SAE INTERNATIONAL

SURFACE VEHICLE RECOMMENDED PRACTICE

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2-D CAD Template for SAE J826 H-point Machine

RATIONALE

The SAE HADD Committee recently developed computer-aided design (CAD) data representing the SAE J826 2-D H-point machine (HPD) template. Prior to this activity, CAD versions of the HPD were created by end users based on scans of the official physical plastic template for SAE 2-D J826. This standard provides traceable documentation for the SAE HPD CAD files that can be used as a design template or can verify the shape/ size compliance of existing templates.

This project coincides with the SAE HADD Committee's creation of CAD surface data for the SAE J826 3-D H-point machine (HPM-1) cushion and back pan outer shells published in J826/1_2011. Previous documentation describing the production SAE J826 HPM was contained in a series of 2-D dimensional layout drawings from 1974, the final assembly fixturing jig, and in other minor build and SAE J826 revisions made over the years.

Key changes to the template since the earlier plastic template versions include:

- Values for the Thigh Length and Lower Leg segment lengths have been updated to reflect values set for the physical HPM-I in J826_2015.
- New segments for the Thigh and Lower Leg were created based on FMVSS 208 (§ 571.208 S10.4.2.1) testing requirements.

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1. SCOPE

This document describes the 2-D computer-aided design (CAD) template for the HPM-1 H-point machine or HPD available from SAE. The elements of the HPD include the curve shapes, datum points and lines, and calibration references. The intended purpose for this information is to provide a master CAD reference for design and benchmarking. The content and format of the data files that are available are also described.

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 J826 Devices for Use in Defining and Measuring Vehicle Seating Accommodation

SAE J826/1 CAD Model for SAE J826® 3-D H-Point Machine

SAE J1100 Motor Vehicle Dimensions

FMVSS 208 (§ 571.208 S10.4.2.1)

3. DEFINITIONS

The following terms are defined in SAE J826 and SAE J1100. When appropriate, added explanation is provided.

3.1 ACCELERATOR HEEL POINT, AHP

3.2 ANKLE (FOOT) ANGLE, A46

3.3 BALL OF FOOT, BOF

3.4 FLOOR REFERENCE POINT, FRP

3.5 H-POINT

3.6 HEEL OF SHOE

3.7 HIP ANGLE, A42

3.8 KNEE ANGLE, A44

3.9 SEATING REFERENCE POINT, SGRP

3.10 SHOE PLANE

3.11 THIGH ANGLE, A57

3.12 THIGH LINE

3.13 TORSO (BACK) ANGLE, A40

3.14 TORSO LINE

3.15 LEG LINE

4. CAD TEMPLATE DATA FOR HPM-1

4.1 Description

The HPM-1 is described in detail in SAE J826, including the installation and calibration procedures of the physical manikin. The CAD 2-D template or HPD described in this document contains dimensional details of the following elements:

- HPD curves
  - Torso segment
  - 95th % Thigh segment [1]
  - 50th % Thigh segment [2]
  - 5th % Thigh segment [2]
  - FMVSS Thigh segment [3]
  - 95th % Lower Leg segment [1]
  - 50th % Lower Leg segment [2]
  - 5th % Lower Leg segment [2]
  - FMVSS Lower Leg segment [3]
  - Shoe segment

[1] Values for the 95th percentile leg lengths were developed on the basis of best judgment of available data by the Design Devices Subcommittee of the SAE Human Factors Engineering Committee at the July 1968 and March 1969 meetings.

[2] S. P. Geoffrey, "A 2-D Manikin - The Inside Story." Paper 267A presented at SAE Automotive Engineering Congress, Detroit, January 1961.

[3] Values for the FMVSS leg lengths were established based on FMVSS 208 (§ 571.208 S10.4.2.1) testing requirements.

- Datum Points and lines
    - Torso Line
    - Weight hanger center point
    - H-point
    - Thigh (Cushion) Line
    - Knee joint
    - Ankle joint
    - Bare Foot Line
    - Heel point
    - Ball of Foot point
- Calibration References
    - Calibration point for cushion pan
    - Calibration points (2) for back pan

The Thigh (Cushion) Angle land, which is a triangular-shaped flat area between the legs, represents the top surface of the metal plate that is mounted on the inner fiberglass surface between the legs of the HPM. This is the only inner HPM surface that is part of the 2D CAD model.

4.2 CAD Assembly and posturing

The Torso segment, the shoe segment, the selected Thigh segment, and the selected Lower Leg segment are required to assemble a complete 2D template. These segments are connected to one another at common points identified on each segment.

- The Torso is connected to the Thigh segment at the H-point.
- The Thigh is connected to the Lower Leg segment at the Knee Joint.
- The Lower Leg segment is connected to the shoe segment at the Ankle Joint. (see Figure 1.)

Four parameters are needed to posture the HPD in a vehicle package: a known torso angle, H-point location, Shoe Plane Angle, and Heel point. These parameters can be determined from a physical installation of the 3-D HPM in a designated seat position, or from manufacturer specifications (see Figure 2).

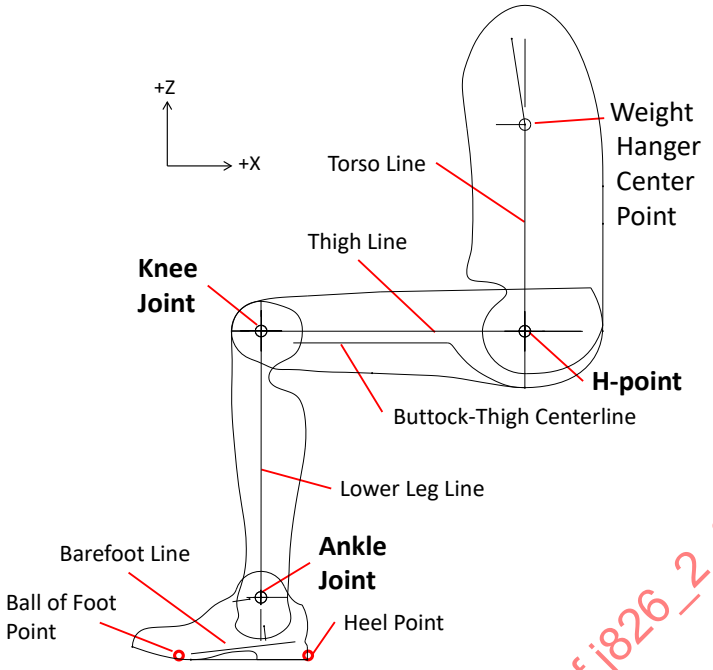

Figure 1 - Side view of the assembled 95th 2-D HPD template reference posture

Position the H-point of the CAD model at an H-point location in the H-point travel path of the seat. (Typically, this is the manufacturer SgRP location.) The Torso and Thigh (Cushion) Lines are positioned in the Y-centerplane of the designated seating position.

The Thigh and Torso segments of the HPD pivot about the H-point. To orient the Torso segment, set the Torso Line to the design Torso Angle, A40. To orient the Thigh segment, set the Thigh (Cushion) Line to the Thigh Angle, A57 (or Cushion Angle, A27).

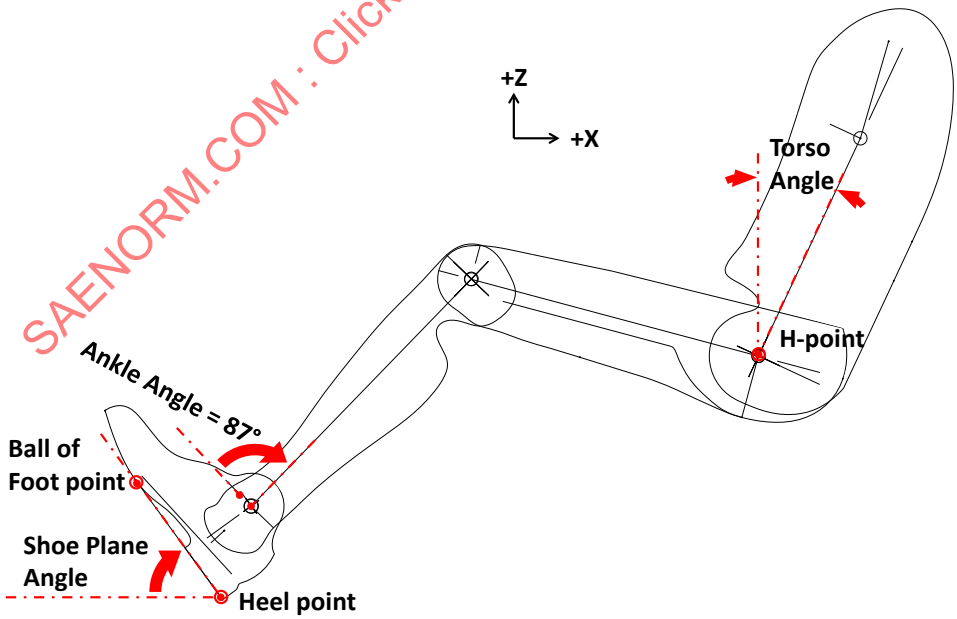

Figure 2 - Positioning the HPD – 2D CAD template

4.3 HPD key Segment dimensions

Some key dimensions for the HPD segments are shown to the nearest tenth of a mm in Figures 3 & 4 with other critical values specified in Tables 1 & 2, respectively. All dimensions in this section are provided in the default reference posture: Thigh Line horizontal (Thigh Angle = 0 degree) and Torso Line vertical (Torso Angle = 0 degree).

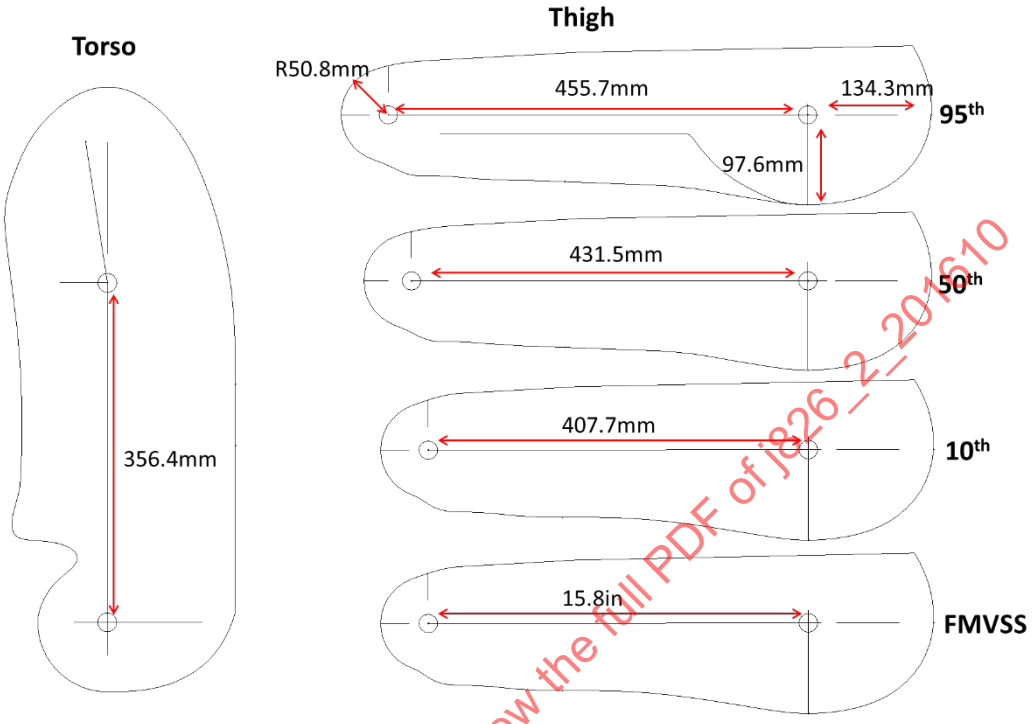

Figure 3 - HPD torso and thigh CAD template parts

Table 1 – Torso coordinates (mm)

Description	Value	Source
H-point	Coordinate Origin	N/A
Upper Torso calibration reference	134.4mm X coordinate 250.0mm Z coordinate	J826/1 REV 201106
Lower Torso calibration reference	134.4mm X coordinate 185.5mm Z coordinate	J826/1 REV 201106
Weight Hanger reference point	356.4mm Z coordinate	J826/1 REV 201106

Table 2 – Thigh coordinates (mm)

Description	Value	Source
H-point	Coordinate Origin	N/A
Knee radius	50.8mm	J1100REV 200911
Knee joint 95th	-455.7mm X coordinate	J826 REV 201511
Knee joint 50th	-431.5mm X coordinate	J826 REV 201511
Knee joint 5th	-407.7mm X coordinate	J826 REV 201511
Knee joint FMVSS	15.8in *(~401.32mm)* X coordinate	FMVSS 208
D-Point (Lowest point)	-97.6mm Z coordinate	J826 REV 201511
Rearmost point	134.3mm X coordinate	J826 REV 201511
Locator calibration reference	-263.8mm X coordinate -72.6mm Z coordinate	J826/1 REV 201106

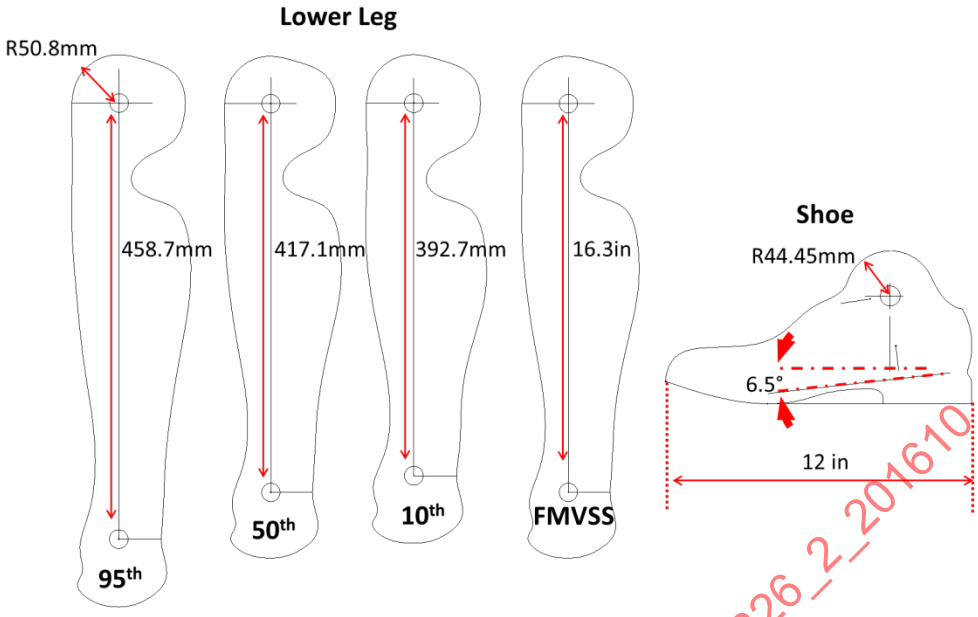

Figure 4 - HPD lower leg and shoe CAD template parts

Table 3 - Lower leg coordinates (mm)

Description	Value	Source
Knee joint	Coordinate Origin	N/A
Ankle joint 95th	-458.7mm Z coordinate	J826 REV 201511
Ankle joint 50th	-417.1mm Z coordinate	J826 REV 201511
Ankle joint 5th	-392.7mm Z coordinate	J826 REV 201511
Ankle joint FMVSS	16.3in *(~414.02mm)* Z coordinate	FMVSS 208

Table 4 - Shoe coordinates (mm)

Description	Value	Source
Ankle joint	Coordinate Origin	N/A
Ankle radius	44.45mm	J1100REV200911
Heel point	81.0mm X coordinate -107.2mm Z coordinate	J4002REV20508
Ball of Foot	-122.0mm X coordinate -107.2mm Z coordinate	J826 REV201511
Bare foot line angle	6.5 deg	J826 REV201511
Bare foot line angle origin	-205.9mm X coordinate -107.2mm Z coordinate	J1100 REV200911
Toe Tip to Heel Point distance	12 in	1972 SAE J826 drawing

4.3.1 CAD Tolerances of Key Dimensions

Dimensional variation may occur when importing and exporting the HPM CAD template data to and from various software programs. To represent the intended shape and size of the HPM, it is expected that variation at the key dimensions be less than ±0.1 mm.