

The minimum Front Contact Surface Head Restraint

**TNO measurements using Netherlands'
protocol FCS HR 20071012**

TNO | Knowledge for business



**gtr meeting on head restraints
8 - 9 November 2007, Basildon
UK**

Test procedure

- **Seat set-up:**
 - According to manufacturer specification based on R point and design torso angle.
 - If vehicle manufacturer has failed to supply information regarding the position of the R-point or regarding the design torso angle, the centroid of the three measured points or the average of the three measured angles shall be used and be regarded as applicable in all cases where the R-point or the design torso angle is referred.
- **Head restraint set-up:**
 - Highest position of use
 - Most rearward position if adjustable

R-point and design torso angle verification

- Using SAE machine to determine if R-point and torso angle fulfil following requirements:
 - the H-point, as defined by its coordinates, shall lie within a square of 50 mm side length with horizontal and vertical sides whose diagonals intersect at the R-point.
 - actual torso angle shall be within 5 degree of the design torso angle.
 - If these conditions are met, the R-point and the design torso angle, shall be used to demonstrate compliance with the provisions



Determination of the upper border of the Front Contact Surface Head Restraint

1. Draw the centre line of the head restraint which is determined by the vertical median plane of the seat
2. Draw two vertical lines on the head restraints which are determined by longitudinal planes set at 85 mm on either side of the centre line of the head restraint. These two lines are lateral borders of the Front Contact Surface Head Restraint area.



Determination of the upper border of the Front Contact Surface Head Restraint

3. Set the portal in initial position based on a calculation (see the protocol).
4. Move the portal towards head restraint and apply 10N force. Measure the position of the probe.
5. Calculate the backset (see the protocol).

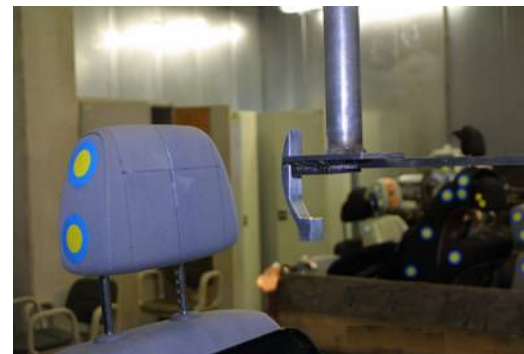
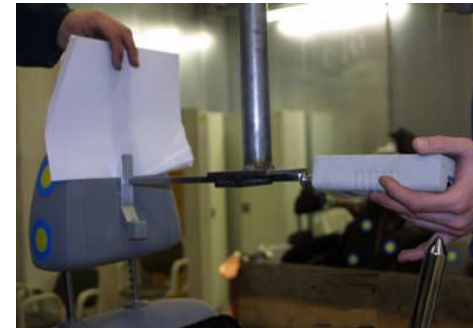


Determination of the upper border of the Front Contact Surface Head Restraint

6. Move the probe more upward along head restraint centreline and repeat steps 4 and 5.



7. Repeat the above step (6) to determine the highest point that fulfils the requirement. Draw a horizontal line on the head restraint which goes through this point and crosses the vertical borders.



Determination of the upper border of the Front Contact Surface Head Restraint

8. Shift the probe laterally and determine if additional four points evenly distributed on the horizontal line limited by the lateral borders fulfil the backset requirement.
9. If one of the points does not fulfil the backset requirement then start again with establishing a new point on the centre line at a lower level height.

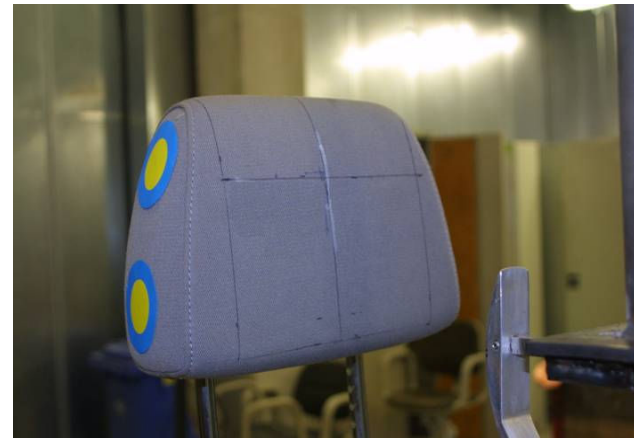


Determination of the upper border of the Front Contact Surface Head Restraint

10. Check if the horizontal line fulfils the minimum head restraint height above the R-point.
11. If the height fulfils the minimum head restraint height then the horizontal line is the upper border of the Front Contact Surface Head Restraint and is considered as the highest effective head restraint height.

Determination of the lower border of the Front Contact Surface Head Restraint

12. Draw a horizontal line on the head restraint such that it is parallel and 100 mm below the upper border (see protocol).



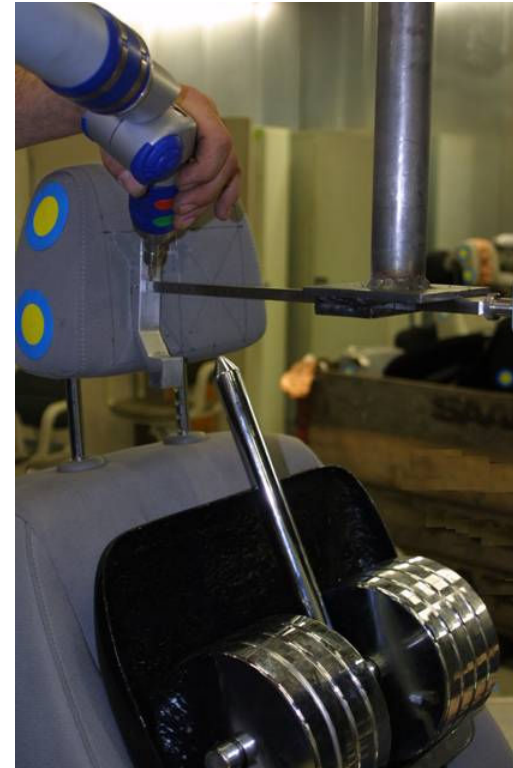
Determination of the lower border of the Front Contact Surface Head Restraint

13. Determine whether five points evenly distributed on the lower horizontal line limited by the lateral borders fulfil the backset criterion.



Determination and check of other points on Front Contact Surface Head Restraint

14. Determine whether additional points in the Front Contact Surface fulfil the backset criterion



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Conclusion and future work

- **During this project experience is gained and it is concluded that the protocol should be improved to make it more clear and robust.**
- Important points that are hereby reflected:
 - The constants used in the Formula, especially the angle between the torso reference line and the so called torso link (in gtr OICA-proposal called line AB), will have a big influence on the determination of the initial position of the head. This angle on the TNO 3-D H machine is 1.9 degree, however in the OICA-proposal it is 2.6 degrees and in the study UMTRI-2001-8, page 7 (Modelling Vehicle Occupant Head and Head Restraint Positions) are again different constants used.
 - All these constants should be a representation of the same human. Therefore a clear position is needed before it comes to measuring the head restraint position and next judging this head restraint on its backset.
 - There is the open question whether taller people have the same fore-aft head location with respect to their H-point. The study UMTRI-2001-8 (page 17, par.4.1) concludes that there is no significant relation to driver anthropometry. However if it is felt necessary, the NL protocol can be adapted such that taller people will get an adapted initial head position.