
**Road vehicles — H-point machine
(HPM-II) — Specifications and procedure
for H-point determination**

*Véhicules routiers — Machine point H (HPM-II) — Spécifications et
procédure pour la détermination du point H*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 20176 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 13, *Ergonomics applicable to road vehicles*.

This second edition of ISO 20176 cancels and replaces the first edition (ISO 20176:2006), which has been technically revised. It also constitutes a technical revision of ISO 6549:1999.

It is the intent of ISO/TC 22/SC 13 that both ISO 20176 and ISO 6549:1999 be applicable until 2021-05-31. ISO 6549:1999 is thus provisionally retained until this date.

As from 2021-06-01, ISO 20176 will cancel and replace ISO 6549:1999.

During the transition period, it is the responsibility of vehicle designers to specify to regulatory and other bodies which document is applicable.

Introduction

The tools and procedures for H-point determination given in this International Standard are based on SAE J4002.

H-point devices are used during vehicle design and development to establish interior reference points and dimensions for occupant packaging, and to validate the location of these key reference points and dimensions on physical properties during audits.

H-point devices are also used for the design and validation of seats. However, in these instances, the reference points and dimensions are defined relative to the seat structure or surface, rather than the vehicle's interior. The procedures for positioning the H-point devices in seats do not require the use of the shoe tool or leg segments.

For convenience and simplicity, many terms associated with H-point devices use human body parts in their name. However, they should not be construed as measures that indicate occupant accommodation, human capabilities, or comfort. H-point devices do not represent the size or posture of any category of occupant.

a) Key differences from ISO 6549

Compared to the H-point machine (HPM) specified in ISO 6549, the HPM specified in this International Standard provides improved repeatability, greater ease of use, as well as additional features and measurement capabilities. All efforts were made to achieve these improvements while minimizing their impact on the location of reference points and measurements. Several of the changes are discussed below.

1) Separate components

For this HPM, the legs (upper and lower), shoe, cushion pan and back pan are all separate pieces. This greatly improves the ease of installation.

2) "Legless" manikin

The H-point location is defined without having to attach the legs. This is a major advantage. The procedure specified in this International Standard is based on installing the HPM without legs. Use of legs is optional.

3) Shoe tool

Several improvements were made to the shoe tool and how it is positioned in the vehicle, including:

- i) replacing the pedal reference point (PRP) with a new ball of foot reference point (BOFRP);
- ii) specifying a new procedure for positioning the shoe on the pedal.

4) Cushion angle

The cushion angle is now measured independently of thigh angle, and at the same time the other measurements are made. With the ISO 6549 HPM, cushion angle was measured from the thigh line, and required a separate installation of the HPM.

5) Lumbar support

The articulation of the back pan assembly allows the HPM specified in this International Standard to be better seated in contoured seats. It also provides a measurement of lumbar support prominence (LSP). This measurement provides an indication of the amount the seat back is contoured to provide support for the

lumbar spine. The contour of the back pan assembly is most similar to the ISO 6549 H-point machine when the HPM is in a neutral posture (LSP equals zero).

b) Changes from ISO 20176:2006

The procedures for auditing the seat are essentially unchanged from the first edition. The most significant change is that the ball of foot (BOF) of the shoe does not have to be on the pedal surface. The HPM shoe can contact the pedal at any point(s) on the bottom of the shoe. The term pedal reference point (PRP) has been deleted (since the BOF may not be on the pedal) and replaced by a new term called the ball of foot reference point (BOFRP). The accelerator heel point (AHP) to BOF distance was changed from 200 mm to 203 mm to be consistent with ISO 6549, SAE J1100, and vehicle manufacturers around the world.

The following physical modifications were made to the HPM. The flat part of the shoe bottom was extended from 200 mm to 203 mm. A new scale was added to the top of the shoe to aid in determining the pedal contact point (PCP). A new H-point divot was added to allow coordinate measuring machine (CMM) point taking from above. The knee angle scale was recessed to improve its durability and reoriented to improve its readability. Several figures were revised to illustrate these changes.

The terms pedal plane and pedal plane angle (PPA) have been replaced by shoe plane and shoe plane angle (SPA). These new terms more accurately convey the meaning. SPA is a side view angle that is provided by the vehicle manufacturer.

Road vehicles — H-point machine (HPM-II) — Specifications and procedure for H-point determination

1 Scope

This International Standard provides the specifications and procedures for using the H-point machine (HPM)¹⁾ to audit vehicle seating positions. The HPM is a physical tool used to establish key reference points and measurements in a vehicle. The H-point design tool (HPD) is a simplified computer-aided design (CAD)²⁾ version of the HPM, which can be used in conjunction with the HPM to take the optional measurements specified in this International Standard, or used independently during product design.

These H-point devices provide a method for reliable layout and measurement of occupant seating compartments or seats. This International Standard specifies the procedures for installing the H-point machine (HPM) and using the HPM to audit (verify) key reference points and measurements in a vehicle.

The devices are intended for application at designated seating positions. They are not to be construed as tools that measure or indicate occupant capabilities or comfort. They are not intended for use in defining or assessing temporary seating, such as folding jump seats.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4130, *Road vehicles — Three-dimensional reference system and fiducial marks — Definitions*

SAE J1100, *Motor vehicle dimensions*

SAE J4002, *H-point machine (HPM-II) specifications and procedure for H-point determination — Auditing vehicle seats*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in SAE J1100 and the following apply.

3.1

H-point

point at the pivot centre of the back pan and cushion pan assemblies, located on the lateral centreline of the H-point device

1) All references to H-point machine or HPM in this International Standard refer to the SAE J4002 H-point machine (HPM-II), unless otherwise noted.

2) CAD has come to encompass any software system or approach to automotive design and development, and is often used to refer to CAE (computer-assisted engineering) and CAM (computer-assisted manufacturing) software systems as well.