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An American National Standard

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TRUCK DRIVER STOMACH POSITION

***Foreword*—**This Document has not changed other than to put it into the new SAE Technical Standards Board Format.

***1. Scope*—**This SAE Recommended Practice describes two-dimensional 95th percentile truck driver side view, seated stomach contours for horizontally adjustable seats (see Figure 1). There is one contour and three locating lines to accommodate male-to-female ratios of 50:50, 75:25, and 90:10 to 95:5.

2. References

2.1 Applicable Publications—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the latest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1100—Motor Vehicle Dimensions
SAE J1516 OCT85—Accommodation Tool Reference Point
M.S. Sanders (1983), "U.S. Truck Driver Anthropometric and Truck Workspace Data Survey," Final Report Submitted to: Society of Automotive Engineers, Inc., Warrendale, PA.
B. E. Shaw and M. S. Sanders (1984), "Female U.S. Truck Driver Anthropometric and Truck Workspace Data Survey," Final Report Submitted to: Society of Automotive Engineers, Inc., Warrendale, PA.

3. Definitions

3.1 Driver's Stomach Range—A statistical representation of the driver's stomach location in a heavy-duty truck or bus with horizontally adjustable seats.

3.2 Driver's Stomach Contour—An arc with a radius of 157.46 mm which defines the driver's stomach range.

3.3 The following definitions of interior dimensions are given in SAE J1100:

a. H-point
b. H-point height (H30)
c. Steering wheel diameter (W9)
d. Back angle (140)
e. Seat track travel (L23)

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3.4 Vehicle Accommodation Tool Reference Point—A two-dimensional side view line which defines a horizontal reference point as a function of H-point height to which stomach contours can be located in vehicle space. Three different lines are provided to accommodate truck driver populations with male-to-female ratios of 50:50, 75:25, and 90:10 to 95:5. (See SAE J1516.)

3.5 Stomach Position Locator Line—A series of two-dimensional side view lines which define the stomach contour x and z locations as a function of H-point height (H30). Three seats of locator lines are defined to accommodate truck driver populations with male-to-female ratios of 50:50, 75:25, and 90:10 to 95:5. The three lines are defined using one of two methods.

3.5.1 The x and z values for the stomach position locator lines can be obtained from the following equations:

For 50:50 male-to-female mix:

$$x = (-752.657 + 1.0461(H30)) - 2(((-752.657 + 1.0461(H30)) - (-368.243 + 0.4462(H30)))) \quad \text{(Eq. 1)}$$

$$z = 249.319 - 0.1127(H30) \quad \text{(Eq. 2)}$$

For 75:25 male-to-female mix:

$$x = (-765.65 + 1.0149(H30)) - 2(((-765.65 + 1.0149(H30)) - (-391.943 + 0.4595(H30)))) \quad \text{(Eq. 3)}$$

$$z = 240.182 - 0.0891(H30) \quad \text{(Eq. 4)}$$

For 90:10 to 95:5 male-to-female mix:

$$x = (-788.548 + 1.0451(H30)) - 2(((-788.548 + 1.0451(H30)) - (-424.852 + 0.5087(H30)))) \quad \text{(Eq. 5)}$$

$$z = 235.894 - 0.0793(H30) \quad \text{(Eq. 6)}$$

4. Background—The stomach contours were obtained by developing data gathered during the Truck Driver Anthropometric and Work Space Survey (see M. S. Sanders 1983 and B. E. Shaw and M. S. Sanders 1984). This survey utilized a static seating buck in which drivers were photographed in three seat heights for three different configurations. From the photographs, two points were identified on each subject in the stomach region. The first of the two points was the maximum forward protrusion of the stomach. The second point was found by determining the intersection of the driver's lap with the upper edge of a seat belt that was provided for subjects during testing. Using photogrammetric techniques, these two points were related in true scale and referenced from the seat H-point. At this point, the data was separated by male and female and using statistical techniques, recombined to form four male-to-female population ratios of 50:50, 75:25, 90:10, and 95:5. Ellipses were generated based on the four population ratios representing 95th percentile accommodation levels for the two data points, lap and stomach protrusion.

Individual stomach contours were then drawn for each population ratio for the three different seat heights for one of the three configurations. The contours were drawn so as to encompass the lap ellipse, the protrusion ellipse, and a point selected by the intersection of a horizontal line tangent to the top of the protrusion ellipse and a vertical line tangent to the front of the protrusion ellipse. The stomach contours were fit first by a best fit curve procedure and adjusted from there to fit the criteria stated previously. Due to curve similarities, the locating lines for the 90:10 and 95:5 male-to-female population ratios were combined.

There is one general curve which can be used to accommodate drivers in heavy truck design for three ranges of male-to-female population ratios. These curves are representative of stomach locations in a truck environment and can be used to provide stomach definition.

5. Application

5.1 The stomach position contours provide a drafting tool from which driver stomach locations can be described in vehicles with horizontally adjusted seats.

5.2 The stomach position contours are applicable only to motor vehicles, whether trucks, buses or multipurpose passenger vehicles with bucket or bench seats, that are within the following range of driver workspace dimensions:

- **a.** (L40) Back angle: 11.0 to 18 degrees
- **b.** (H30) H-Point heights: 405 to 530 mm
- **c.** (W9) Steering wheel diameter: 450 to 560 mm
- **d.** (L23) Normal driving seat track travel greater than 100 mm

6. Stomach Position Contour Locator

6.1 Use the method described in SAE J1516 to locate reference line in vehicle space. Select the point on this line at the workspace H-point height (H30). This point defines the stomach contour reference station.

6.2 Use the appropriate stomach position locator line for the population mix to be accomodated. Solve the equations in 3.5 using the desired H-point height (H30) or use the values from Tables 1, 2, or 3 to determine the x and z stomach contour coordinates in mm forward and above H30 on the accommodation tool reference point.

TABLE 1—TRUCK DRIVER STOMACH CONTOUR (50:50 MALE-TO-FEMALE RATIO)

HP	X	Z
405	–46.0775	203.676
410	–46.846	203.112
415	–47.6145	202.549
420	–48.383	201.985
425	–49.1515	201.421
430	–49.92	200.858
435	–50.6885	200.295
440	–51.457	199.731
445	–52.2255	199.167
450	–52.994	198.604
455	–53.7625	198.041
460	–54.531	197.477
465	–55.2995	196.913
470	–56.068	196.35
475	–56.8365	195.787
480	–57.605	195.223
485	–58.3735	194.66
490	–59.142	194.096
495	–59.9105	193.532
500	–60.679	192.969
505	–61.4475	192.406
510	–62.216	191.842
515	–62.9845	191.278
520	–63.753	190.715
525	–64.5215	190.152
530	–65.29	189.588

TABLE 2—TRUCK DRIVER STOMACH CONTOUR (75:25 MALE-TO-FEMALE RATIO)

HP	X	Z
405	–57.0755	204.096
410	–57.555	203.651
415	–58.0345	203.205
420	–58.514	202.76
425	–58.9935	202.314
430	–59.473	201.869
435	–59.9525	201.423
440	–60.432	200.978
445	–60.9115	200.532
450	–61.391	200.087
455	–61.8705	199.641
460	–62.35	199.196
465	–62.8295	198.75
470	–63.309	198.305
475	–63.7885	197.859
480	–64.268	197.414
485	–64.7475	196.968
490	–65.227	196.523
495	–65.7065	196.077
500	–66.186	195.632
505	–66.6655	195.186
510	–67.145	194.741
515	–67.6245	194.295
520	–68.104	193.85
525	–68.5835	193.404
530	–69.063	192.959

TABLE 3—TRUCK DRIVER STOMACH CONTOUR (95:5 AND 90:10 MALE-TO-FEMALE RATIO)

HP	X	Z
405	–72.3745	203.777
410	–72.513	203.381
415	–72.6515	202.984
420	–72.79	202.588
425	–72.9285	202.191
430	–73.067	201.795
435	–73.2055	201.398
440	–73.344	201.002
445	–73.4825	200.605
450	–73.621	200.209
455	–73.7595	199.812
460	–73.898	199.416
465	–74.0365	199.019
470	–74.175	198.623
475	–74.3135	198.226
480	–74.452	197.83
485	–74.5905	197.433
490	–74.729	197.037
495	–74.8675	196.64
500	–75.006	196.244
505	–75.1445	195.847
510	–75.283	195.451
515	–75.4215	195.054
520	–75.56	194.658
525	–75.6985	194.261
530	–75.837	193.865

6.3 Using the point described in 6.2 as the center, draw an arc on the forward side of this point with a radius of 157.5 mm. This arc should sweep through 50 degrees above and 50 degrees below a horizontal line drawn through the point found in 6.2. (See Figure 1.)