



SURFACE VEHICLE STANDARD

J1052™

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Motor Vehicle Driver and Passenger Head Position

RATIONALE

This revision clarifies the basis of the head position contour shape and adds a locating procedure for front passenger head position contours to Appendix C. In addition, definitions were added referring to SAE J941 and updated to align with SAE J1100, and in 7.2, the coefficient of A40 was corrected (used to calculate the side view fixed seat eyellipse angle).

SAE J1052 has been reaffirmed to comply with the SAE Five-Year Review policy.

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1. SCOPE

This SAE Standard describes head position contours and procedures for locating the contours in a vehicle. Head position contours are useful in establishing accommodation requirements for head space and are required for several measures defined in SAE J1100. Separate contours are defined depending on occupant seat location and the desired percentage (95 and 99) of occupant accommodation.

This document is primarily focused on application to Class A vehicles (see SAE J1100), which include most personal-use vehicles (passenger cars, sport utility vehicles, pick-up trucks). A procedure for use in Class B vehicles can be found in Appendix B.

2. REFERENCES

2.1 Applicable Documents

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.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J941	Motor Vehicle Drivers' Eye Locations
SAE J1100	Motor Vehicle Dimensions
SAE J1516	Accommodation Tool Reference Point
SAE J1517	Driver Selected Seat Position

3. DEFINITIONS

The following terms are defined in SAE J941

3.1 Eyellipse

3.2 Cyclopean (Mid-Eye) Eyellipse

The following terms are defined in SAE J1100.

3.3 Accelerator Heel Point, AHP

3.4 AHP Z Coordinate, H8

3.5 Ball of Foot Reference Point, BOFRP

3.6 Ball of Foot Reference Point (BOFRP) to Steering Wheel Center, L6

3.7 BOFRP X Coordinate, L1

3.8 Seat Height, H30

3.9 Seating Reference Point, SgRP

3.10 SgRP Y Coordinate, W20

3.11 H-Point Travel Path, TL23

3.12 Torso Angle, A40

3.13 Steering Wheel Center

4. USING THE HEAD POSITION CONTOURS IN DESIGN

The following considerations should be kept in mind when applying head position contours during design. Head position contours are models that describe occupant head locations for a population, not an individual. In this document, the head contours for Class A vehicles are based on a USA population having an equal number of males and females. The original Head position contours were constructed as tangent cutoff tools by applying a mean head profile (SAE Paper 750356) to the appropriate tangent cutoff eyellipse (see Figure 1). This means that a plane drawn tangent to the surface of a 95 percentile head position contour will result in 95% of the head locations lying on one side of the plane, while 5% will be on the other. It does not mean that the 95th percentile head position contour contains 95 percent of occupant head locations inside its surface.

The surface of a head position contour represents the surface of the population of heads with hair. If the top of the 95% head contour is just touching a vehicle surface, this means that 5% of a population consisting of half males/half females would have their head or hair contacting a vehicle surface when sitting in their preferred seating posture. Designers will need to add additional clearance around the head contours in order to prevent occupants' head or hair from touching vehicle surfaces and structures in normal driving or riding postures.

5. SELECTING THE CORRECT HEAD POSITION CONTOUR

Three factors determine which head contour to use: H-Point Travel Path (TL23), desired accommodation percentile value, and occupant seat location.

5.1 H-Point Travel Path, TL23

The size and location of the head position contour varies depending on the amount of fore/aft H-Point Travel Path, or seat track travel, available. There are three categories of seat track travel: 0 mm (fixed seat), up to 133 mm, and greater than 133 mm.

Seat track travel also determines the side view angle of the contour. For adjustable seats (track travel greater than 0 mm), the head contour is tipped down in front 12 degrees. Head contours for fixed seats are not tipped.

5.2 Accommodation Percentile Values

Head position contours for 95th and 99th accommodation percentiles are provided. Percentile value affects the size of the contour, with the 99th percentile contour larger than the 95th. Only the 95th percentile head position contours are required for dimensions given in SAE J1100.

5.3 Occupant Seat Location

5.3.1 Front Row

For the driver and front outboard passenger, the head position contours are 23 mm wider in rear view than for other occupants (see 6.3 and A.1.2). The additional 23 mm is located outboard of occupant centerline. There are 6 possible head position contours available for the driver and front outboard passenger depending on the amount of seat track travel available and the desired accommodation percentile value. Adjustable seat head position contours are also used for the center occupant in the front row. In this case, the 23 mm segment should not be incorporated into the adjustable seat head contour.

5.3.2 Second and Succeeding Rows

For occupant seat locations behind the front row, only two contours are provided – 95th percentile fixed seat and 99th percentile fixed seat.

If the 2nd or succeeding row seat has fore/aft H-point adjustment, with a seat back angle that is either fixed or adjustable, there are no field data available on which to base a procedure for selecting or locating a head contour. Until such data are available, select the 95% or 99% fixed seat head contour, locate it from the manufacturer's SgRP and design torso angle, and then sweep the head contour along the range of normal riding fore/aft seat adjustment. The swept volume defines the range of rider head locations. If the manufacturer's SgRP or design torso angle is unknown, use the rearmost, lowest normal riding position and a torso angle of 25 degrees to position the contour.

6. HEAD POSITION CONTOUR GEOMETRY

Head position contours are constructed by modifying 3-D ellipsoids. The size of the initial ellipsoid, defined by the length of the X, Y, and Z axes, depends on the desired accommodation percentile value and amount of seat track travel. The centroid of the initial ellipsoid is the point used for positioning the completed head contour.

The size and shape of the completed head contour depends on the desired percentile value, amount of seat track travel, and occupant seat location.

6.1 Construct an Ellipsoid

Construct the appropriate ellipsoid using the values in Table 1. Identify the centroid of the ellipsoid and maintain this point.

Table 1 - Ellipsoid axes dimensions (mm)

Percentile Value	H-Point Travel Path (TL23)	Axis Length from Centroid X	Axis Length from Centroid Y	Axis Length from Centroid Z
95th	>133 mm	± 211.25	± 143.75	± 133.50
	< or = 133 mm	± 198.76	± 143.75	± 133.50
	0 mm (fixed seat)	± 161.45	± 143.41	± 147.07
99th	>133 mm	± 246.04	± 166.79	± 151.00
	< or = 133 mm	± 232.40	± 166.79	± 151.00
	0 mm (fixed seat)	± 181.25	± 165.20	± 171.20

6.2 Discard Lower Half

The lower half of the ellipsoid is not used in any of the contours and should be discarded. The centroid identified in 5.1 will now be centered at the bottom of the completed contour.

NOTE: This completes construction of the head contours for fixed seat rear passengers (see Figure 2).

6.3 Extend Contour, Driver and Front Row Outboard Passenger Only

Head position contours used for driver and front row outboard passengers are asymmetrical in rear view. The contours extend 23 mm farther on the outboard side than on the inboard side (see A.1.2). Note in this case the ellipsoid centroid will not be at the center of the completed head contour (see Figure 3).

To extend the contour, divide the symmetrical contour in half along the lateral (Y) centerplane, while maintaining the position of the ellipsoid centroid relative to the *inboard* section. Following the x,z curve of the ellipsoid centerline section, create a lateral segment 23 mm wide. Put this in the middle of the divided contour. The inboard edge of the 23 mm segment is located at the same Y as the ellipsoid centroid. Dimensions for the completed head position contours are provided in Table 2 (95th percentile contours) and Table 3 (99th percentile contours).

Table 2 - 95th Percentile head position contour dimensions: distance from ellipsoid centroid to outer edge of the head position contour (mm)

Occupant Seat Location	H-Point Travel Path (TL23)	X	Y		Z
			INBOARD	OUTBOARD	
Driver and Front Outboard Passenger	>133 mm	± 211.25	143.75	166.75	+ 133.50
	< or = 133 mm	± 198.76	143.75	166.75	+ 133.50
	0 mm (fixed seat)	± 161.45	143.41	166.41	+ 147.07
Front Center Passenger	>133 mm	± 211.25	143.75	143.75	+ 133.50
	< or = 133 mm	± 198.76	143.75	143.75	+ 133.50
All Other Passengers	0 mm (fixed seat)	± 161.45	143.41	143.41	+ 147.07