

# SURFACE VEHICLE RECOMMENDED PRACTICE

J1522

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Superseding J1522 FEB2009

## Truck Driver Stomach Position

### RATIONALE

J1522 has been reaffirmed to comply with the SAE five-year review policy.

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—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 sets 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 accommodated. Solve the equations in 3.5 using the desired H-point height (H30) or use the values from Table 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 |