

Dummy Seating Procedure for Rear Outboard Positions (Version II)

DRAFT II

January 2021



Insurance Institute for Highway Safety

988 Dairy Road

Ruckersville, VA 22968

researchpapers@iihs.org

+1 434 985 4600

iihs.org



DOCUMENT REVISION HISTORY

Version II

In October 2020, the procedure was revised in following ways:

Steps 3, 8.2.3, and 10 were updated to improve the procedure's repeatability and reproducibility.

Step 7.2 was updated to clarify the final position of the feet.

In April 2020, the procedure was revised to Version II in the following ways:

Step 1 was updated to include the initial upper anchor position for the shoulder belt.

Step 2 (2.2) procedure to center the dummy on bench seats was changed and the pelvis lateral alignment was added.

Step 3 was updated to specify the pelvis and seatback gap and the tibia-thigh angle.

Steps 6 and 7 were interchanged in sequence.

Step 8 (8.3) was updated to specify the number of repetitions if the pelvic angle is above the specified range.

Step 9 was changed to specify the priority between the head level and pelvic angle, if both cannot be achieved within specified tolerances.

Step 10 was added to address situations where the rear occupant space and rear occupant's knees prevent the front seat from being placed in the UMTRI position.

Step 11 (11.1 and 11.2) were interchanged in sequence. (11.2 and 11.3) were updated to address the unnatural belt placement of the lower and upper portions of the safety belt.

Step 12 was updated to specify the positioning of the arms and hands for dummies with full arms.

Version I

In April 2012, the Version I procedure was revised in the following way:

Step 3 was updated to clarify the tibia-thigh angle when a pelvic and seatback gap exceeds 50 mm.

In August 2005, the Version I procedure was revised in the following ways:

Steps 8 and 9 were updated to address vehicles with adjustable seatbacks in rear outboard positions.

POSITIONING PROCEDURE

The following rear occupant seating procedure is intended for use with small female dummies. It also may be used as a guideline for seating midsize and large male dummies.

1. Adjust the rear seat, if applicable. Set the rear seat to the rearmost position in the fore-aft adjustment range, unless otherwise specified by the test vehicle manufacturer. If a seat is vertically adjustable, place it in its full-down position. Set the seatback angle to 23 degrees, as measured by an H-point manikin torso angle, or to the angle specified by the manufacturer. If adjustable, the shoulder belt upper anchor should be initially placed at a position recommended by the manufacturer.
2. Place the dummy in the seat.
 - 2.1 On bucket or contoured seats, center the dummy on the seat cushion so that its midsagittal plane is vertical and coincides with the vertical longitudinal plane through the center of the seat cushion.
 - 2.2 On bench seats, center the dummy on the seat cushion so that its midsagittal plane is vertical and coincides with the vertical longitudinal plane through the center of the head restraint. If no head restraint exists, align the midsagittal plane evenly between the lap belt anchor points.

Align the pelvis so that it is parallel to the vehicle's lateral axis.
3. Place the lower legs at 90 degrees to the thighs and the feet on and/or level with the floor pan. Set the initial transverse distance between the longitudinal centerline of the dummy's knees approximately at 160–170 mm, with the thighs and legs of the dummy in vertical planes. If the driver seat, when positioned according to the UMTRI procedure (IIHS, 2004), contacts the rear occupant's knees or feet when the lower legs are positioned at 90 degrees to the thighs, then the driver seating position should be modified temporarily in order to conduct the rear occupant seating procedure without interference.
 - 3.1 Push rearward on the dummy's knees to force the pelvis into the seat, so there is no gap between the pelvis and the seatback or until contact occurs between the back of the dummy's calves and the front of the seat cushion, without allowing the angle between the thighs and lower legs to change. If the heels contact the seat first, preventing both the pelvis and the calves from contacting, continue pushing rearward on the dummy's knees to force the pelvis into the seat while allowing the angle between the thighs and lower legs to change just until there is no gap between the pelvis and the seatback or until contact occurs between the back of the dummy's calves and the front of the seat cushion.
4. Hold the dummy's thighs down and push rearward on the upper torso to maximize the dummy's pelvic angle.

5. Gently rock the upper torso relative to the lower torso laterally in a side-to-side motion three times through a ± 5 degree arc (approximately 50 mm side to side) to reduce friction between the dummy and the seat.
6. In this and the following steps, the tibia-thigh angle will be dictated by the steps of the procedure and no longer needs to remain at 90 degrees or the final angle achieved in step 3. Rest the dummy's thighs against the seat cushion and ensure that the transverse distance between the longitudinal centerline of the dummy's knees is 160–170 mm, with the thighs and legs of the dummy in vertical planes.
7. Position the feet.
 - 7.1. If the feet can reach the floorpan, place them flat on the floorpan and beneath the front seat as far as possible without interference. After the initial positioning, it should be possible to lift the legs behind the ankles and, when slowly released, the legs should return to the original position with the heel contacting the floor. The upper and lower legs should have centerlines that are close to longitudinal and vertical planes, respectively.
 - 7.2. If the feet are suspended above the floorpan, they should be moved rearward until the back of the calves or feet contact the seat.
8. Measure the dummy's pelvic angle. The angle should be set to 20 ± 2.5 degrees for small female dummies and 22.5 ± 2.5 degrees for midsize and large male dummies.
 - 8.1. If the dummy's pelvic angle is within the specified range, proceed to step 9.
 - 8.2. If the measured pelvic angle is below the specified range, complete the following steps:
 - 8.2.1. Hold the dummy's thighs down and push rearward on the upper torso to maximize the dummy's pelvic angle. If the pelvic angle is within the specified range, proceed to step 9.
 - 8.2.2. If the pelvic angle is still below the specified range and the seatback is adjustable, adjust the seatback rearward one notch (or 2 degrees for infinitely adjustable seatbacks) and repeat steps 8.2.1 and 8.2.2 until the pelvic angle is within the specified range, or until the seatback is in the full-rearward position.
 - 8.2.3. If the driver seat was temporarily modified in step 3, proceed to step 9. If the driver seat was not modified in step 3 and the pelvic angle is still below the specified range or the seatback is not adjustable, lift the thighs and pelvis and move them forward (away from the seatback) the minimum amount necessary to achieve the correct pelvic angle. Then hold the dummy's thighs down and push rearward on the upper torso to maximize the dummy's pelvic

angle. Repeat this until the pelvic angle is within the specified range or until the knees/feet cannot be moved further forward without contacting the front seat. Proceed to step 9.

- 8.3. If the measured pelvic angle is above the specified range, complete the following steps:
 - 8.3.1 Rotate the torso forward. Doing this will push the pelvis rearward and decrease the pelvic angle. Holding the dummy's thighs down, slowly rotate the torso rearward until it is supported by the seatback. If the pelvic angle is within the specified range, proceed to step 9.
 - 8.3.2 If the pelvic angle is above the specified range, repeat step 8.3.1 up to a total of three times. If the pelvic angle remains above the specified range and the seatback is fixed, record the pelvic angle and proceed to step 9.
 - 8.3.3 If the seatback is adjustable, adjust the seatback forward one notch (or 2 degrees for infinitely adjustable seatbacks) and repeat steps 8.3.1 and 8.3.2 until the pelvic angle is within the specified range or until the seatback is in the full-forward position. Proceed to step 9.
9. Measure the head transverse instrumentation platform angle. The anterior-posterior and medial-lateral angle should be level to within ± 0.5 degrees. Adjust the lower neck bracket to level the head in the anterior-posterior direction. If it is not possible to achieve the head level within ± 0.5 degrees and the seatback is adjustable, minimize the angle by moving the seatback one notch (or 2 degrees for infinitely adjustable seatbacks) in the appropriate direction to achieve the head level, ensuring that the pelvic angle remains either within the specified tolerance or no further out of the tolerance than was achieved in step 8. If it is not possible to achieve both the head level and the specified pelvic angle, priority goes to achieving the pelvic angle within or as close as possible to the specified tolerance.
10. If the driver seat position was temporarily modified in step 3, reset the driver seat by first moving the rear occupant's feet rearward until the back of the calves or feet contact the rear seat and then adjusting the driver seat longitudinally forward of the calculated UMTRI position (IIHS, 2004) just until there is no contact between the driver seatback and the rear occupant's knees or feet. If there is room for the rear occupant's feet to move forward after the driver seat has been positioned, they should be placed flat on the floorpan and beneath the front seat as far as possible without interference.
11. Place the seat belt around the dummy and fasten the latch.
 - 11.1 If the belt has an automatic retractor, remove all slack from the lap belt and pull all webbing out of the retractor and allow it to retract against tension by holding pressure on the webbing with your fingers. Repeat this operation four times.

- 11.2 Apply an estimated 8-18 Newton (2–4 pound) load to the lap belt by pulling the upper torso belt adjacent to the latchplate. The lap belt should lie across the top of the thighs close to the pelvis, but not push into the abdomen. If placing the belt so that it touches the tops of the thighs creates an unnatural belt position (e.g., gaps or hammocks across the abdomen), allow the belt to slide upward just until the belt lays smoothly and naturally across the abdomen.
- 11.3. The upper portion of the belt should lie flat on the dummy’s chest. Pull the belt 50–100 mm from the chest and allow it to retract on its own. If the manufacturer’s-recommended upper belt anchor position creates an unnatural belt placement (e.g., offset from the sternum or mid-clavicle), move the upper belt anchor in the appropriate direction until the belt lies naturally across the sternum and mid-clavicle. If not adjustable, proceed to step 12.

12. Position the dummy’s arms and hands.

For dummies with half arms (BioSID, EuroSID-1, EuroSID-2, and SID-IIs), adjust the upper arm to the stop position 45 degrees forward of the neutral (down) position.

For dummies with full arms (Hybrid III, THOR), place the arms resting on the thighs.

REFERENCE

Insurance Institute for Highway Safety. (2004). *Guidelines for using the UMTRI ATD positioning procedure for ATD and seat positioning (Version V)*. Arlington, VA.