# Draft Global Technical Regulation on Head Restraints
# As of September 9, 2005

## B. Text of Regulation

**1. Scope and Purpose: [**This gtr specifies requirements for head restraints to reduce the frequency and severity of injuries caused by rearward displacement of the head.**]**

**2. Application:** This standard applies to Category 1-1 vehicles, **[**Category1-2**]** vehicles with a Gross Vehicle Mass of **[**4,536 kg**]** or less, and Category 2 vehicles with a Gross Vehicle Mass of **[**4,536 kg**]** or less.

**3. Definitions:**

3.1. [Backlight means the window glazing located at the rear [of the roof panel], but is not a part of the roof panel, in vehicles subject to this GTR.]

3.2. Backset means the minimum horizontal distance between the rear of a representation of the head of a seated 50$^{th}$ percentile male occupant and the head restraint, [as measured by the head restraint measurement device].

3.3. Head restraint:

3.3.1. Means a device that limits rearward displacement of a seated occupant's head relative to the occupant's torso.

3.3.2. **Rear head restraint [**Means, [at any forward-facing seat,] [at any designated seating position], a seat back, or any independently adjustable seat component attached to or adjacent to a seat back, that has a height equal to or greater than 700 mm, in any position of backset and height adjustment, as measured in accordance Annex 1.**]** [move to S4?]

* Define DSP

3.4. [Head restraint measurement device (HRMD) means the Society of Automotive Engineers (SAE) (rev. Jul 95) J826 three-dimensional manikin with the ICBC head form attached, representing the head position of a seated 50th percentile male, with sliding scale at the back of the head for the purpose of measuring backset.[1]]

* include drawings in the Annex. Define the head form with greater precision beyond the company name.

3.5. Head Restraint Height means the distance from the [H-point/R-point], measured parallel to the torso reference line [defined by the three dimensional SAE J826 (rev. Jul 95) manikin**]**, to a plane normal to the torso reference line. *Do we need to define?*

* Define: H-point, R-point (from ECE 17/25)

3.6. Intended for occupant use means, when used in reference to the adjustment of a seat, seat adjustment positions other than those intended solely for the purpose of allowing ease of ingress and egress of occupants; access to cargo storage areas; and storage of cargo in the vehicle [add other language for forward-folded seat back, etc...THE LANGUAGE IS DESIGN-RESTRICTIVE. Don't define in the negative – concentrate on occupant transport.]

*necessary to reference HR?

3.7. Top of the head restraint means the point on the head restraint with the greatest height.

[More precise definition, what about "butterfly" HRs? How is it established?]

## 4. General Requirements

4.1. Whenever a range of measurements is specified, the head restraint must meet the requirement at any position of adjustment within the specified range. *redundant*

[1] The head form is designed by and available from the ICBC, 151 West Esplanade, North Vancouver, BC V7M 3H9, Canada (www.icbc.com).

4.2. In each vehicle a head restraint that conforms to either 5.1 or 5.2 of this section must be provided at each front outboard designated seating position.

4.3. In each vehicle equipped with rear outboard **[**and/or front center**]** head restraints the head restraint must conform to either 5.1 or 5.2 of this section.

* rear center requirement?

4.4. Each vehicle must comply with 4.2 and 4.3 of this section with the seat [and head restraint] adjusted as intended for occupant use, except as provided in 5.3 of this section.

*Move to 4.2, 4.3?*

4.5. [At each designated seating position incapable of seating a 50$^{th}$ percentile male Hybrid III test dummy, the applicable head restraint must conform to 5.1 of this section.]

**5. Performance requirements**

5.1. Dimensional and static performance. Each head restraint must conform to paragraphs 5.1.1. through 5.1.7. of this section:

5.1.1. Minimum height.

5.1.1.1. Front outboard designated seating positions. Except as provided in 5.1.1.2. of this section, when measured in accordance with Annex 1, the top of a head restraint located in a front outboard designated seating position must have a height not less than 800 mm **[**850 mm**]** in at least one position of head restraint adjustment.

5.1.1.2. Exception. The requirements of 5.1.1.1 do not apply if the [interior padding of the vehicle roofline] physically prevents a head restraint, located in the front outboard designated seating position, from attaining the required height. In those instances in which this head restraint cannot attain the required height, when measured in accordance with Annex 1, the maximum vertical distance between the top of the head restraint and

the roofline must not exceed 25 mm. Notwithstanding this exception, when measured in accordance with Annex 1, the top of a head restraint located in a front outboard designated seating position must have a height not less than 700 mm [*use*] in the lowest position of adjustment.

5.1.1.3. All outboard **[**and front center**]** designated seating positions equipped with head restraints. Except as provided in 5.1.1.4. of this section, when measured in accordance with Annex 1 of this section, the top of a head restraint located in an outboard **[**and front center**]** designated seating position must have a height not less than 750 mm in any position of adjustment.

5.1.1.4. Exception. The requirements of 5.1.1.3 do not apply if the interior padding of the vehicle roofline or backlight physically prevent a head restraint, located in the rear outboard designated seating position, from attaining the required height. In those instances in which this head restraint cannot attain the required height, when measured in accordance with Annex 1, the maximum vertical distance between the top of the head restraint and the roofline or the backlight must not exceed 25 mm.

5.1.2. Minimum width.

5.1.2.1. When measured in accordance with Annex 2, the lateral width of a head restraint must be not less than 170 mm.

[5.1.2.2. When measured in accordance with Annex 2, the lateral width of the front outboard head restraint in a vehicle with a front center designated seating position without a head restraint, must be not less than 254 mm.]

- legislating misuse
- no off-center seating will occur because of seatbelts center the occupant

- provision shouldn't apply to bucket seats, or "curved/shaped" bench

5.1.3. Minimum Backset for Front Outboard Designated Seating Positions. When measured in accordance with Annex 3, the backset must not be more than [55 mm]. For adjustable restraints, the requirements of this section must be met with the top of the head restraint in all possible ~~any~~ height positions of adjustment between 750 mm and 800 mm **[**850 mm**]**, inclusive. If the top of the head restraint, in its lowest position of adjustment, is above 800 mm **[**850 mm**]**, the requirements of this section must be met at that position. [If the head restraint position is *not attached to?* independent of the seat back inclination position, the head restraint must not be capable of being adjusted such that the backset is more than [55 mm] when the seat back inclination is positioned closer to vertical than the position specified in Appendix 3]

5.1.4. Gaps within head restraint. When measured in accordance with Annex 4, there must not be any gap greater than 60 mm within the head restraint [at any backset position].

* [exception if passes displacement test]

[5.1.4.a. Gap between the head restraint and seat.

When measured in accordance with *insert new test procedure from ECE 17*, there must not be a gap greater than 25 mm between the anterior surface of the head restraint and anterior surface of the seat with the head restraint adjusted to its lowest height position.]

5.1.5. Energy absorption. When the anterior [*front*] surface of the head restraint is impacted in accordance with Annex 5 at any velocity up to and including 24.1 km/h, the deceleration of the head form must not exceed 785 $m/s^2$ (80 g) continuously for more than 3 milliseconds. [*Insert text for radius of curvature*]

5.1.6. Height retention. When tested in accordance with Annex 6, the [cylindrical] test device specified in Annex 6 must return to within 13 mm of its initial reference position after application of at least a 500 N load and subsequent reduction of the load to 50 N ± 1 N. During application of the initial reference load specified in Annex 6, the [cylindrical] test device must not move downward more than 25 mm.

5.1.7. Backset retention, displacement, and strength.

5.1.7.1. Backset retention and displacement. When tested in accordance with Annex 7, the head form described in Annex 7 must:

5.1.7.1.1. Not be displaced more than 25 mm during the application of the initial reference moment of 37 ± 0.7 Nm;

5.1.7.1.2. Not be displaced more than 102 mm perpendicularly and posterior of the displaced extended torso reference line during the application of a 373 ± 7.5 Nm moment about the H-point; and

5.1.7.1.3. Return to within [13 mm] of its initial reference position after the application of a 373 ± 7.5 Nm moment about the H-point and reduction of the moment to 37 ± 0.7 Nm.

5.1.7.2. Strength. When the head restraint is tested in accordance with Annex 7, the load applied to the head restraint must reach 890 N and remain at 890 N for a period of 5 seconds.

5.2. Dynamic performance and width. At each forward-facing outboard designated seating position equipped with a head restraint, the head restraint adjusted midway between the lowest and the highest position of adjustment, and at any position of backset adjustment, must conform to the following:

5.2.1. Injury criteria. When tested in accordance with 6.3 of this section, during a forward acceleration of the dynamic test platform described in 6.3.1, the head restraint must:

5.2.1.1. Angular rotation. Limit posterior angular rotation between the head and torso of the 50th percentile male Hybrid III test dummy specified in […] to 12 degrees for the dummy in all outboard designated seating positions;

5.2.1.2. Head injury criteria. Limit the maximum $HIC_{15}$ value to 500. $HIC_{15}$ is calculated as follows: For any two points in time, $t_1$ and $t_2$, during the event which are separated by not more than a 15 millisecond time interval and where $t_1$ is less than $t_2$, the head injury criterion ($HIC_{15}$) is determined using the resultant head acceleration at the center of gravity of the dummy head, $a_r$, expressed as a multiple of g (the acceleration of gravity) and is calculated using the expression:

$$HIC = \left[ \frac{1}{(t_2 - t_1)} \int_{t_1}^{t_2} a_r \, dt \right]^{2.5} (t_2 - t_1)$$

5.2.2. Width. The head restraint must have the lateral width specified in 5.1.2 of this section.

5.3. [Non-use positions] ~~Folding or retracting rear head restraints~~. A rear head restraint may be adjusted to a position at which its height does not comply with the requirements of 5.1.1. of this section. However, in any such position, the head restraint must meet either 5.3.1 or 5.3.2 [or 5.3.3] of this section.

5.3.1. FRONT AND REAR The head restraint must automatically return to a position in which its minimum height is not less than that specified in 5.1.1. of this section when a test dummy representing a 5th percentile female Hybrid III test dummy is positioned in the seat in accordance with Annex 9; or [front center may need to be addressed]

5.3.2. REAR ONLY The head restraint must, when tested in accordance with Annex 9, be capable of manually rotating either forward or rearward by [more than] not less than 60 degrees from any position of adjustment in which its minimum height is not less than that specified in 5.1.1. of this section.

5.3.3. [alternative criteria; i.e., warning labels, telltale, "discomfort metric," torso angle change?]

5.4. Removability of head restraints. The head restraint must not be removable without a deliberate action distinct from any act necessary for [upward] adjustment.

**6. Test Procedures.** Demonstrate compliance with 5.1 through 5.3 of this section with any adjustable lumbar support adjusted to its most posterior nominal design position. If the seat cushion adjusts independently of the seat back, [position the seat cushion such that the highest H-point position is achieved with respect to the seat back, as measured by SAE J826 (rev. Jul 95) manikin, with leg and thigh segments of the H-point machine adjusted to 16.3 and 15.8 inches].

6.1. Except as specified in Annex 3, if the seat back is adjustable, it is set at [an initial inclination position closest to 25 degrees from the vertical, as measured by SAE J826 manikin (rev. Jul 95). If there is more than one inclination position closest to 25 degrees from vertical, set the seat back inclination to the position closest to and rearward of 25 degrees.]

6.2. Procedure for determining presence of head restraints. Measure the height of the top of a seat back or the top of any independently adjustable seat component attached to or adjacent to the seat back [in its highest position of adjustment using the scale incorporated into the SAE J826 (rev. Jul 95) manikin or an equivalent scale], which is

positioned laterally within 15 mm of the centerline of the seat back or any independently adjustable seat component attached to or adjacent to the seat back.

**Annex 1**

**Minimum Height Measurement Test procedure**

1. Procedure for height measurement. Demonstrate compliance with 5.1.1 in accordance with 1.2. and 1.3 of this annex, **[**using the scale incorporated into the SAE J826 (rev. Jul 95) manikin or an equivalent scale**]**, which is positioned laterally within 15 mm of the head restraint centerline. If the head restraint position is independent of the seat back inclination position, **[**compliance is determined at a seat back inclination position closest to 25 degrees from vertical, and each seat back inclination position less than 25 degrees from vertical.**]**

1.2. Height measurement for front outboard head restraints

1.2.1. For head restraints in front outboard designated seating positions, adjust the top of the head restraint to the highest position and measure the height.

1.2.2 For head restraints located in the front outboard designated seating positions that are prevented by the vehicle roofline from meeting the required height as specified in 5.1.1.2., measure the clearance between the top of the head restraint and the roofline, [with the seat adjusted to its lowest vertical position intended for occupant use], by attempting to pass a 25 mm sphere between them. Adjust the top of the head restraint to the lowest position and measure the height.

1.3 Height measurement for front center and rear outboard head restraints

1.3.1. For head restraints in all designated seating positions equipped with head restraints, adjust the top of the head restraint to the lowest position other than allowed by 5.3 and measure the height.

1.3.2. For head restraints located in rear designated seating positions that are prevented by the vehicle roofline or rear backlight from meeting the required height as specified in 5.1.1.4., measure the clearance between the top of the head restraint or the seat back and the roofline or the rear backlight, with the seat adjusted to its lowest vertical position intended for occupant use, by attempting to pass a 25 mm sphere between them.

## Annex 2

## Minimum Width Measurement Test procedure

1. Procedure for width measurement. Demonstrate compliance with 5.1.2 using **[**calipers**]** to measure the maximum dimension perpendicular to the vehicle vertical longitudinal plane of the intersection of the head restraint with a plane that is normal to the torso reference line of SAE J826 (rev. Jul 95) manikin and 65 ± 3 mm below the top of the head restraint.

## Annex 3

## Minimum Backset Measurement Test Procedure

1. Procedure for backset measurement. Demonstrate compliance with 5.1.3. using the HRMD positioned laterally within 15 mm of the head restraint centerline. Adjust the front head restraint so that its top is at any height between and inclusive of 750 mm and 800 mm [850 mm] and its backset is in the maximum position other than allowed by 5.3. If the lowest position of adjustment is above 800 mm [850 mm], adjust the head restraint to that position. If the head restraint position is independent of the seat back inclination position, [compliance is determined at each seat back inclination position closest to and less than 25 degrees from vertical.]

**Annex 4**

**Maximum Gap Measurement Test Procedure**

1. Procedures for gap measurement. Demonstrate compliance with 5.1.4 in accordance with the procedures of 1.2. through 1.4. of this annex, with the head restraint adjusted to its lowest height position and any backset position.

1.2. The area of measurement is anywhere on the anterior surface of the head restraint or seat with a height greater than 540 mm and within the following distances from the centerline of the seat:

1.2.1. 127 mm for seats required to have 254 mm minimum head restraint width; and

1.2.2. 85 mm for seats required to have a 170 mm head restraint width.

1.3. [Displacement test]; or

1.4.1. Applying a load of no more than 5 N against the area of measurement specified in subparagraph (a), place a 165 ± 2 mm diameter spherical head form against any gap such that at least two points of contact are made within the area. The surface roughness of the head form is less than 1.6 μm, root mean square.

1.4.2. Determine the gap dimension by measuring the vertical straight line distance between the inner edges of the two furthest contact points, as shown in Figures 2 and 3.

**Annex 5**

**Energy Absorption Test Procedure** *add text for alternative devices*

1. Procedures for energy absorption. Demonstrate compliance with 5.1.5 of this section in accordance with 1.2.1. through 1.2.5. of this section, [with the seat back rigidly fixed] and the adjustable head restraints in any height and backset position of adjustment.

1.2.1. Use an impactor with a semispherical head form and a 165 ± 2 mm diameter and a surface roughness of less than 1.6 μm, root mean square. The head form and associated base have a combined mass of 6.8 ± 0.05 kg.

1.2.2. Instrument the impactor with an acceleration sensing device whose output is recorded in a data channel that conforms to the requirements for a 600 Hz channel class as specified in SAE Recommended Practice J211/1 (rev. Mar 95). The axis of the acceleration-sensing device coincides with the geometric center of the head form and the direction of impact.

1.2.3. Propel the impactor toward the head restraint. [At the time of launch, the longitudinal axis of the impactor is within 2 degrees of being horizontal and parallel to the vehicle longitudinal axis.]

1.2.4. [Constrain the movement of the head form so that it travels linearly along the path described in 6.2.5.4 of this section for not less than 25 mm before making contact with the head restraint.]

1.2.5. Impact the anterior surface of the seat or head restraint at any point with a height greater than 635 mm and within a distance of the head restraint vertical centerline of 70 mm.

**Annex 6**

**Height Retention Test Procedure**

1. Procedures for height retention. Demonstrate compliance with 5.1.6 in accordance with 1.2. through 1.3. of this section.

1.2. Adjust the adjustable head restraint so that its top is at any of the following height positions at any backset position:

1.2.1. For front outboard designated seating positions:

1.2.1.1. The highest position; and

1.2.1.2. Not less than, but closest to 800 mm [850 mm]; and

1.2.2. For rear outboard and front center designated seating positions

1.2.2.1. The highest position; and

1.2.2.2. Not less than, but closest to 750 mm.

1.3. Orient a cylindrical test device having a 165 ± 2 mm diameter in plane view (perpendicular to the axis of revolution), and a 152 mm length in profile (through the axis of revolution) with a surface roughness of less than 1.6 μm, root mean square, such that the axis of the revolution is horizontal and in the longitudinal vertical plane through the longitudinal centerline of the head restraint. Position the midpoint of the bottom surface of the cylinder in contact with the head restraint.

1.3.1. Establish initial reference position by applying a vertical downward load of 50 ± 1 N.

1.3.2. Increase the load at the rate of 250 ± 50 N/minute to at least 500 N and maintain this load for not less than 5 seconds.

1.3.3. Reduce the load at the rate of 250 ± 50 N/minute to 50 ± 1 N and determine the position of the cylindrical device with respect to its initial reference position.

**Annex 7**

**Backset Retention, Displacement, and Strength Test Procedures**

1. Procedures for backset retention, displacement, and strength. Demonstrate compliance with 5.1.7 of this section in accordance with 1.2. and 1.3. of this annex. The load vectors that generate moment on the head restraint are initially contained in a vertical plane parallel to the vehicle longitudinal centerline.

1.2. Backset retention and displacement

1.2.1. Adjust the head restraint so that its top is at a height closest to and not less than:

1.2.1.1. 800 mm [850 mm] for front outboard designated seating positions (or the highest position of adjustment for head restraints subject to 5.1.1.2; and

1.2.1.2. 750 mm for rear outboard [and front center] designated seating positions equipped with head restraints (or the highest position of adjustment for rear head restraints subject to 5.1.1.4.

1.2.3. Adjust the head restraint to any backset position.

1.2.4. In the seat, place a test device having the back pan dimensions and torso reference line (vertical center line), when viewed laterally, with the head room probe in the full back position, of the three dimensional SAE J826 (rev. Jul 95) manikin;

1.2.5. Establish the displaced torso reference line by creating a posterior moment of 373 ± 7.5 Nm about the H-point by applying a force to the seat back through the back pan at the rate of 187 ± 37 Nm/minute. The initial location on the back pan of the moment generating force vector has a height of 290 mm ± 13 mm. Apply the force vector normal to the torso reference line and maintain it within 2 degrees of a vertical plane parallel to the vehicle longitudinal centerline. Constrain the back pan to rotate about the H-point.

Rotate the force vector direction with the back pan.

1.2.6. Maintain the position of the back pan as established in 1.2.5. of this annex. Using a 165 ± 2 mm diameter spherical head form with a surface roughness of less than 1.6 μm, root mean square, establish the head form initial reference position by applying, perpendicular to the displaced torso reference line, a posterior initial load at the seat centerline at a height 65 ± 3 mm below the top of the head restraint that will produce a 37 ± 0.7 Nm moment about the H-point. Measure the posterior displacement of the head form during the application of the load.

1.2.7. Increase the initial load at the rate of 187 ± 37 Nm/minute until a 373 ± 7.5 Nm moment about the H-point is produced. Maintain the load level producing that moment for not less than 5 seconds and then measure the posterior displacement of the head form relative to the displaced torso reference line.

1.2.8. Reduce the load at the rate of 187 ± 37 Nm/minute until a 37 ± 0.7 Nm moment about the H-point is produced. While maintaining the load level producing that moment, measure the posterior displacement of the head form position with respect to its initial reference position; and

1.3. Strength. Increase the load specified in 6.2.7.1.7 of this section at the rate of 250 ± 50 N/minute to at least 890 N and maintain this load level for not less than 5 seconds.

## Annex 8

## Dynamic Performance Test Procedure

1. Procedures for dynamic performance. Demonstrate compliance with 5.2 in accordance with this annex, using a 50th percentile male Hybrid III test dummy, and with the head restraint midway between the lowest and the highest position of adjustment, and at any position of backset adjustment.

1.2. Mount the vehicle on a dynamic test platform so that the longitudinal centerline of the vehicle is parallel to the direction of the test platform travel and so that movement between the base of the vehicle and the test platform is prevented. Instrument the platform with an accelerometer and data processing system. Position the accelerometer sensitive axis parallel to the direction of test platform travel.

1.3. Remove the tires, wheels, fluids, and all unsecured components. Remove or rigidly secure the engine, transmission, axles, exhaust, vehicle frame and any other vehicle component necessary to assure that all points on the acceleration vs. time plot measured by an accelerometer on the dynamic test platform fall within the corridor described in Figure 1 and Table 1.

1.4. Place any moveable windows in the fully open position.

1.5. Seat Adjustment. At each outboard designated seating position, using any control that primarily moves the entire seat vertically, [place the seat in the lowest position]. Using any control that primarily moves the entire seat in the fore and aft directions, place the seat midway between the forwardmost and rearmost position. If an adjustment position does not exist midway between the forwardmost and rearmost positions, the closest adjustment position to the rear of the midpoint is used. Adjust the seat cushion and seat

back, without using any controls that move the entire seat, as required by 6 and 6.1 of this section. If the specified position of the H-point can be achieved with a range of seat cushion inclination angles, adjust the seat inclination such that the most forward part of the seat cushion is [at its lowest position] with respect to the most rearward part. If the head restraint is adjustable, adjust the top of the head restraint to a position midway between the lowest position of adjustment and the highest position of adjustment. If an adjustment position midway between the lowest and the highest position does not exist, adjust the head restraint to a position below and nearest to midway between the lowest position of adjustment and the highest position of adjustment.

1.6. Seat Belt Adjustment. Prior to placing the Type 2 seat belt around the test dummy, fully extend the webbing from the seat belt retractor(s) and release it three times to remove slack. If an adjustable seat belt D-ring anchorage exists, place it in the adjustment position closest to the mid-position. If an adjustment position does not exist midway between the highest and lowest position, the closest adjustment position above the midpoint is used.

1.7. Dress and adjust each test dummy as follows:

Each test dummy is clothed in a form fitting cotton stretch short sleeve shirt with above-the-elbow sleeves and above-the-knee length pants. The weight of the shirt or pants shall not exceed 0.25 pounds each. Each foot of the test dummy is equipped with a size 11XW shoe which meets the configuration size, sole, and heel thickness specifications of MIL-S-13192 change "P" and whose weight is 1.25 ±0.2 pounds.

Limb joints are set at 1g, barely restraining the weight of the limb when extended horizontally. Leg joints are adjusted with the torso in the supine position.

1.8. Test dummy positioning procedure. Place a test dummy at each outboard designated seating position equipped with a head restraint.

1.9. Head. The transverse instrumentation platform of the head is level within 1/2 degree. To level the head of the test dummy, the following sequence is followed. First, adjust the position of the H point[2] to level the transverse instrumentation platform of the head of the test dummy. If the transverse instrumentation platform of the head is still not level, then adjust the pelvic angle of the test dummy. If the transverse instrumentation platform of the head is still not level, then adjust the neck bracket of the dummy the minimum amount necessary from the non-adjusted "0" setting to ensure that the transverse instrumentation platform of the head is horizontal within 1/2 degree. The test dummy remains within the limits specified in Footnote 2 after any adjustment of the neck bracket.

1.10. Upper arms and hands. Position each test dummy as specified below:

1.10.1. The driver's upper arms shall be adjacent to the torso with the centerlines as close to a vertical plane as possible.

1.10.2. The passenger's upper arms shall be in contact with the seat back and the sides of the torso.

1.10.3. The palms of the drivers test dummy shall be in contact with the outer part of the steering wheel rim at the rim's horizontal centerline. The thumbs shall be over the steering wheel rim and shall be lightly taped to the steering wheel rim so that if the hand of the test

[2] The H-points of the driver and passenger test dummies shall coincide within 1/2 inch in the vertical dimension and 1/2 inch in the horizontal dimension of a point 1/4 inch below the position of the H-point determined by using the equipment and procedures specified in SAE J826 (APR 1980) except that the length of the lower leg and thigh segments of the H-point machine shall be adjusted to 16.3 and 15.8 inches, respectively, instead of the 50th percentile values specified in Table 1 of SAE J826.

dummy is pushed upward by a force of not less than 2 pounds and not more than 5 pounds, the tape shall release the hand from the steering wheel rim.

1.10.4 The palms of the passenger test dummy shall be in contact with the outside of the thigh. The little finger shall be in contact with the seat cushion.

1.11. Torso. Position each test dummy as specified in [*insert text from S10.4.1.1, S10.4.1.2, and S10.4.2.1of §571.208*], except that the midsagittal plane of the dummy is aligned within 15 mm of the head restraint centerline. If the midsagittal plane of the dummy cannot be aligned within 15 mm of the head restraint centerline then align the midsagittal plane of the dummy as close as possible to the head restraint centerline.

1.12. Legs. Position each test dummy as follows:

The upper legs of the driver and passenger test dummies shall rest against the seat cushion to the extent permitted by placement of the feet. The initial distance between the outboard knee clevis flange surfaces shall be 10.6 inches. To the extent practicable, the left leg of the driver dummy and both legs of the passenger dummy shall be in vertical longitudinal planes. To the extent practicable, the right leg of the driver dummy shall be in a vertical plane. Final adjustment to accommodate the placement of feet in various passenger compartment configurations is permitted.

1.13. Feet. Position each test dummy as specified in [S10.6 of §571.208,[3]] except that for rear outboard designated seating positions the feet of the test dummy are placed flat on the floorpan and beneath the front seat as far forward as possible without front seat interference. For rear outboard designated seating position, if necessary, the distance between the knees can be changed in order to place the feet beneath the seat.

[3] http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=f71ca7d062d9b2fa66b9ddb3fec6e0e3&rgn=div5&view=text&node=49:5.1.2.3.36&idno=49#49:5.1.2.3.36.2.4.64.

2.1. Accelerate the dynamic test platform to 17.3 ± 0.6 km/h. All of the points on the acceleration vs. time curve fall within the corridor described in Figure 1 and Table 5 when filtered to channel class 60, as specified in the SAE Recommended Practice J211/1 (rev. Mar 95). Measure the maximum posterior angular displacement.

2.2. Calculate the angular displacement from the output of instrumentation placed in the torso and head of the test dummy and an algorithm capable of determining the relative angular displacement to within one degree and conforming to the requirements of a 600 Hz channel class, as specified in SAE Recommended Practice J211/1, (rev. Mar 95). No data generated after 200 ms from the beginning of the forward acceleration are used in determining angular displacement of the head with respect to the torso.

2.3. Calculate the $HIC_{15}$ from the output of instrumentation placed in the head of the test dummy, using the equation in 5.2.1.2 of this section and conforming to the requirements for a 1000 Hz channel class as specified in SAE Recommended Practice J211/1 (rev. Mar 95). No data generated after 200 ms from the beginning of the forward acceleration are used in determining HIC.

**Annex 9**

**Retracting Head Restraint Test Procedure**

1. Procedures for folding or retracting head restraints for unoccupied rear [and front center] designated seating positions.

1.2. Demonstrate compliance with 5.3.1, using a 5th percentile female Hybrid III test dummy in accordance with the following procedure:

1.2.1. Position the test dummy in the seat such that the dummy's midsaggital plane is aligned within the 15 mm of the head restraint centerline and is parallel to a vertical plane parallel to the vehicle longitudinal centerline.

1.2.2. Hold the dummy's thighs down and push rearward on the upper torso to maximize the dummy's pelvic angle.

1.2.3. Place the legs as close as possible to 90 degrees to the thighs. Push rearward on the dummy's knees to force the pelvis into the seat so there is no gap between the pelvis and the seat back or until contact occurs between the back of the dummy's calves and the front of the seat cushion such that the angle between the dummy's thighs and legs begins to change.

1.2.4. Note the position of the head restraint. Remove the dummy from the seat. If the head restraint returns to a retracted position upon removal of the dummy, manually place it in the noted position. Determine compliance with the height requirements of 5.1.1 of this section by using the test procedures of 6.2.1this section.

1.3. Demonstrate compliance with 5.3.2 in accordance with the following procedure:

1.3.1. Place the rear head restraint in any position meeting the requirements of 5.1 of this section;

1.3.2. Strike a line on the head restraint. Measure the angle or range of angles of the head restraint reference line as projected onto a vertical longitudinal vehicle plane;

1.3.3. Fold or retract the head restraint to a position in which its minimum height is less than that specified in 5.1.1.2 of this section or in which its backset is more than that specified in 5.1.3 of this section;

1.3.4. Determine the minimum change in the head restraint reference line angle as projected onto a vertical longitudinal vehicle plane from the angle or range of angles measured in 1.3.2.

**Table 1 – Sled pulse corridor reference point locations.**

| Reference Point | Time (ms) | Acceleration ($m/s^2$) |
|---|---|---|
| A | 0 | 10 |
| B | 28 | 94 |
| C | 60 | 94 |
| D | 92 | 0 |
| E | 4 | 0 |
| F | 38.5 | 80 |
| G | 49.5 | 80 |
| H | 84 | 0 |

**Figure 1 - Sled pulse acceleration corridor. The target acceleration with time expressed in milliseconds is $a = 86 \sin(\pi t/88)$ $m/s^2$, for $\Delta V = 17.3 \pm 0.6$ km/h. The time zero for the test is defined by the point when the sled acceleration achieves 2.5 $m/s^2$ (0.25 G's).**

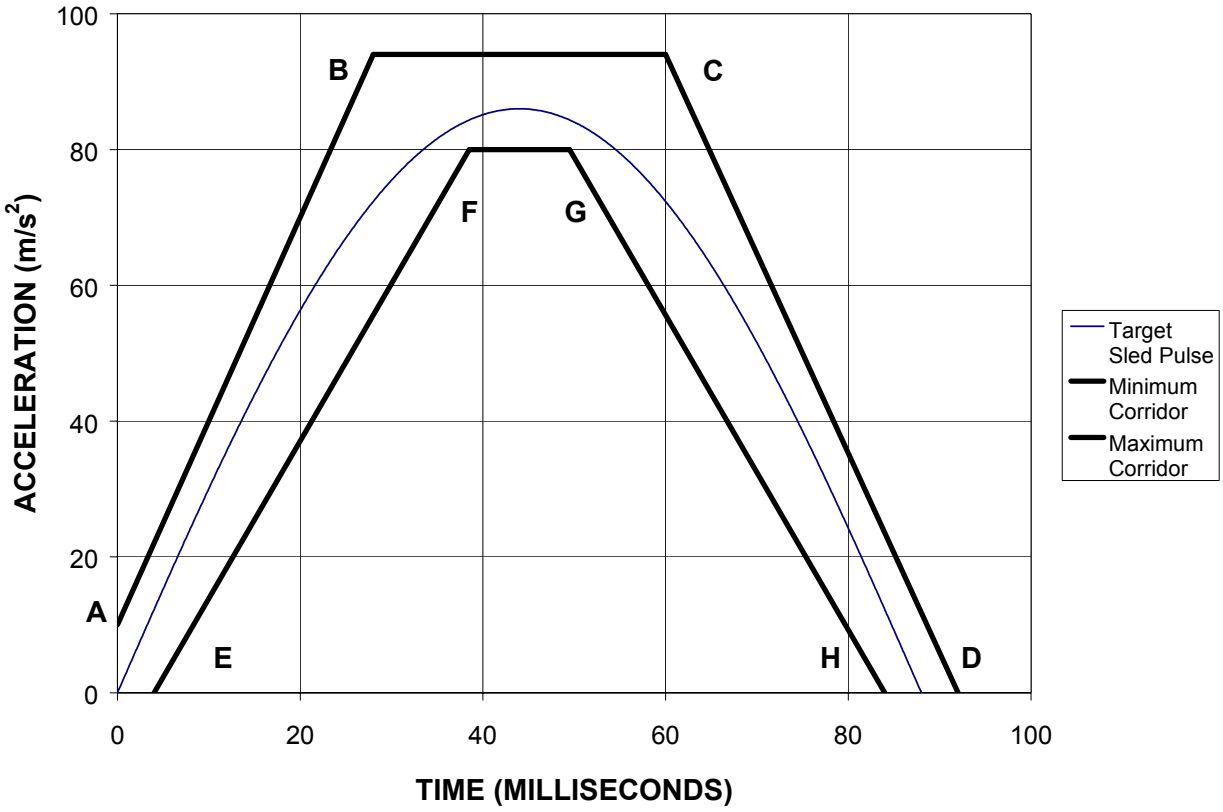
100
80
60
40
20
0
ACCELERATION (m/s2)
0
20
40
60
80
100
TIME (MILLISECONDS)
A
B
C
D
E
F
G
H
Target Sled Pulse
Minimum Corridor
Maximum Corridor

**Figure 2 - Measurement of a vertical gap "a".**

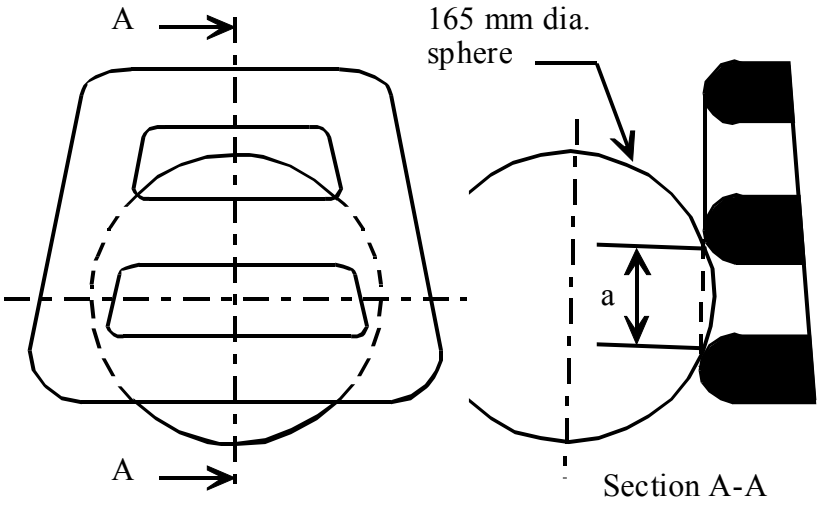

**Figure 3 - Measurement of a horizontal gap "a".**