TECHNICAL REPORT

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Impact test procedures for road vehicles — Rear seat positioning procedures for Hybrid III 5th percentile female dummy

Procédures de chocs pour les véhicules routiers - Procédures d'installation et de positionnement en places arrières des mannequins Hybrid III 5ème percentile femme

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Foreword

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ISO/TR 17950 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 36, *Safety and impact testing*.

Impact test procedures for road vehicles — Rear seat positioning procedures for Hybrid III 5th percentile female dummy

1 Scope

This document specifies the conditions for the recommended placement of the Hybrid III 5th percentile female frontal impact dummy (HIII5F) when used in forward-facing outboard 2nd row rear seating positions of passenger cars (M Category) for frontal impact testing . For example:

— Frontal Impact 0° and Pole (ISO 3560)

— Frontal Impact Offset Deformable Barrier (ISO 15828)

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

—ISO Online browsing platform: available at http://www.iso.org/obp

2.1
H points of Hybrid III 5th percentile female dummies for rear seat position
design H point
locations of the Hybrid III 5th dummy H point on a seat adjusted to the manufacturer's specification for a 5% female

Note 1 to entry: The H point is the point of the H joint.

Note 2 to entry: The design H-point is defined as the H-point of SAE J826 device corrected in accordance with 6.2.2.

2.2
Seat Reference Point
marked point at the side of the seat near the H-point

4 Symbols and abbreviated terms

X forward direction of the vehicle

Z downward direction of the vehicle

SRP Seat Reference Point

5 Recommendations

5.1 General

It is recommended to start with the positioning of the rear outboard dummies to facilitate the placement of all dummies.

5.2 Position of the rear seats

5.2.1 Rear seats

Longitudinal seat adjustment should be positioned according to the design longitudinal position for Hybrid III 5th percentile female dummy defined by car manufacturer. If no design position is available, the seat should be adjusted as close as possible to the mid-track position.

Vertical seat adjustment should be positioned in the design position defined by car manufacturer. If no design position is available, the seat should be adjusted as close as possible to the lowest position.

If pitch angle can be adjusted independently, it should be adjusted according to the design position defined by car manufacturer. If no design position is available, it should be as close as possible to the mid-angled position.

In absence of any manufacture specifications the default procedure should be:

1) The seat control that primarily moves the seat vertically should be used to adjust the seat reference point to the upper most vertical location.

2) The seat control that primarily moves the seat fore-aft should be used to adjust the seat reference point defined to the rear most location.

3) The range of angles of the seat cushion pitch referring to the line and using only the control(s) that primarily adjust(s) the cushion pitch should be determined and recorded, and the set cushion pitch should be as close as possible to the mid-angle.

4) The seat control that primarily moves the seat vertically should be used to adjust the seat reference point to the lowest vertical location. A verification that you are still at the rearmost seat track location should be conducted. The X position should be recorded.

5) The seat control that primarily moves the seat fore-aft to adjust the seat reference point to the forward most location should be used and the X position recorded.

6) The midpoint of X-positions recorded in 4.) and 5.) should be calculated and marked.

7) The seat control that primarily moves the seat fore-aft to adjust the seat reference point to the X position marked in step 6 (−0/+2 mm) should be used, or, if not possible, to the first X possible position rearward the marked position in step 6. If the seat cannot be placed exactly at the midpoint the next closest available rearward setting should be selected.

NOTE For some vehicles this final step changes the cushion pitch as established in step 7; this is acceptable.

8) The test seat position (for example recording the position of the reference point) should be measured and recorded.

5.2.2 Rear seatbacks

If adjustable, the rear seatbacks should be set at the manufacturer's design position. If no design position is available and the seatback is adjustable independently from the fore-aft adjustment, the seatback should be adjusted to 25° or as close as possible.

5.2.3 Rear head restraints

The head restraint position to the vehicle manufacturer's nominal design position for a 5th percentile adult female occupant should be set, or in the lowest locking position if no design position is available.

5.2.4 Seat supports

Any adjustable parts that provide additional support should be positioned so that they are in the lowest or fully retracted positions, e.g.: the seat's adjustable lumbar supports are positioned so that the lumbar supports are in the lowest, retracted or deflated adjustment positions.

5.2.5 Seatbelt upper torso adjustment

Any seatbelt upper torso adjustment at the vehicle manufacturer's design position for the 5th percentile female should be placed. If no design position is specified, the seatbelt upper torso adjustment should be adjusted to the lowest vertical position.

5.2.6 Armrests

If adjustable, the armrests can be stowed

5.2.7 Defining the seat centre reference line

In case of bucket seats:

For future reference, the longitudinal seat center reference line of the seat cushion should be located and marked. The intersection of the vertical longitudinal plane that passes through the SRP and the seat cushion upper surface determines the longitudinal center line of a bucket seat cushion.

In case of bench seats:

For future reference, the longitudinal line on the seat cushion that marks the intersection of the vertical longitudinal plane through the seat cushion upper surface and the mid seating position point should be located and marked. This is defined as:

1) designated seating transverse position defined by car manufacturer;

2) the middle of the head restraint, if size of the dummy allows it; and

3) the middle position of HIII 5th (or SAE dummy), ensuring the best pelvis alignment(minimal yaw in the most rearward position).

5.3 Design H-Point Determination

5.3.1 Determining the H-point of SAE J826 device

The seat in front of the occupant can be displaced to the foremost position to facilitate access to the occupant's seat. Final position of the seat in front of the occupant is based on the test protocol.

1) Using only the controls that move the seat fore-aft, the test seat should be returned to the rearmost position to facilitate placement of the SAE H-point manikin.

2) The SAE H-point manikin in the seat and position the seat to the test position for the 5th percentile female should be placed, as defined in 6.1.

3) The procedure as described in SAE J826 should be followed, except that the length of the lower leg and thigh segments of the SAE H-point manikin should be adjusted to the 50th percentile (418 mm) and 10th percentile (408 mm) positions respectively.

4) The seat back angle should be set to achieve the torso angle specified by the manufacturer.

5) The H-point (of the SAE H-point manikin) X, Y and Z coordinates should be recorded.

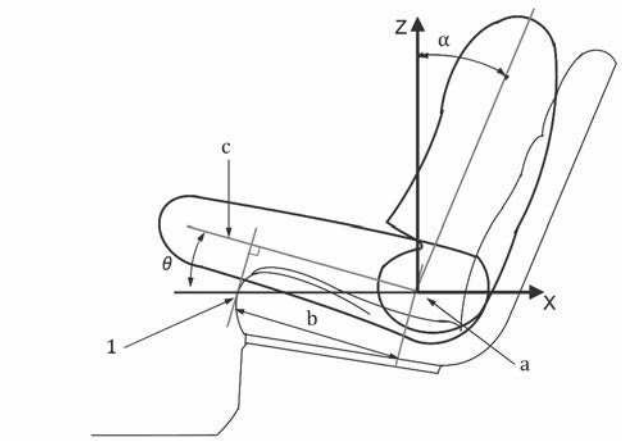
NOTE If there is not sufficient clearance to permit the placement of the SAE H-point manikin legs or feet, install the manikin with the legs removed.

5.3.2 Method for deriving the Design H Points of Hybrid III 5th percentile female Dummies for rear seat position

The SAE J826 anthropomorphic model with its thigh and leg lengths adjusted to 408 mm and 418 mm respectively should be installed on a seat which is adjusted to the manufacturer's specification for 5th percentile female, the positions of its H point or those of the H joint (X50M, Z50M) should be determined.

The seat cushion length ("SCL") shown in Figure 1 is the distance between the front end of the seat cushion (X_{Ft}, Z_{Ft}) and the SAE H-point manikin's H-point (X_{50M}, Z_{50M}). The front end of the seat cushion should be determined by drawing a perpendicular line from the manikin's thigh line to the front end of the seat cushion in the vertical plane.

The design H point of a Hybrid III 5th percentile female dummy for rear seat position is derived in accordance with the formula shown in Table 1.



Key

1 front end of seat cushion X_{Ft}, Z_{Ft})
a H point (X_{50M}, Z_{50M})
b SCL-138 mm
c Manikin thigh line
α Seat back angle
θ Angle of front end and manikin thigh-line

Figure 1 — Definition of SCL (Seat Cushion Length)

$$SCL-138=\left(\left|X_{Ft}-X_{50M}\right|*\cos\theta-\left|Z_{Ft}-Z_{50M}\right|*\sin\theta\right)$$

Table 1 — Design H-point of Hybrid III 5th female

x-axis coordinate X_{5F}	X_{50M}+(138-0,323×SCL)
z-axis coordinate Z_{5F}	Z_{50M}

5.4 Installation and positioning of Dummy

5.4.1 Installation method for Hybrid III 5th percentile female Dummies

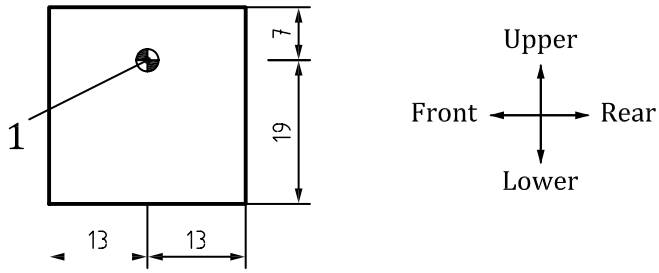
The rear seats of the test vehicle should be adjusted to the test position defined in 6.1.

The Hybrid III 5th percentile female dummies should be installed on the rear seats of the test vehicle

5.4.1.1 Seating position

The dummy should be seated in such a position that its longitudinal center line is aligned with the design seat center line. The torso of the dummy should be in contact with the seatback.

The pelvis should be adjusted so that the left and right H-points of the dummy are coincident with the H-points calculated in 6.2.2,within the tolerance defined in Figure 2.



Key

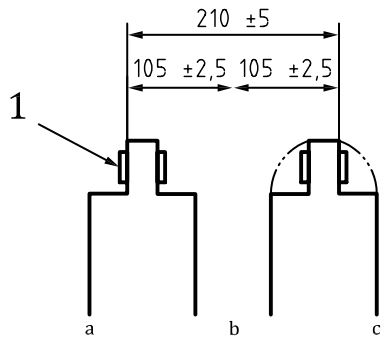
1 design hip point

Figure 2 — H point position tolerance

The pelvic angle should be kept within 20,0° ± 2,5° and recorded.

5.4.1.2 Position of the legs and feet

The initial distance of the outside metal surfaces of the dummy's knees can be 210mm ± 5mm as shown in Figure 3. Below; however, this distance does not finalize the position of the knees.



Key

1 outside metal surface

a Left

b Dummy centre

c Right

Figure 3 — Initial knee distance for Hybrid III 5th percentile female

The lower legs should be positioned as forward as possible from the front end of the rear seat cushion while the thighs should be kept in contact with the seat cushion as shown in Figure 4.

While maintaining the thigh angle and the legs parallel to a vertical longitudinal plane, each foot should be lowered until the heel contacts the floor, as shown in Figure 5.

Then each foot should be placed as flat on the floor, as possible as shown in Figure 6.

If a foot does not make contact with the floor, it should be lowered until the calf or the heel makes contact with the front end of the seat. The foot should be positioned parallel to the floor, as shown in Figure 7.

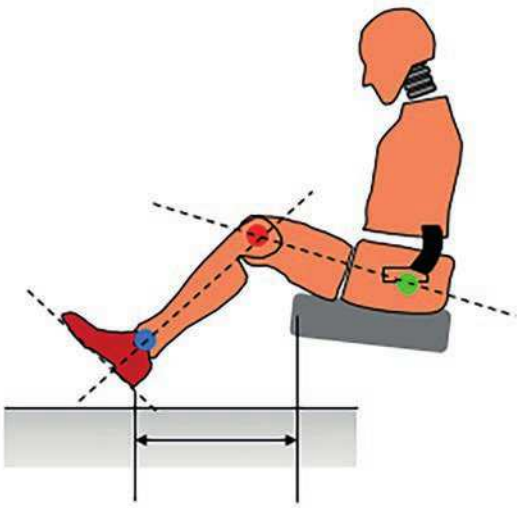


Figure 4 — Lower leg positioning Step 1

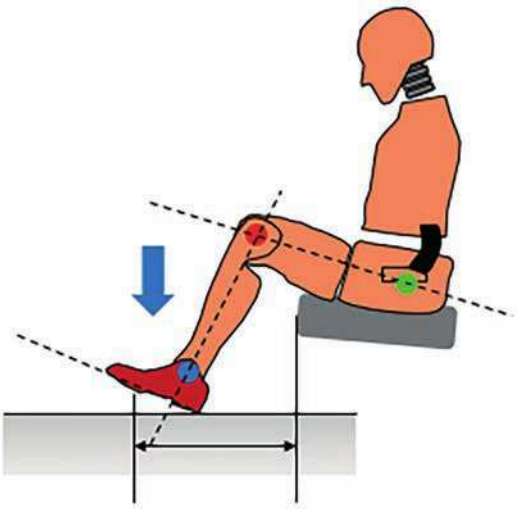


Figure 5 — Lower leg positioning Step 2

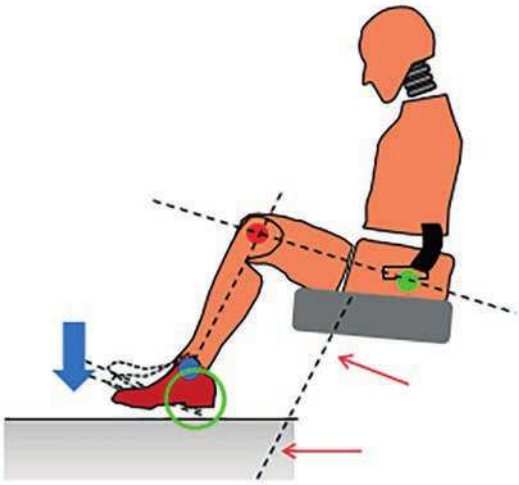


Figure 6 — Lower leg positioning Step 3

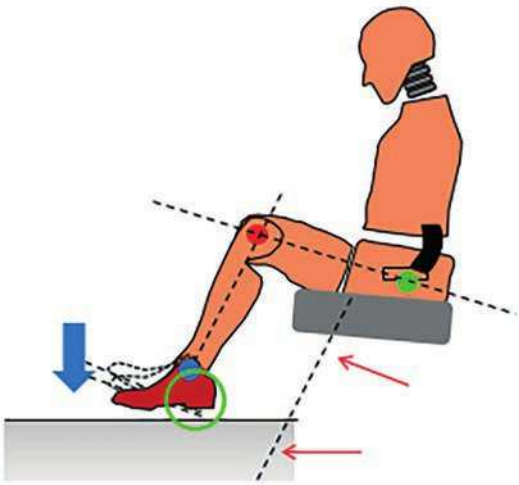


Figure 7 — Lower leg positioning Step 4

5.4.1.3 Initial position of the upper limbs

The upper arms should be adjacent to the torso and in contact with the seatback.

The hands should be placed with the palms in contact with the outside of the legs and the little finger in contact with the seat cushion.

5.4.1.4 Finalization of torso position

H points on outer sides of the pelvis should be verified and aligned to the calculated H points recorded in 6.2.2. Alignment is acceptable if the H points fall within the area around the calculated H points shown in Figure 2. Adjustments should be made as necessary.

The head angle should be aligned to within ±0,5° of the horizontal. If the head cannot be levelled to the specified tolerance, the head and torso should be flexed forward and rearward by keeping the pelvis stable. If the head still does not meet the specified tolerance, the pelvis position should be adjusted while remaining within the specified tolerance for the pelvis. Should both attempts be unsuccessful, the neck bracket should be adjusted to level the head to within the required tolerance.

5.4.1.5 Readjustment of the position of the upper limbs

The upper arms should be positioned in contact with the seatback.

The forearms and the hands should be positioned as close as possible to the outer sides of the thighs while the little fingers are lightly in contact with the seat cushion.

If there is interference by a trim part or other parts during the positioning of the upper limbs, the interfered upper limb should be placed on the armrest of the same side to avoid the interference.

5.4.1.6 Readjustment of the foot position

In case the foot position is displaced during the positioning of the torso or other routines, the foot position should be readjusted to the original position prescribed in 6.3.1.2.

5.4.2 Fastening of seatbelts

After installation, the seat belt should be deployed and allowed to fall into its natural position. Adjustments may be made to keep the belt inside the clavicle outer edge and between the breasts.

If the seatbelt assembly is equipped with a device to reduce the seatbelt tension for the occupant, the amount of slack to be introduced is specified by the manufacturer. If the test vehicle is equipped with a seat belt guide (e.g. adjustable guide loop, child comfort guide), it should be adjusted to design position.

Bibliography

[1] Stapp Car Crash Journal, Vol. 49 (November 2005), pp. 381-421 "*Development of ATD Installation Procedures Based on Rear- Seat Occupant Postures*" Matthew P. Reed et.al University of Michigan Transportation Research Institute

[2] SAE J826, *Devices for use for defining and measuring vehicle seating accommodation*

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