



SURFACE VEHICLE RECOMMENDED PRACTICE

J1516™

DEC2024

Issued 1985-10
Revised 2011-10
Reaffirmed 2024-12

Superseding J1516 OCT2011

Accommodation Tool Reference Point for Class B Vehicles

RATIONALE

Previously this practice provided procedures for determining accommodation tool reference points and seating reference point for both Class A vehicles (Passenger Cars and Light Trucks) and Class B vehicle (Heavy Trucks and Buses). Procedures for Class A vehicles have been updated, removed from J1516 and J1517 and are now provided in SAE J4004 Positioning the H-Point Design Tool – Seating Reference Point and Seat Track Length. This practice has been revised to apply only to Class B vehicles.

Revisions made to the Class B vehicle procedures in this edition of J1516 include improved procedures for determining the Accelerator Heel Point (AHP) and shoe plane angle, and utilization of the new definitions and procedures in SAE J1100.

SAE J1516 has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

This Recommended Practice provides procedures for defining the Accelerator Heel Point and the Accommodation Tool Reference Point, a point on the seat H-point travel path which is used for locating various driver workspace accommodation tools in Class B vehicles (heavy trucks and buses). Three accommodation tool reference points are available depending on the percentages of males and females in the expected driver population (50:50, 75:25, and 90:10 to 95:5).

These procedures are applicable to both the SAE J826 HPM and the SAE J4002 HPM-II.

2. REFERENCES

2.1 Applicable Documents

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

SAE J1100 Motor Vehicle Dimensions

SAE J1517 Driver Selected Seat Position

SAE Executive Standards Committee Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2024 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, or used for text and data mining, AI training, or similar technologies, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
<http://www.sae.org>

SAE WEB ADDRESS:

For more information on this standard, visit
https://www.sae.org/standards/content/J1516_202412/

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 SAE Publications

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

SAE J941	Motor Vehicle Drivers' Eye Locations
SAE J1052	Motor Vehicle Driver and Passenger Head Position
SAE J1521	Truck Driver Shin-Knee Position for Clutch and Accelerator
SAE J1522	Truck Driver Stomach Position
SAE J826	Devices for Use in Defining and Measuring Vehicle Seating Accommodation
SAE J4002	H-Point Machine (HPM-II) Specifications and Procedure for H-Point Determination – Auditing Vehicle Seats
SAE J4003	H-Point Machine (HPM-II) - Procedure for H-Point Determination – Benchmarking Vehicle Seats
SAE J4004	Positioning the H-Point Design Tool – Seating Reference Point and Seat Track Length

N. L. Philippart, R. W. Roe, A. J. Arnold, T. J. Kuechenmeister (1984), "Driver Selected Seat Position Model," SAE Paper No. 840508, Detroit, MI.

M. S. Sanders (1983), "U.S. Truck Driver Anthropometric and Truck Workspace Study," Final Report Submitted to: SAE International, Warrendale, PA.

B. E. Shaw and M. S. Sanders (1984), "Female U. S. Truck Driver Anthropometric and Truck Workspace Study," Final Report Submitted to: SAE International, Warrendale, PA.

3. DEFINITIONS

The following definitions are given in SAE J1100.

- a. H-point
- b. Seat height (H30)
- c. Steering wheel diameter (W9)
- d. Accelerator heel point (AHP)
- e. Seating reference point (SgRP)
- f. Shoe plane
- g. Shoe Plane Angle (A27)
- h. Ball of Foot Reference Point (BOFRP)

3.1 CLASS B VEHICLES

Vehicles whose seat SgRP height (H30) is between 405 and 530 mm, and steering wheel diameter (W9) is between 450 and 560 mm (Figure 1).

NOTE: Class B vehicles include heavy trucks, some medium duty trucks, and some buses. In most cases these vehicles have flat treadle accelerator pedals and horizontal fore/aft seat travel paths.

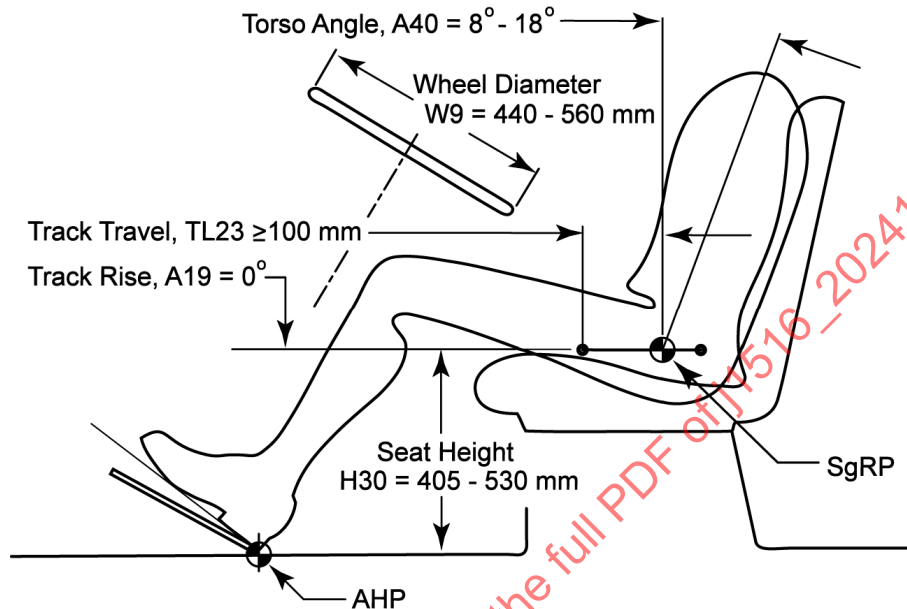


FIGURE 1: DEFINING PARAMETERS FOR CLASS B VEHICLES

3.2 ACCOMMODATION TOOL REFERENCE LINE

Two-dimensional side-view line, defined as a function of H30 for three selected male/female driver population mixes, used to specify a reference point relative to the AHP in the vehicle interior for the purpose of locating driver workspace accommodation tools (Figure 2).

3.3 ACCOMMODATION TOOL REFERENCE POINT (ATRP)

Point at the intersection of the accommodation tool reference line for the given driver population mix and the design H-point travel path (Figure 2).

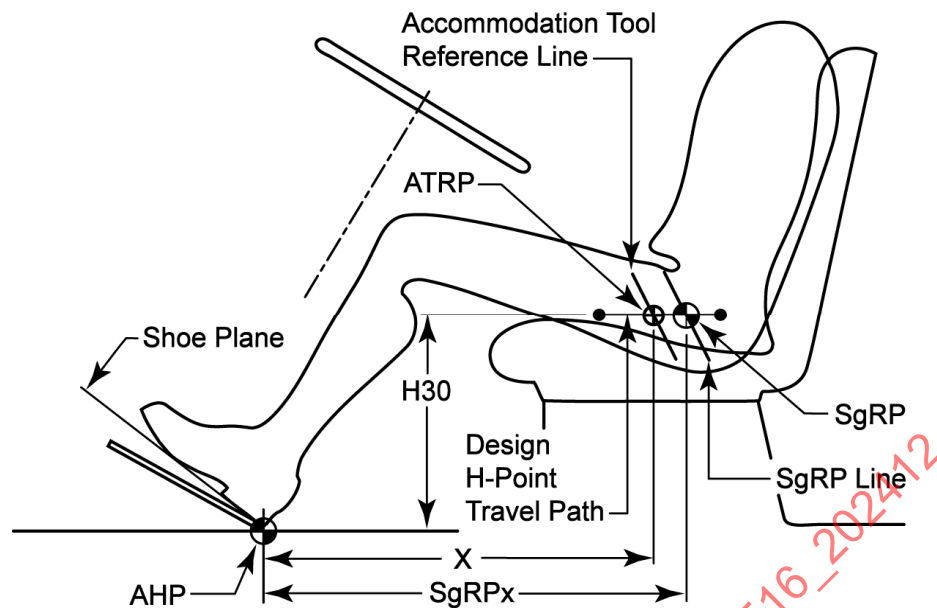


FIGURE 2: ACCOMMODATION TOOL REFERENCE POINT AND SGRP, FLAT SEAT TRACK

3.4 H-POINT TRAVEL PATH

Travel path of seat H-point when the seat is moved through its full range of vertical and fore/aft adjustments.

NOTE: The seat is loaded with a weight equal to that of an SAE H-point machine (or an HPM is installed in the seat per SAE J826 or J4002) and all other seat adjustments are set to the manufacturer's design nominal condition

3.5 DESIGN H-POINT TRAVEL PATH

Fore/aft H-point travel path with the seat vertical adjustment set at its mid-height value.

NOTE: The design H-point travel path is used to determine SGRP and H30.

3.6 SHOE PLANE ANGLE (SPA)

Acute angle of the driver's shoe plane from the horizontal that defines the side view orientation of the HPM shoe.

NOTE 1: The HPM ankle angle is set at 87 degrees with some portion of the shoe in contact with the pedal and the heel at the depressed floor covering. See Figure 3.

NOTE 2: The shoe plane and SPA are defined at the lateral centerline of the undepressed accelerator pedal. The SPA is measured with the pedal in design position and the shoe in contact with the lateral centerline of the pedal pad. When the shoe contacts the pedal pad at a single point, that point is called the Pedal Contact Point (PCP). Where there is continuous contact, e.g. with a flat treadle pedal, there is not a specific PCP. In rear view, the shoe will be square to grid (the shoe is not yawed even if the pedal pad has a yaw angle). If the pedal pad has a roll angle, the shoe should not be rolled to align to the pad, so a portion of the pedal pad on either side of the lateral centerline may penetrate the shoe plane.

NOTE 3: When either the HPM or HPM-II physical devices are used to locate the AHP and ball of foot in an actual vehicle or seating buck the shoe might not contact the accelerator pedal at the pedal centerline due to pedal pad orientation (roll or yaw). This discrepancy will be small and therefore can be ignored. If scan data is obtained on a vehicle it will be possible to adjust the shoe position in CAD to bring it into point contact at the pedal pad centerline.

3.7 ACCELERATOR HEEL POINT (AHP)

Point on the shoe plane where it intersects the depressed floor covering at the lateral centerline of the accelerator pedal.

NOTE: This point defines both the horizontal and vertical reference planes in side view for positioning the Class B accommodation tool reference line. See Figure 3.

3.8 TREADLE PEDAL

Foot pedal hinged so it pivots at the floor (Figure 3).

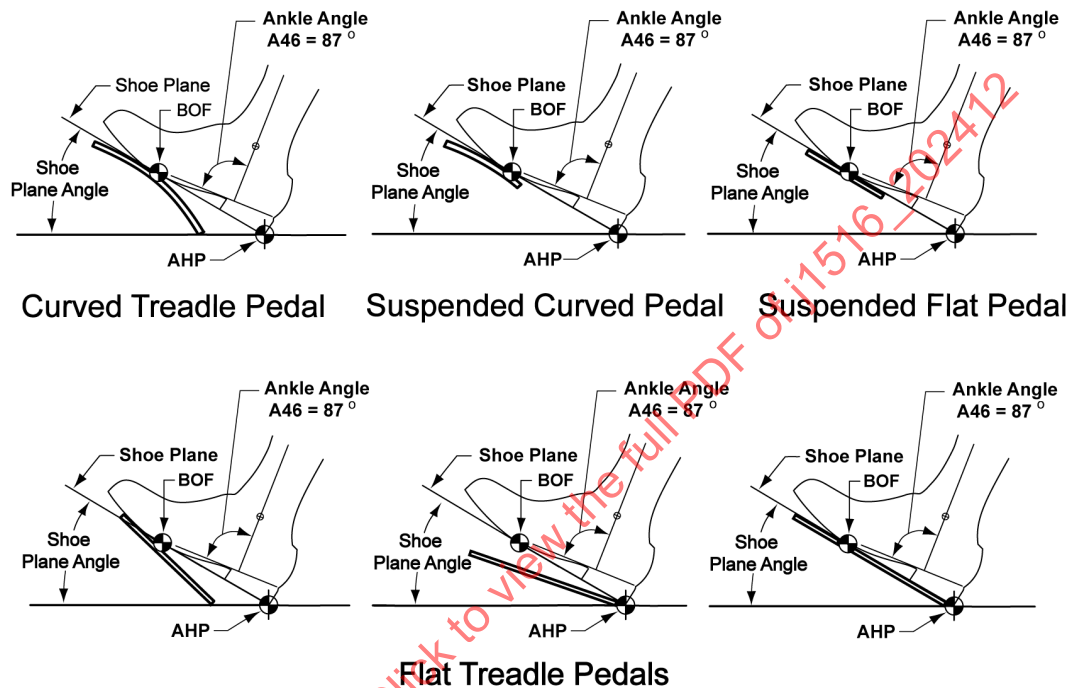


FIGURE 3: ACCELERATOR HEEL POINT LOCATION FOR VARIOUS PEDAL ARRANGEMENTS.

4. BACKGROUND

The accommodation tool reference line is a statistically stable reference line that was determined from a heavy truck workspace study (see References M.S. Sanders 1983 and B.E. Shaw 1984). The workspace simulated three truck cab configurations with SgRP heights of 405, 468, and 530 mm and steering wheel diameters of 457, 508, and 560 mm. All configurations had a treadle accelerator pedal and suspended clutch. Driver selected seat position of male and female heavy truck drivers were collected in the workspace. Data were converted to H-point locations relative to the accelerator heel point reference for each package. The accommodation tool reference line was calculated from the median fore/aft driver H-point (the ATRP) in each vehicle configuration.

Most Class B vehicles have treadle accelerator pedals. With this configuration, the heel point of the 3-D H-point machine has a physical stop to rest against making it less likely for the heel to move as a function of accelerator pedal depression angle.

A statistical technique was used to generate four populations from the original truck workspace data with the following ratios of males and females; 50:50, 75:25, 90:10, and 95:5. Median H-point locations were determined for the three SgRP height configurations by population mix and plotted as a function of SgRP height (H30). Straight lines were fitted to each of the four mixes of data. (Second degree expressions were not used due to paucity of data). Separate equations define horizontal reference points as a function of H30 for truck driver populations with 50:50 and 75:25 male-to-female ratios. The linear expressions for populations with 90:10 and 95:5 male-to-female ratios were very similar. Therefore, one equation, appropriate for both mixes, was developed to define a horizontal reference point as a function of H30.

These three lines, which give horizontal H-point location as a function of H30 for driver populations consisting of male-to-female ratios of 50:50, 75:25, and 90:10 to 95:5 are the accommodation tool reference lines for Class B vehicles.

The SgRP reference line is based 95% driver fore/aft seat accommodation. This line is rearward of the accommodation tool reference line. This procedure is similar in development to the Class A vehicle SgRP location and provides a consistent location for dimensioning a class B seating package. When the HPM or H-point template is positioned at SgRP with its ankle angle (A46) set at 87 degrees, the manikin heel will be at AHP and the shoe plane angle will be given by equation 5.

5. ACCOMMODATION TOOL REFERENCE LINES

Three different lines are provided to reference workspace tools to accommodate truck driver populations with male-to-female ratios of 50:50, 75:25, and 90:10 to 95:5. The reference lines can be determined from the following equations.

$$\begin{aligned} \text{For 50:50 male-to-female ratio:} \\ x = 798.74 - 0.446z \end{aligned} \quad (\text{Eq. 1})$$

$$\begin{aligned} \text{For 75:25 male-to-female ratio:} \\ x = 822.44 - 0.460z \end{aligned} \quad (\text{Eq. 2})$$

$$\begin{aligned} \text{For 90:10 to 95:5 male-to-female ratio:} \\ x = 855.31 - 0.509z \end{aligned} \quad (\text{Eq. 3})$$

where:

x is the horizontal reference location in mm aft of the accelerator heel point, and
z is the vertical H-point location relative to the AHP.

These first degree equations in z define the accommodation tool reference lines. One line is appropriate to reference workspace tools to accommodate truck driver populations with 50% males and 50% females; the second line, populations with 75% males and 25% females; the third line, populations with 90% to 95% males and 10% to 5% females. All accommodation tool reference lines are located in vehicle space relative to vertical and horizontal side-view planes. These planes are defined from accelerator heel point.

5.1 AHP and Accommodation Tool Reference Point Locating Procedures

These procedures are based on the design H-Point travel path location and the given accelerator pedal hardware.

5.1.1 Determine the design H-point travel path.

5.1.2 Determine (or measure) H30.

NOTE 1: H30 is the seat height of the SgRP above the accelerator heel point. See SAE J1517 and J1100.

NOTE 2: For a horizontal design H-point travel path H30 is also the height of this path above the AHP.

5.1.3 Calculate the shoe plane angle for $z = H30$.

$$A27 = \text{Shoe Plane Angle (SPA)} = 5.568E-08z^3 - 4.609E-06z^2 - 0.09461z + 78.385 \quad (\text{Eq 4})$$

5.1.4 In side view place a line or plane at this angle rear of the accelerator pedal. Place the manikin shoe on this line (plane) so the line originates from the shoe heel point. Slide the shoe heel point along the depressed floor covering until the shoe just contacts the pedal surface. The shoe may contact the pedal at some point along the pedal surface or may be tangent to the pedal surface depending on the pedal geometry. See Figures 2 and 3.

NOTE: Either the HPM shoe with a heel pocket or the optional CAD version with no heel pocket may be used. See SAE J826.