International Standard 6549

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Road vehicles — Procedure for H-point determination

Véhicules routiers — Procédure de détermination du point H

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 6549 was developed by Technical Committee ISO/TC 22, *Road vehicles,* and was circulated to the member bodies in February 1979.

It has been approved by the member bodies of the following countries :

Austria	Japan	Spain
Belgium	Korea, Dem. P. Rep. of	Sweden
Brazil	Korea, Rep. of	Switzerland
Chile	Mexico	Turkey
Czechoslovakia	Netherlands	United Kingdom
Egypt, Arab Rep. of	Poland	USA
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Germany, F.R.	South Africa, Rep. of	

The member body of the following country expressed disapproval of the document on technical grounds :

Italy

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Road vehicles — Procedure for H-point determination

1 Scope

This International Standard defines a three-dimensional H-point machine for use in the determination of the H-point of an actual seat.

2 Field of application

This International Standard applies to any new motor vehicle programme where the distance, vertically measured, between the operator heel point and the R-point is less than 550 mm, where the back angle is greater than 5° rearward or where the attitude of the thigh centreline as indicated by the thigh bar is greater than 5° above the horizontal. The three-dimensional H-point machine is intended to be used as a checking device for one designated seat position at a time and is not a device which measures or indicates an occupant's capabilities or comfort.

3 References

ISO 3833, *Road vehicles — Types — Terms and definitions.*

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

ISO 4131, *Road vehicles — Dimensional symbols for passenger cars.*

4 Definitions

4.1 three-dimensional H-point machine : The three-dimensional H-point machine is a device used for the determination of the actual H-point in a vehicle.

4.2 H-point : The pivot centre of the torso and thigh of the three-dimensional H-point machine used for actual H-point determination. It is located on the centreline of the device which is between the H-point sight buttons on either side of the H-point machine.

4.2.1 R-point or "seating reference point"
manufacturer's design H-point : which

a) establishes the rearmost normal driving or riding position of each designated seating position as stipulated by the manufacturer and which accounts for all modes of adjustment (horizontal, vertical and tilt) that are available for the seat;

b) has coordinates established with respect to the designed vehicle structure;

c) simulates the position of the pivot centre of the human torso and thigh;

d) is the reference point employed to position a two-dimensional template.

4.2.2 actual H-point : Pivot centre of the torso line and thigh centreline of the three-dimensional H-point machine using one of the appropriate leg lengths shown in figure 2 installed in the rearmost normal driving or riding position of the seat as specified by the manufacturer. The actual H-point is measured to the H-point sight buttons.

4.3 torso line : Centreline of the probe in the fully rearward position of the three-dimensional H-point machine.

4.3.1 design back angle : Angle measured between a true vertical line through the R-point or seating reference point and the torso line of a two-dimensional template.

4.3.2 actual back angle : Angle measured from a true vertical line through the actual H-point using the back angle quadrant on the three-dimensional H-point machine and probe in the fully rearward position.

4.4 centreplane of occupant (C/LO) : Y-coordinate of the H-point and is represented by the centreplane of the occupant, or the three-dimensional H-point machine, in each designated seating position. In vehicles with individual seats, the centreplane of the seat represents the centreplane of the occupant. On other seats, the centreplane of the occupant is specified by the manufacturer.

4.5 operator heel point : Intersection of the heel of the three-dimensional H-point machine with the surface of the depressed floor covering or other heel support. When 95th percentile leg elements are used, the foot sole of the device shall touch, and is allowed to depress, the accelerator pedal through some portion of its travel as specified by the manufacturer. When 50th percentile leg elements are used, the foot sole of the device may not contact the accelerator pedal and both feet are allowed to take natural positions on the floor with the legs extended and, in this case, the heel point is the heel point as defined by the manufacturer. The seat shall be located in the rearmost normal driving or riding position as specified by the manufacturer.

4.6 foot angle : Angle measured between the lower leg centreline and a line tangential to the shoe sole of the device's right foot. The foot angle is restricted to not less than 87°.

5 Description of the three-dimensional H-point machine

The back and seat pans of the three-dimensional H-point machine (see figure 1) are representations of average back and seat contours of an adult male.[1)]

Constructed of reinforced plastic and metal, these separate back and seat pans simulate the human torso and thigh and are mechanically hinged at the actual H-point. A quadrant is fastened to the probe hinged at the H-point to measure the actual back angle. An adjustable thigh bar, attached to the seat pan, establishes the thigh centreline and serves as a baseline for the hip angle quadrant.

Lower leg segments, also adjustable in length, are connected to the seat pan assembly at the T-bar joining the knees, which is a lateral extension of the adjustable thigh bar. Quadrants are incorporated in the lower leg segments to measure knee angles. Shoe and foot assemblies are calibrated to measure the foot angle. Positive stops are provided in the thigh and lower leg segments for the 50th and 95th percentile of adult male dimensions (see figure 2). Two spirit levels orient the device in space. Body element weights are placed at the corresponding centres of gravity to provide seat penetration equivalent to a 76 kg male. All joints of the H-point machine should be checked for free movement without encountering noticeable friction.[2)]

6 Installation procedure for the three-dimensional H-point machine

6.1 The vehicle shall be preconditioned at the manufacturers discretion, at a temperature of 20 ± 10 °C ensure that the seat material reaches room temperature. If the seat to be checked has never been sat upon, a 70 to 80 kg person or device shall sit on the seat to flex the cushion and back. At the manufacturer's request, all seat assemblies shall remain unloaded for a minimum period of 30 min prior to installation of the three-dimensional H-point machine.

6.2 Dimensions are measured relative to the vertical and horizontal body zero planes by setting up the vehicle relative to the fiducial marks (see ISO 4130) as specified by the manufacturer. The seat is adjusted to a position according to the location of its seating reference point and all adjustment features are positioned for the normal driving position as specified by the manufacturer. For seats with an independent vertical adjustment or suspension, the vertical position shall be rigidly fixed and be placed in a normal driving position as specified by the manufacturer. In addition, the seat shall be positioned in the rearmost normal driving position as specified by the manufacturer.

6.3 Place muslin cotton cloth over seat area to be checked. The muslin is described as a plain cotton, knitted or non-woven fabric having 18,9 threads per cm^2 and weighing 0,228 kg/m^2. The muslin should be of a sufficient amount to avoid preventing the machine contacting the seat. If the test is run in an installation for the seat suitable pieces of floor covering, or their equivalent, are to be placed under the feet of the three-dimensional H-point machine.

6.4 Place the seat and back assembly of the three-dimensional H-point machine so that the centreplane of the occupant (C/LO) coincides with the centreplane of the H-point machine. At the manufacturer's request, the C/LO may be moved inboard with respect to the C/LO if the H-point machine is located so far outboard that the seat edge will not permit leveling of the H-point machine. When the H-point machine has been moved inboard the necessary distance to permit its levelling, the distance from the centreplane of the vehicle to the C/LO shall be noted in the recorded measurements.

6.5 Adjust the leg elements to one of the appropriate lengths shown in figure 2.

1) Derived from data based on the driving population in the USA.

2) Drawings and videotape are available from SAE, 400 Commonwealth Drive, Warrendale, Pennsylvania 15096, USA.

For seats which are highly contoured to give special support for the driver during cornering subject to a high lateral forces (for example sports cars), the three-dimensional H-point machine may give unrealistic H-point results. For these cases, a new three-dimensional H-point machine with redesigned seat and back pan needs to be developed and will require new investigation of the real driving population taking into account males and females of different nationality.

6.6 Attach the foot and lower leg assemblies to the seat pan assembly, either individually or by using the T-bar and lower leg assembly. A line through the H-point sight buttons shall be parallel to the ground and perpendicular to the longitudinal centreplane of the seat.

6.7 The feet and leg positions of the three-dimensional H-point machine are as follows :

6.7.1 Designated seat position : driver.

6.7.1.1 For 50th percentile leg lengths : both feet and leg assemblies shall be moved forward in such a way that the feet take up natural positions, between the operating pedals if necessary. The spirit level verifying the transverse orientation of the device is brought to the horizontal by re-adjustment of the seat pan if necessary, or by adjusting the leg and foot assemblies towards the rear.

6.7.1.2 For 95th percentile leg lengths : the right foot and leg assembly is placed on the accelerator pedal and the heel on the floor as far forward as specified by the manufacturer. However, the foot angle shall never be less than 87°. This is accomplished by inserting the positive stop pin of the H-point machine into the foot assembly.

6.7.1.2.1 The left foot is positioned on the floor or toe-rest and located approximately the same distance to the left of the centreplane of the H-point machine as the right foot is to the right. A line passing through the H-point sight buttons shall be maintained parallel to the horizontal reference plane, and perpendicular to the longitudinal centreplane of the seat.

6.7.1.2.2 If the left leg cannot be kept parallel to the right leg and the left foot cannot be supported by the structure, release the tension on the left lower leg element and move the left foot until it is supported. The alignment of the sight buttons shall be maintained. Retighten the leg element setting.

6.7.1.2.3 In cases where the heel point of the device would be on the toe-rest instead of the floor when the foot is at the minimum angle of 87°, the foot shall be moved until the heel touches the intersection of the toe-rest and the floor covering; then the foot shall be pivoted until it is in contact with the accelerator pedal.

6.7.2 Designated seat position : passenger.

6.7.2.1 Outside front seat : for both 50th or 95th percentile leg lengths, refer to the procedure in 6.7.1.1.

6.7.2.2 Outside rear seat : for both 50th or 95th percentile leg lengths for rear seats or auxiliary seats, the legs are located as specified by the manufacturer.

If the feet then rest on parts of the floor which are at different levels, the foot which first comes into contact with the front seat shall serve as a reference and the other foot shall be so arranged that the spirit level giving the transverse orientation of the seat of the device indicates the horizontal.

6.7.3 Designated seat position — centre, front or rear : if the H-point is being determined for a centre seat, the feet shall be placed one on each side of the tunnel if there is one.

6.8 Apply lower leg and thigh weights and level the H-point machine.

6.9 Tilt the back pan forward against the forward stop and draw the three-dimensional H-point machine away from the seat back using the T-bar. Reposition the H-point machine on the seat by one of the following methods :

6.9.1 If the three-dimensional H-point machine tends to slide rearward, use the following procedure. Allow the three-dimensional H-point machine to slide rearward until a forward horizontal restraining load on the T-bar is no longer required i.e. until the seat pan contacts the seat back. If necessary, reposition the lower leg.

6.9.2 If the three-dimensional H-point machine does not tend to slide rearward, use the following procedure. Slide the H-point machine rearwards by applying a horizontal rearward load to the T-bar until the seat pan contacts the seat back (see figure 2).

6.10 Apply a 100 ± 10 N load to the back and pan assembly at the intersection of the hip angle quadrant and the T-bar housing. The direction of load application should be maintained along a line passing by the above intersection to a point just above the thigh bar housing. Then carefully return the back pan to the seat back. Care must be exercised through the remainder of the procedure to prevent the three-dimensional device from sliding forward.

6.11 Install the right and left buttock weights and then alternately the eight torso weights. Maintain the H-point machine's level.

6.12 Tilt the back pan forward to release the tension on the seat back. If desired by the manufacturer, rock the three-dimensional H-point machine from side to side over a 10° arc (5° to each side of the vertical centreplane) for three complete cycles to release any accumulated friction between the H-point machine and the seat.

During the rocking action, the T-bar of the H-point machine may tend to diverge from the specified horizontal and vertical alignment. The T-bar must therefore be restrained by applying an appropriate lateral load during the rocking motions. Care shall be exercised in holding the T-bar and rocking the H-point machine to ensure that no inadvertent exterior loads are applied in a vertical or fore and aft direction.

The feet of the H-point machine are not to be restrained or held during this step. If the feet change position, they should be allowed to remain in that attitude for the moment.

Carefully return the back pan to the seat back and check that the device is level. Due to the movement of the feet during the rocking operation of the H-point machine, the feet are repositioned as follows :

Alternately lift each foot off the floor the minimum necessary amount until no additional foot movement is obtained. During this lifting, the feet are to be free to rotate; and no forward or lateral loads are to be applied. When each foot is placed back in the down position, the heel is to be in contact with the structure designed for this.

If the seat pan is not level at the completion of this step, apply a lateral load to the top of the seat back pan sufficient to level the H-point machine's seat pan on the seat.

6.13 Holding the T-bar prevent the H-point machine from sliding forward on the seat cushion, proceed as follows :

a) Return the back pan to the seat back.

b) Alternately apply and release a horizontal rearward load, not to exceed 25 N, to the back angle bar at a height approximately at the centre of the torso weights until the hip angle quadrant indicates that a stable position has been reached after load release. Care shall be exercised to ensure that no exterior downward or lateral loads are applied to the H-point machine. If another level adjustment of the H-point machine is necessary, rotate the back pan forward, re-level, and repeat the procedure from 6.12.

6.14 Take all measurements :

6.14.1 The coordinates of the actual H-point are measured with respect to a three-dimensional reference system.

6.15 If a re-run of the installation of the H-point machine is desired, the seat assembly should remain unloaded for a minimum period of 30 min prior to the re-run. The H-point machine should not be left loaded on the assembly longer than the time required to perform the test.

Dimension	50th percentile	95th percentile
A	417	459
B	432	456
C	variable from 108 to 424	

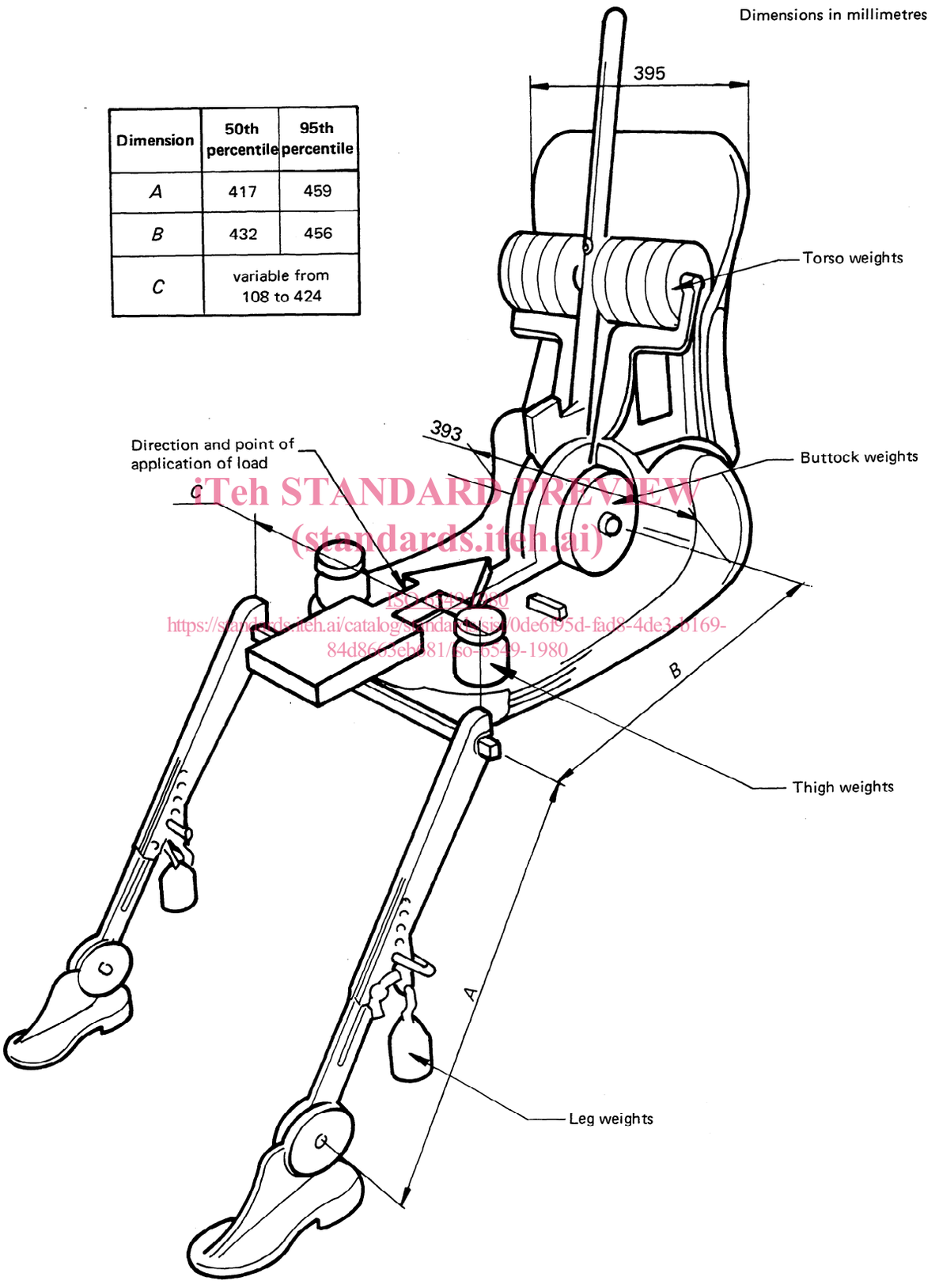

Figure 1 — H-point machine elements designation

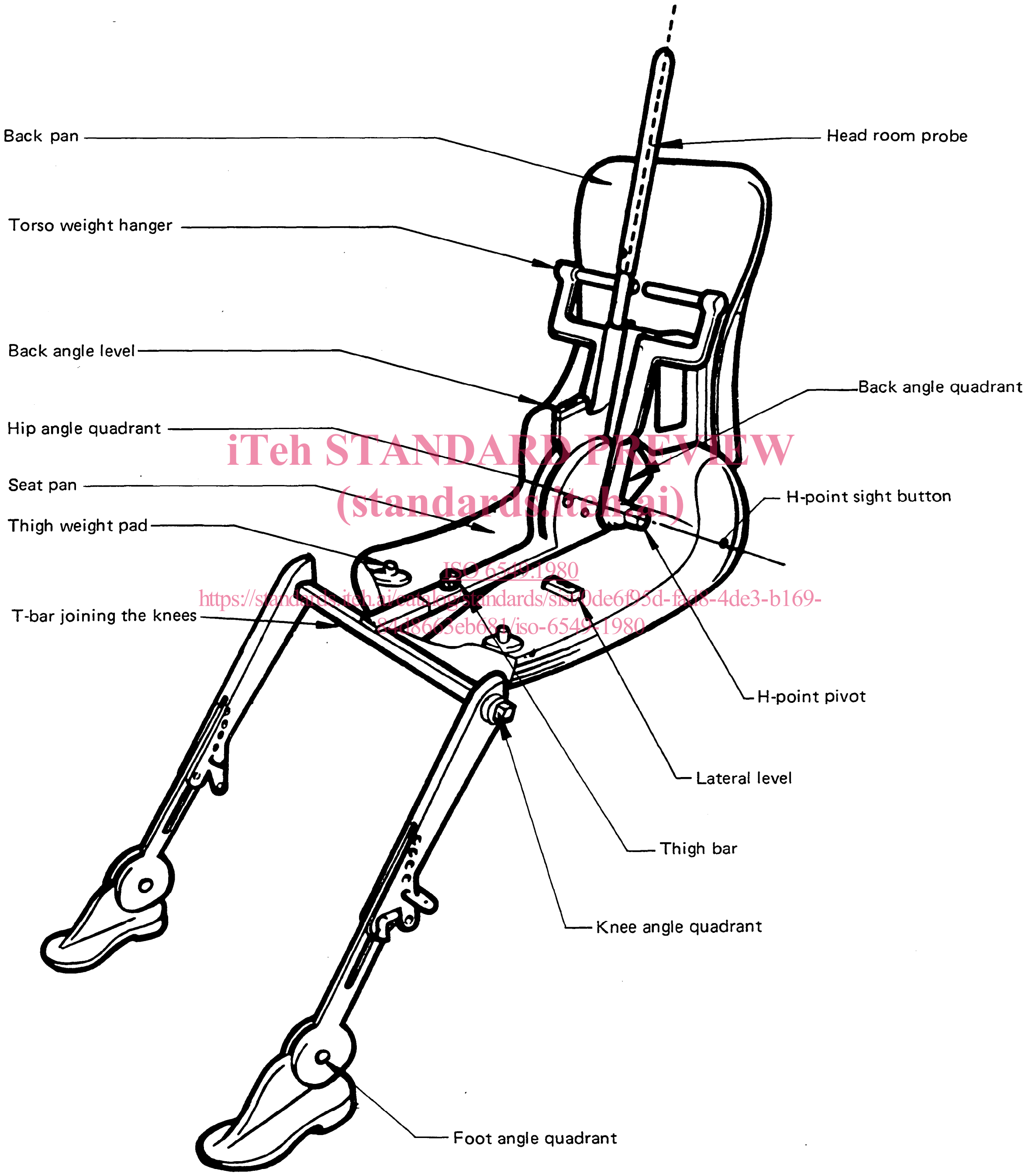

Figure 2 — Dimensions of the H-point machine elements and load distribution