skull is level both fore-and-aft and side-to-side, within 0.5 degrees. The rear surface of the skull cap should be  $45.7 \pm 2.5$  mm ( $1.8 \pm 0.1$  in) from the vertical surface of the test fixture. A strap or bungee cord may be placed around the dummy's head to stabilize the head in this position.



**Figure 3. Front and side views of the HIII-5F strapped in place with H-point tool inserted into pelvis.**

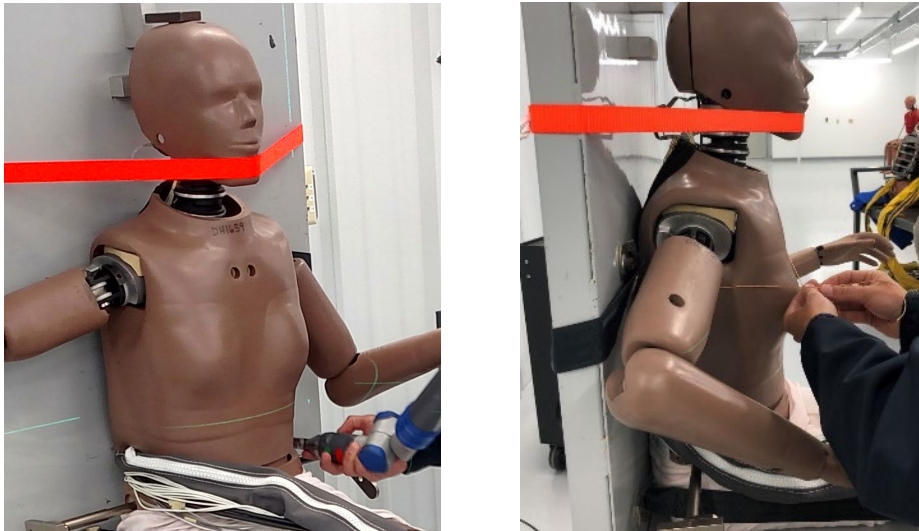
4. Establish the sagittal midline of the dummy. The midline is coincident with the vertical plane passing through the anterior-most point of the lowest (of 3) intervertebral discs of the molded neck.
5. Record the locations of the anterior most points on the jacket (left and right) as follows:

x-coordinate with respect to the bench back plate

y-coordinate with respect to the dummy midline

z-coordinate with respect to the midpoint of a line segment connecting the right and left H-points

Note: x,y,z axes are parallel to the bench. Arms may be repositioned as needed.



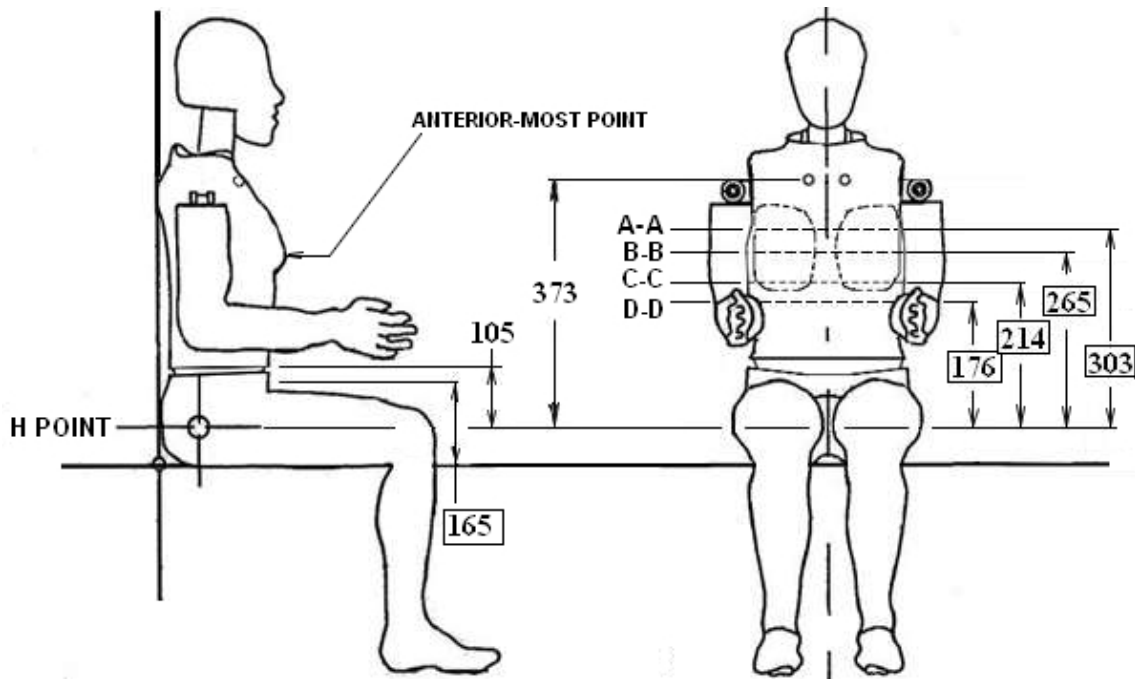
**Figure 4. Measurement coordinates may be defined with the aid of a Faro arm and laser level (left); circumference measurements may be determined by using a taut string (right).**

6. Reposition the jacket, if necessary. If the z-coordinates recorded in Step 5 are within 5 mm of the target height of 265 mm, go directly to Step 7. If they are not, re-seat the jacket by rolling it fore/aft against the shoulders in an attempt to move the z-coordinate closer to the target height while maintaining the position of the H-point. The re-seated jacket shall rest in contact with the underlying shoulder pads with no gap between the pads and the jacket or between the pads and the clavicle castings. Re-record the locations of the anterior-most points by overwriting those taken in Step 5.

*Note: The goal of this exercise is to collect data to assess the variability of the dummy's torso anthropometry due to differences in manufactured dummy components, including the jacket and the underlying skeletal parts. Step 6 is performed to lessen any variability introduced by end-users in how the jacket is positioned on the dummy.*

7. Record the remaining dimensions shown in the "Worn Exterior Measurements" in Figs. 5 and 6 and Tables 3 and 4 for each dummy. Neither the dummy nor the jacket shall be nudged, repositioned, or readjusted in this step.

NOTE: ALL NOMINAL DIMENSIONS SHOWN IN THE FIGURES AND LISTED IN THE TABLES ARE FOR REFERENCE ONLY. ACTUAL JACKET MEASUREMENTS MAY VARY.

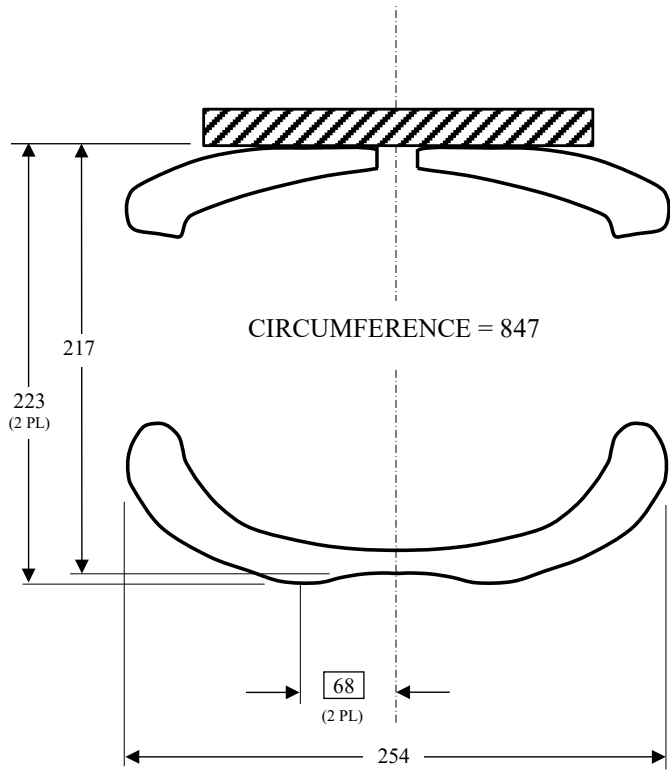


**Figure 5. Seated Reference Dimensions (mm)**

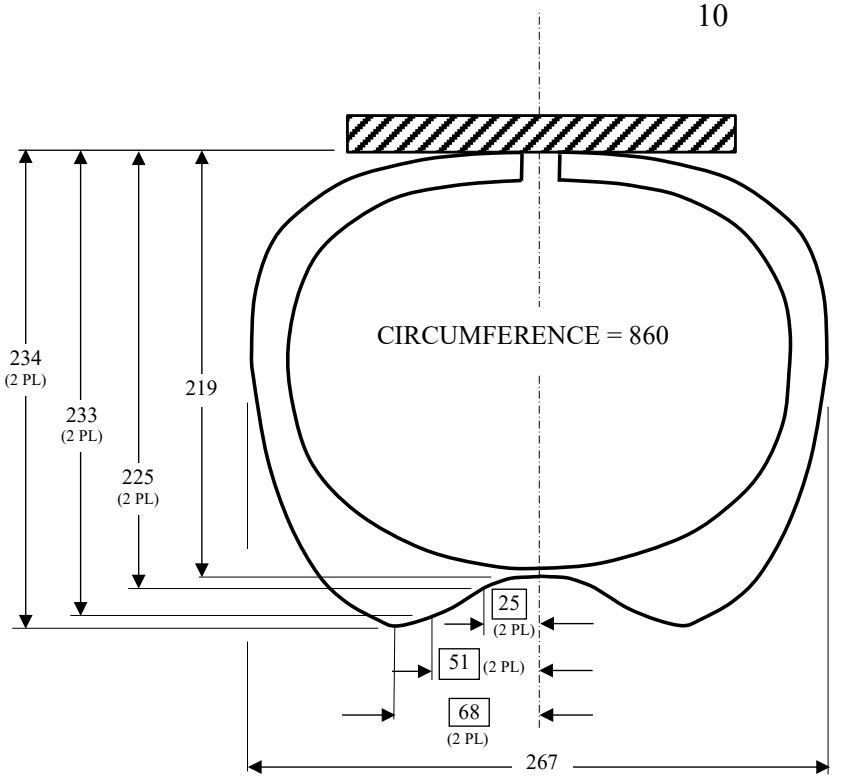
(Adapted from 880105-000, Rev J Sheet 5 of 6, Complete Assembly, 5th Female)

**Table 3. Jacket measurements coordinates, full dummy.**

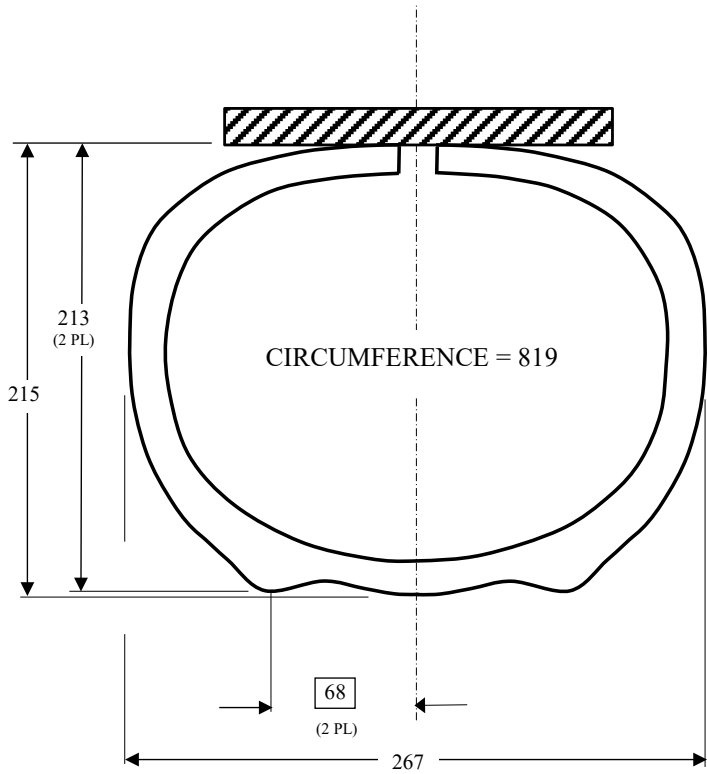
| Measurement   | Nominal Dimension (mm) |
|---|------------------------|
| <i>Existing Subpart O requirements</i>                                |                        |
| Circumference at 165 mm (waist)                                       | 775                    |
| <i>New measurements – section heights from H-pt</i>                   |                        |
| Center of left upper access hole                                      | 373                    |
| Center of right upper access hole                                     | 373                    |
| Lower edge of the jacket, anterior point on midline                   | 105                    |
| <i>Coordinates of H-pts (relative to the bench coordinate system)</i> |                        |
| x,y,z coordinates, left H-pt  | (147, tbd, 84)         |
| x,y,z coordinates, right H-pt   | (147, tbd, 84)         |
| <i>Coordinates for anterior-most points, left and right</i>           |                        |
| x,y,z coordinates, left aspect  | (234, -68, 265)        |
| x,y,z coordinates, right aspect                                       | (234, +68, 265)        |



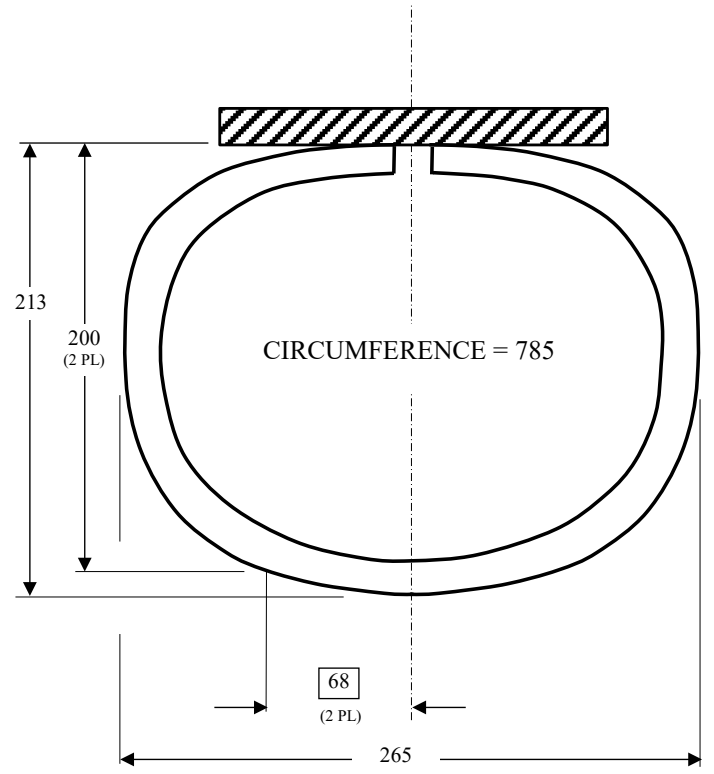
SECTION A-A



SECTION B-B



SECTION C-C



SECTION D-D

Figure 6. Section Dimensions (mm)

**Table 4. Jacket section measurements and dimensions.**

| Section                             | Measurement                             | Nominal dim. (mm) |
|-------------------------------------|---|-------------------|
| A-A<br>303 mm above<br>average H-pt | Depth @ 68 mm offset, left              | 223               |
|                                     | Depth @ 68 mm offset, right             | 223               |
|                                     | Sternal Depth                           | 217               |
|                                     | Breadth                                 | 254               |
|                                     | Circumference                           | 847               |
| B-B<br>265 mm above<br>average H-pt | Depth @ 68 mm offset, left              | 234               |
|                                     | Depth @ 51 in offset., left             | 233               |
|                                     | Depth @ 25 mm offset., left             | 225               |
|                                     | Depth @ 68 mm offset, right             | 234               |
|                                     | Depth @ 51 mm offset, right             | 233               |
|                                     | Depth @ 25 mm offset., right            | 225               |
|                                     | Sternal Depth                           | 219               |
|                                     | Breadth                                 | 268               |
| Circumference                       | 860                                     |                   |
| C-C<br>214 mm above<br>average H-pt | Depth @ 68 mm offset, left              | 213               |
|                                     | Depth @ 68 mm offset, right             | 213               |
|                                     | Sternal Depth                           | 215               |
|                                     | Breadth                                 | 267               |
|                                     | Circumference                           | 819               |
| D-D<br>176 mm above<br>average H-pt | Depth @ 68 mm offset, left              | 200               |
|                                     | Depth @ 68 mm offset, right             | 200               |
|                                     | Sternal Depth                           | 213               |
|                                     | Breadth                                 | 265               |
|                                     | Circumference                           | 785               |
| Center of Access<br>Holes           | Height above avg H-pt, left access hole | 373               |
|                                     | Depth, left access hole                 | 208               |
|                                     | Height avg H-pt, right access hole      | 373               |
|                                     | Depth, right access hole                | 208               |

Notes:

Circumference. This measurement shall be taken with a string or flexible tape measure that will span any gaps along the jacket surface contour of the jacket.

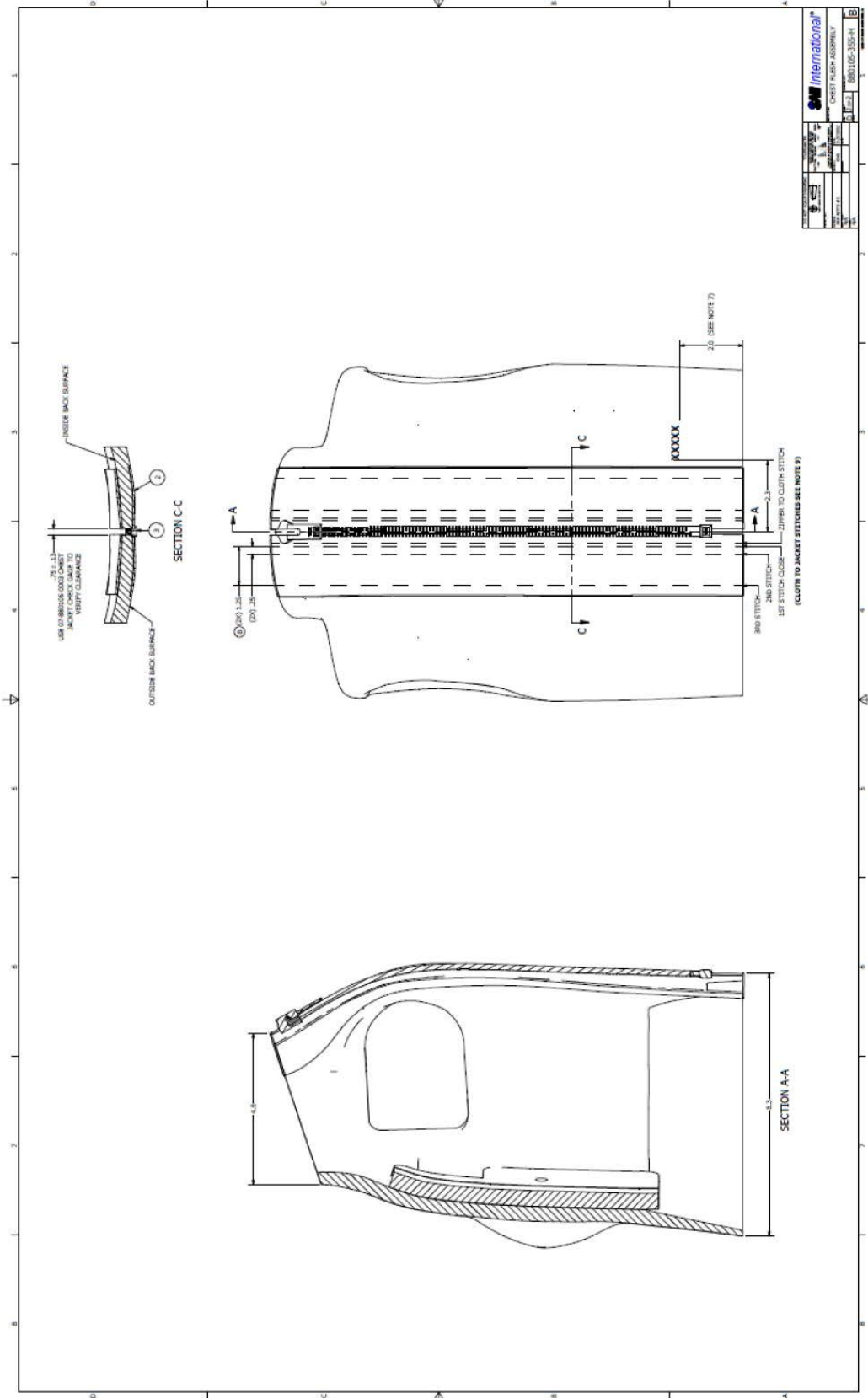
**Appendix**

**SAE J2921**

**Jacket Drawings**

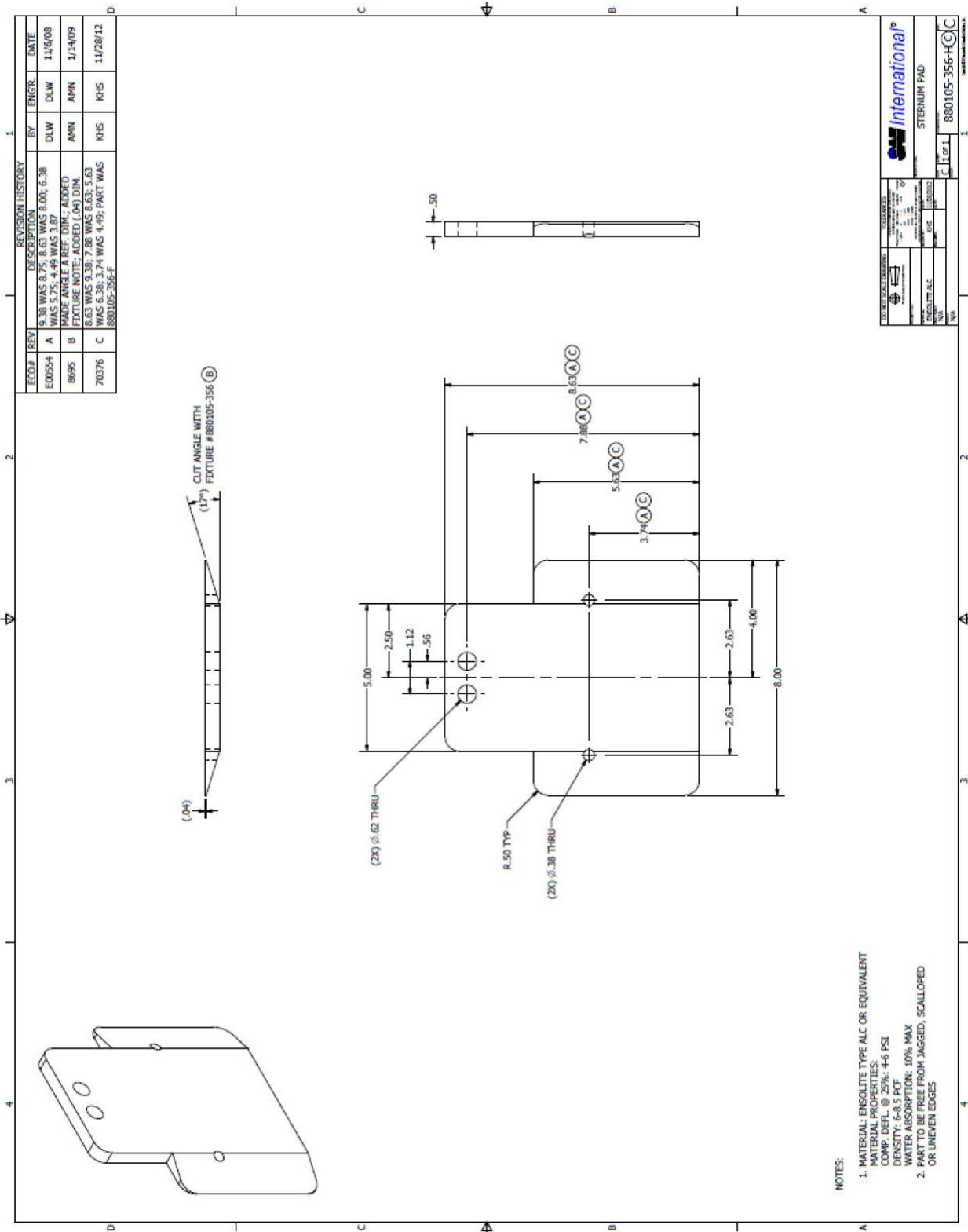
**Hybrid III 5th Percentile Female Dummy**





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