Transmitted by the expert from United States of America

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FOURTH PROGRESS REPORT OF THE INFORMAL WORKING GROUP

ON HEAD RESTRAINTS

(Transmitted by the Chair of the Head Restraint Informal Working Group)

1. INTRODUCTION

During the one-hundred-twenty-sixth session of WP.29 of March 2002, the Executive Committee of the 1998 Agreement (AC.3) adopted a Program of Work, which includes the development of a global technical regulation (gtr) to address neck injuries in crashes. The United States of America (U.S.A.) volunteered to lead the group's efforts and develop a document detailing the recommended requirements for the gtr. The United States of America presented an informal document (WP.29-134-12) in November 2004 proposing the work and highlighting the relevant issues to be addressed in the gtr. This proposal was adopted at the March 2005 session of WP.29 (TRANS/WP.29/AC.3/13).

At the November 2004 WP.29 session, the Executive Committee charged the Working Party on Passive Safety (GRSP) to form an informal working group on Head Restraints (working group) to discuss and evaluate relevant issues concerning requirements for head restraints to make recommendations regarding a potential gtr.

Under the guidelines governing the development of a gtr, the working group is to first evaluate the merits of the proposal. This evaluation should include:

1. An examination of the merits of the proposal in detail, outlining the pros and cons of the proposal;
2. Consideration of other regulations on the same subject, which are listed in the compendium;
3. A determination that the proposal addresses a problem of sufficient magnitude to warrant the development of a regulation;
4. An examination of whether the nature, extent and cause of the problem addressed by the proposal are correctly characterized;
5. An examination of whether the proposal provides a sufficiently effective, performance oriented approach to address the problem;
6. A determination that the approach identified in the proposal is appropriate to address the problem; and
7. A description of needed additional information.

The working group met to discuss the development of a gtr on head restraints on:
1-2 February 2005 in Paris, France
11-13 April 2005 in Paris, France

13-15 June 2005 in Washington, D.C., United States of America
7-9 September 2005 in Paris, France
23-26 January 2006 in Cologne, Germany
19-21 April 2006 in London, United Kingdom
12-14 September 2006 in Montreal, Canada
7-8 December 2006 in Paris, France.

The Contracting Parties represented on the working group are the Netherlands, France, Canada, Japan, Germany, Korea, Spain, United Kingdom, United States of America, and the European Commission. Representatives from European Association of Automotive Suppliers (CLEPA) and International Organization of Motor Vehicle Manufacturers (OICA) are also participants.

The next meeting is tentatively planned after the completion of validation testing of the R-point method of measuring backset. This meeting should occur before the May 2007 GRSP session.

This report summarizes the main issues discussed by the working party in evaluating the proposal to develop a draft global technical regulation on head restraints.

2. REQUEST TO PROCEED WITH THE DRAFTING OF A GTR

The United States of America recently upgraded its head restraint standard to provide more stringent requirements. In 1982, the United States of America assessed the performance of head restraints installed pursuant to the current standard and reported that integral head restraints are 17 per cent effective at reducing neck injuries in rear impacts and adjustable head restraints are only 10 per cent effective. The UNECE Regulations on head restraints were considerably more stringent than the old United States regulation, and were used as a baseline in developing the new upgraded United States head restraint regulation.

Due to the United States regulatory upgrade effort, this is an excellent opportunity for the international community to develop and establish a gtr in this area. It is the belief of the working group that everyone could benefit from harmonization and new technology based improvements of head restraints. The benefits to the governments would be the improved safety of the head restraints, leveraging of resources, and the harmonization of requirements. Manufacturers would benefit from reduction of the cost of development, testing, and fabrication process of new models. Finally, the consumers would benefit by having a choice of vehicles built to higher, globally recognized standards, providing a better level of safety at a lower price.

The proposed gtr will combine elements from UNECE Regulations Nos. 17, 25, and newly upgraded United States Federal Motor Vehicle Safety Standard (FMVSS) No. 202. While not all issues that would be addressed by a gtr have been resolved, no issues are sufficiently problematic to prevent the development of a draft regulation. It is proposed that a draft gtr could be prepared for discussion at the next GRSP meeting pursuant to the following schedule:

Tasks	Dates
1st Progress Report to GRSP	May 2005
1st Progress Report to AC.3	June 2005
3rd Working Group Meeting	June 2005

Development of draft gtr begins	June 2005
4th Working Group Meeting	September 2005
2nd Progress Report	December 2005
5th Working Group Meeting	January 2006
2nd Progress Report to AC.3	March 2006
6th Working Group Meeting	April 2006
3rd Progress Report and Draft gtr to GRSP	May 2006
3rd Progress Report to AC.3	June 2006
7th Working Group Meeting	September 2006
8th Working Group Meeting	December 2006
4th Progress Report/Draft gtr to GRSP	December 2006
4th Progress Report to AC.3	March 2007
9th Working Group Meeting	TBD 2007
Final Progress Report and Draft gtr to GRSP	May 2007
Submittal of Final Draft gtr to AC.3	November 2007

3. EVALUATION OF THE SAFETY PROBLEM

In the United States of America, between 1988 and 1996, 805,581 whiplash injuries (non-contact Abbreviated Injury Scale (AIS 1) neck) occurred annually in all crashes of passenger cars and LTVs (light trucks, multipurpose passenger vehicles and vans). 272,464 of these whiplash injuries occurred as a result of rear impacts. For rear impact crashes, the average cost of whiplash injuries in 2002 dollars is $9,994 (which includes $6,843 in economic costs and $3,151 in quality of life impacts, but not property damage), resulting in a total annual cost of approximately $2.7 billion. Although the front outboard seat occupants sustain most of these injuries, whiplash is an issue for rear seat passengers as well. During the same time frame, an estimated 5,440 whiplash injuries were reported annually for occupants of rear outboard seating positions. A more detailed discussion of the safety problem in the United States of America and their new requirements in the upgraded FMVSS No. 202 can be reviewed in working paper No. HR-1-8.

In the European Community, there are over 1 million total whiplash injuries a year and the cost of these injuries in the EC is estimated to be €5 to €10 billion per annum and rising (Kroonenburg and Wismans, 1999). The estimated UK cost is approximately £800 million per annum (Batchelor, 2001) (this is equivalent to £30 of every motor insurance premium).

In Korea, rear end collisions account for 34% of all car to car collisions and cause 31% of fatalities and 37% of injuries. Additionally, rear impact collisions cause 260,000 neck injuries in 2002 or 57% of all neck injuries in car to car collisions.

In Japan, rear impacts account for 30% of collisions resulting in bodily injury. Of these crashes, 90% of the injuries or 309,939 are minor neck injuries. Among rear impact collisions resulting in bodily injury, 81.7% of male and 88% of female drivers of the impacted vehicles sustained minor neck injuries.

4. REVIEW OF EXISTING INTERNATIONAL REGULATIONS

The following existing regulations, directives, and standards pertain to head restraints:

- UNECE Regulation No. 17 - Uniform provisions concerning the approval of vehicles with regard to the seats, their anchorages, and any head restraints
- UNECE Regulation No. 25 - Uniform provisions concerning the approval of head restraints (Head Rests), whether or not incorporated in vehicle seats
- European Union Directive 74/408/EEC (consolidated), relating to motor vehicles with regard to the seats, their anchorages and head restraints.
- European Union Directive 78/932/EEC …
- European Union Directive 96/03/EC, adapting to technical progress Council Directive 74/408/EEC relating to the interior fittings of motor vehicles (strength of seats and of their anchorages)
- United States Code of Federal Regulations (CFR) Title 49: Transportation; Part 571.202: Head Restraints
- Australian Design Rule 3/00, Seats and Seat Anchorages
- Australian Design Rule 22/00, Head Restraints
- Japan Safety Regulation for Road Vehicles Article 22 – Seat
- Japan Safety Regulation for Road Vehicles Article 22-4 – Head Restraints, etc.
- Canada Motor Vehicle Safety Regulation No. 202 – Head Restraints
- International Voluntary Standards -SAE J211/1 revised March 1995 – Instrumentation for Impact Test – Part 1 – Electronic
- Korea Safety Regulation for Road Vehicles Article 99 – Head Restraints

Additionally, research and activities being conducted by European Enhanced Vehicle Safety Committee (EEVC) Working Group 12, EEVC Working Group 20, EuroNCAP, and Korea NCAP are also being considered.

5. DISCUSSION OF ISSUES TO BE ADDRESSED BY A GTR

The following discussions reflect the working group's identification of specific issues, as well as the group's evaluation of those issues. A draft comparison of the requirements of UNECE Regulation No. 17 and United States FMVSS No. 202 is provided in the Appendix 1 of this document. The working group has started drafting the technical rational and regulatory text for the gtr (Appendix 2). Discussions and recommendations are reflected in the text of this draft.

5.1. Applicability

The application of a head restraint gtr will, to the extent possible, use the revised vehicle classification and definitions of Special Resolution No. 1.

There has been extensive discussion of the applicability of this gtr. The application of United States FMVSS No. 202 is different than UNECE Regulation No. 17. FMVSS No. 202 requires head restraints in all front outboard seating positions and regulates head restraints optionally installed in the rear outboard seating positions for vehicles up to 4,536 kg. UNECE Regulation No. 17 requires head restraints in all front outboard seating positions of vehicles of category M_1, in all front outboard seating positions of vehicles of category M_2 with a maximum mass not exceeding 3,500 kg, and all front outboard seating positions of vehicles of category N_1 1/ and allows for optional type approval of head restraints optionally installed in other seating positions, or in other vehicles.

There is consensus to recommend that the gtr should recommend head restraints in all front outboard seating positions for category 1-1 vehicles and for category 1-2 vehicles with a gross vehicle mass of up to 3,500 kg. Vehicles of category 2 2/ need more discussion especially on the mass limit.

It was proposed that the gtr, as it pertains to front outboard seats, should apply to vehicles up to 4,536 kg. The United States of America presented justification (see working paper No. HR-4-4 of the informal group), developed in 1989, when the applicability of their regulation was increased to 4,536 kg. By extending the applicability from passenger cars to include trucks, buses, and multipurpose passenger vehicles, there was an estimated reduction of 510 to 870 injuries at an average cost of $29.45 per vehicle (1989 dollars). Japan presented data (HR-4-10) showing the breakdown, by vehicle weight, of crashes resulting in whiplash injuries. They show 1,540 (0.7 per cent) rear impacts involving vehicles with a gross vehicle mass over 3,500 kg that resulted in bodily injury.

There is strong support to limit the weight of category 2 vehicles to 3,500 kg. The Unites States of America continues to state that it will be difficult for them to limit application of the gtr to anything less than 4,500 kg. The United States of America was asked to provide justification for applying the gtr to vehicles in the 3,500 kg to 4,500 kg weight range.

This discussion will continue upon receipt of the United States of America data.

5.2. Scope

At the April meeting, scope language was proposed: "This gtr specifies requirements for head restraints to reduce the frequency and severity of [neck injury] in rear end [and other collisions.]" At the June meeting, it was proposed to replace "neck injury" with "whiplash associated disorder".

There was concern about defining the scope using the injuries and the type of accidents in which those injuries occur. New text was proposed for the scope that addresses these issues: "This gtr specifies requirements for head restraints to reduce the frequency and severity of injuries caused by rearward displacement of the head." This text comes from the definition of head restraints and was accepted for recommendation by the informal working group.

5.3. Height of the head restraint

5.3.1. Front outboard

Both UNECE Regulation No. 17 and the FMVSS No. 202 final rule require front outboard head restraints with a minimum height of 800 mm above the R-point/H-point, respectively. A proposal was made to recommend a minimum height of 850 mm, to accommodate the taller citizens of some countries.

Data was provided showing that the average sitting height for adults in Netherlands and the United States has increased over the last 10 years and a higher head restraint is needed to protect these occupants (see HR-3-6). Japan presented data (see HR-4-10) showing that Japanese females and males are smaller than the United States population. They stated that the current height requirement of 800 mm is appropriate and do not want to raise it to 850 mm. The United Kingdom also

submitted data (see HR-4-14 and HR-6-11) that showed although their population is not increasing in size, they are tall enough to need taller head restraints.

Using the Netherlands and University of Michigan Transportation Research Institute (UMTRI) data for automotive sitting height, it was calculated that a 800 mm height of head restraints is sufficient to protect up to almost a 95th percentile Netherlands male (see HR-4-2). This data was revised to include spine straightening and it still did not support raising the height to 850 mm. There is support for this measurement calculation because it incorporates the effect of backset and it measures occupants as they sit in a vehicle.

The Netherlands data was suggested to be more robust because it measures erect sitting height and does not need to take in account spine straightening. Some representatives questioned the necessity of taking into account spine straightening. It was suggested that spine straightening might not be a factor when there is a reduced backset. Additionally, it was suggested that the spine straightening research of Kroonenberg, which showed a T1 z-displacement of 34 mm (SAE paper 983158), was conducted on a standard (cushioned) car seat, and a similar research of Ono (which showed similar effects) was conducted on a rigid board. It was discussed that this phenomenon would not be as pronounced in a cushioned automotive seat.

It was suggested by one representative that their head restraints are built with a compliance margin of 20 mm; therefore their head restraints are being built to 820 mm. If the height of the head restraint were required to be 850 mm, this representative would need to build their head restraints to 870 mm. This statement was countered by another representative who noted that some vehicles in the fleet only have heights inbetween 800 mm and 820 mm. It was noted that with an 800 mm head restraint, it is starting to become a challenge to be able to install seats in the vehicle, and a larger head restraint can also restrict occupant visibility (blocking vision rearward and to the side) (see HR-3-5). Additional data was presented (see HR-3-4) that showed that in small cars (smaller than mini), 850 mm head restraints could severely restrict rearward vision in the rearview mirror.

The Netherlands stated that taller men are also presented in the statistics and that whiplash is a real problem in the Netherlands (50 per cent insurance payments are to whiplash, there are problems with the hospitals, etc.). In Japan, females have a higher potential of whiplash injury (see HR-4-10).

The United States of America reviewed their cost benefits analysis for height and backset and found that there are no benefits to increasing the height to 850 mm (HR-7-11). The benefits calculated are solely influenced by the 55 mm backset. Benefits from height do not come into account until backset is very large.

Based on US and Japanese data, and other data presented at previous meetings, the GTR group decided to recommend a height of 800 mm in the GTR. If benefits for increasing the height are presented at a later date, this issue can be readdressed.

5.3.2. Rear outboard

It was proposed that optionally installed rear outboard head restraints have a minimum height of 750 m. Additionally it was proposed to define a rear head restraint as any seat structure 700 mm above the H-point. Current practice in UNECE is allowing the manufacturer designating what is and is not a head restraint. The United States standard requires that optionally installed rear outboard

head restraints must meet the requirements of the standard. The recommendation of the group is that these head restraints, if installed, must conform to the dimensional requirements, with a 750 mm height, and static requirements, excluding backset.

5.3.3. Front center/rear center

There was discussion on how front center head restraints are regulated under UNECE Regulation No. 17 and how to address these restraints in the gtr. Under UNECE Regulation No. 17, the manufacturer has the option to approve center head restraints to the requirements; meaning that the installation of a center head restraint does not necessarily mean it has been approved to the requirements. In this sense, United States regulations do not have the same capability as the UNECE Regulation. In general in the United States of America, if a manufacturer chooses to optionally install a piece of equipment, than that piece of equipment must meet the regulation. For example, manufacturers have the option to install rear outboard head restraints, but if they are installed, they must meet the requirements outlined in FMVSS No. 202.

Some delegates are concerned with the ability to justify regulating front center head restraints due to low occupancy rates. There is also concern that front center head restraints may impede visibility. It was stated that in Europe there is a UNECE requirement that limits obscurity of rearward visibility to 15 per cent.

The working group recommends that front center head restraints be included in the gtr and regulated in the same manner as rear outboard head restraints (i.e. optional, no backset requirement, 750 mm height, etc.). Requirements for rear center head restraints have also been included. These head restraints have the same requirements as front center head restraints, but they do not have a height requirement (to be called a head restraint, it must have a minimum height of 700 mm).

5.3.4. Clearance exemption

There is consensus to recommend, in the measurement of height, the allowance of a 25 mm clearance exemption for the "roofline or backlight." There is additional discussion on where this measurement is taken and the seat set-up when the measurement is taken.

There are two proposals being considered. One allows 25 mm of clearance between the head restraint and the roofline or rear window when the head restraint is in the lowest position, the seat is in the lowest position, and the seat back angle measures 25 degrees. This is based on the safety concern for maintaining the 800 mm height of the head restraint.

Another proposal was put forth to allow the clearance exemption be applied when the seat is in any position of adjustment (see HR-4-15). It was stated that this exemption was needed to allow the rear seat passengers to exit the vehicle in emergency. Without the clearance, the seat could contact the vehicle structure and slow down the egress process.

Some delegates do not believe that emergency egress is an issue. There is also concern that the clearance exemption could be applied when the seat is in the highest position, thereby allowing head restraints as short as 700 mm. It was stated the reducing the height of a head restraint to less than approximately 780 mm would have an impact on the benefits.

After a review of the fleet, it was determined that the clearance exemption is not needed for front seats for folding positions and therefore it is recommended that this exemption only be applied in cases of interference with the roofline or backlight. This discussion will be re-opened if the height of the front head restraints is raised to 850 mm. This exemption is currently used for some folding rear seats, and therefore the exemption is still being considered in those cases.

With regard to the seat setup, it was discussed that this exemption be applied when the seat is in the lowest position and the head restraint is in the highest position, since this would be the position of the tallest occupant. There is another recommendation that this clearance be applied when the seat is in design position. Evaluation of the proposed setup is still ongoing. The group does recommend that the measurement be taken at any point of forward or aft adjustment.

It was also requested that the working group consider convertible roofs as they are retracted. Regulatory text will be added to apply an added exclusion for convertible roofs.

5.4. Adjustable front head restraints – front surface height

It has been proposed to include in the gtr the UNECE Regulation No. 17 requirement that the height of the head restraint face be a minimum of 100 mm to ensure sufficient surface for the occupant's head to contact. The UNECE Regulation No. 17 requirement is measured in the same manner as the overall height of the head restraint. There have been concerns expressed that the measurement taken in this manner does not address the effective height of the restraint. In the case of extremely contoured head restraints, the height of the surface that the head would contact is less than the measured height. It has been proposed that the 100 mm requirement be applied to this effective height of the head restraint. This proposal was countered by some as not necessary because the shape of the head restraint is governed by the displacement test, energy absorption test, and other requirements.

For inclusion in the gtr, this requirement needs to be justified and if the method of measurement is to be changed, an objective test procedure will need to be proposed.

5.5. Head restraint width

5.5.1. Front seats

5.5.1.1. Single seats

There is consensus to recommend that single front outboard seats have a minimum head restraint width of 170 mm.

5.5.1.2. Bench seats

There is a proposal to recommend that head restraints have a minimum width of 254 mm when installed in the front outboard positions on bench seats. The need for this requirement has been argued because a bench seat can cause the occupant to sit off-center from the head restraint (especially if unbelted), therefore a wider head restraint is needed.

There was concern for regulating the wider head restraints because the gtr would be regulating misuse. Others stated this requirement is no longer necessary, because the vehicle bench seat of today is considerably different from the vehicle bench seat of 40 years ago. There is also a concern that wider head restraints could impact visibility.

At this time, it is difficult to justify this requirement. Unless justification is presented this requirement will not be included in the gtr and thus all head restraints would have a minimum width of 170 mm.

5.5.2. Rear seats

There was consensus to recommend that rear outboard seats, if installed, have a minimum head restraint width of 170 mm.

5.6. Seat set up and measuring procedure for height

There are two proposals under discussions concerning the set-up of the seat for measurement and the measurement procedure. One proposal is to use the manufacturer's recommended seating position as detailed in UNECE Regulation No. 17. The other is to use the procedure that is outlined in the recently adopted FMVSS No. 202, which positions the seat in the highest position of adjustment and sets the seat back angle at a fixed 25 degrees. The United States procedure allows for results of height and backset to be compared from vehicle to vehicle. The UNECE Regulation No. 17 procedure allows the seat to be measured at the same seat back angle that is used to determine other occupant design requirements, such as sight angles and has proved to be very repeatable and reproducible; concerns have been raised that the United States procedure would result in high variations at certification. UNECE Regulation No. 17 also takes into account the difference in seating positions for different vehicle types.

In addition to the set-up of the seat, the method of measuring height is under discussion. Some recommend taking all measurements from the R-point. Another proposal is to use the J826 manikin as the primary measurement tool. The use of the R-point allows measurements to be verified to known design points on the vehicle thus improving repeatability. The use of the J826 manikin allows the seat H-point to be measured as it exists in the vehicle and when it is under load. It was argued that options in seat materials and manikin set up can produce recordable differences from one seat to another. UNECE experience shows that the use of the R-point allows measurements to be easily verified on a drawing and is also very repeatable and reproducible when verified in a car. The use of H-point can address differences in measurements caused by seat materials and manufacturering variability.

5.7. Backset

There is general consensus to recommend the regulation of backset, but there are still intense discussions on the measuring method and backset limit. One proposal is to measure backset, with a limit of 55 mm, using the Head Restraint Measuring Device (HRMD) attached to the three dimensional H-point machine. The other proposal is to measure backset from the R-point using a translation of the measurements of the HRMD, but not the physical HRMD itself.

Data has been presented with regard to concerns relating to repeatability/reproducibility issues with the HRMD and three dimensional h-point machine test device and with using different technicians to measure the backset. It has been shown that for each degree of torso angle change, there is approximately 4.3 mm backset change and a 5 mm deviation in H-point could cause a 20 mm variability on backset. Canada gave a presentation on using the H-point method to measure backset (HR-7-5). They found good repeatability and reproducibility of measurements. This presentation also discussed the issues with calibrating the HRMD & SAE manikin system. The Insurance Industry working group has proposed the GLORIA Jig as a calibration system. Delegates were asked to review the draft calibration test procedure. Some delegates and representatives expressed concerns that the GLORIA is not readily accessible, and will add an extra cost to the regulation to purchase the GLORIA. There were also questions on who calibrates the calibration device? Canada indicated that completion of the new calibration system is expected to occur within a few months. Canada also explained that the plan is not for each HRMD/H-point user to have to purchase a calibrating jig and learn how to use it. Current plan is to have 3 or 4 GLORIA jigs, and HRMD owners would be offered calibration service. The calibration test procedure will be added to the GTR Annex with permission from the Insurance Industry working group.

It has also been noted that H-point scatter around R-point can vary in all directions but is limited by regulatory requirements. Build variability is one of the parameters that can translate into significant variability in backset. Another study showed that vehicle orientation can impact backset variation and it has been recommended to use the design seating position to reduce variability. Other representatives acknowledged their desire to use the design seat back angle in measuring backset, noting that this would be the same angle that is used in other testing, like frontal impact.

There has also been concern for the comfort of the occupant. Representatives are starting to see customer complaints on head restraints that were built to a 50 mm backset. It was mentioned that if backset were regulated at 55 mm, then vehicles would be designed to 35-40 mm. A study was presented (see HR-4-7) based on eye-ellipse data from UMTRI in which interference between the head restraint and head when the backset is 50 mm was calculated. In a seat that was designed for a 50 mm backset at 25° torso angle, with a mean driver selected seat back angle of 20°, there would be interference problem with about 35 to 40 per cent of the occupants. At a mean driver selected seat back angle at 22°, approximately 10 per cent of the occupants would have interference problems with the head restraint.

To alleviate some of the concerns with comfort on seats that have a very upright seat back design angle. The working group agreed to recommend that backset be measured at manufacturers' seat back design angle.

OICA presented a method to measure backset, with a limit of 55 mm, using the R-point as an initial reference point and the dimensions of the HRMD. It is suggested that this method will improve variability and have fewer problems with repeatability and reproducabilty when compared to the HRMD method. This method will be validated in the next couple of months and discussions will resume once testing is complete.

5.8. Gaps

5.8.1. Gaps within head restraint

It is recommended that all gaps with a head restraint are evaluated to ensure a minimum level of protection for the occupant and provide appropriate relief to address rearward visibility concerns. The proposed evaluation requires that if the gap is greater than 60 mm when measured using 165 mm sphere then the gap is tested using the displacement test with the headform applied at the center of the gap. This is an existing UNECE R.17 requirement and is providing appropriate protection for the occupant.

5.8.2. Gaps between bottom of head restraint and top of seat back

It has been proposed that gaps between the bottom of the head restraint and the top of the seat back have maximum dimension of 60 mm when measured using a 165 mm sphere. There has been an alternative proposal to allow a maximum height of 25 mm when measured using the same method to measure overall height as described in UNECE Regulation No. 17. It was also stated the 25 mm gap requirement is to prevent a gap that is too large. Requiring a minimum gap was established to prevent an occupant from contacting the head restraint posts or other structure when the head restraint is in the lowest position. It was noted that because of seat contours, there was concern that using the sphere to measure this gap could result in failure of gaps that would normally pass the UNECE Regulation No. 17 requirement or gaps that are extremely small.

It is recommended that gaps between the bottom of the head restraint and the top of the seat back have either maximum dimension of 60 mm when measured using a 165 mm sphere or a maximum height of 25 mm when measured using the same method to measure overall height as described in UNECE Regulation No. 17, and the gap for non-vertically adjustable head restraints should have a maximum dimension of 60 mm.

5.9. Head restraint height adjustment retention devices (locks)

There is general consensus to recommend that if a device is adjustable for height, then it should hold its position when loaded in the downward direction. It has been proposed that downward force of 500 N be applied to the top of an adjustable head restraint to ensure the integrity of the height retention device. Concern was expressed that this load was overly severe, the forces were being applied in the wrong direction, and that such a requirement might negatively affect active head restraint system design. Data from Hybrid III dummies was provided on the representativeness of the force levels.

It was also questioned if the measurement taken at the top of the head restraint is the correct method, as it does not take into account the foam hysteresis. An alternative suggestion was made to use the bottom of the head restraint as reference. New regulatory text and test procedures were drafted (HR-6-9) and included in the regulatory text.

5.10. Removability

There is consensus to recommend the ability for head restraint removal via a deliberate action distinct from any act necessary for adjustment as stated in UNECE Regulation No. 17. There is discussion on the meaning of "a deliberate action distinct from any act necessary for adjustment". It has been proposed to allow for removal via a deliberate action distinct from any act necessary for upward adjustment. The working group has agreed on recommended language for the gtr to reflect this concept.

5.11. Non-use positions

5.11.1. Front seats

It has been proposed to allow non-use positions in the front seat, as long as they automatically return to the proper position when the seat is occupied. A test procedure using the 5th percentile female Hybrid III dummy or a human surrogate to evaluate these systems has been added to the gtr.

There is addition ongoing discussion to allow any validated method used to determine a non-use position in the rear seats, be allowed as a method to evaluate non-use in the front seats.

5.11.2. Rear seats

5.11.2.1. Manually adjusted non-use positions

There is consensus to recommend regulation of non-use positions in the rear seats, as long as the position is "clearly recognizable to the occupant". There is discussion on how to objectively evaluate this requirement. One proposal is to define "clearly recognizable" as a head restraint that rotates a minimum of 60 degrees forward or aft. There was concern that this definition is too design restrictive as the sole method and additional methods have been proposed (see HR-4-13).

A human factors study was conducted the evaluated the effectiveness of a 5º, 10º, and 15º torso angle degree change in causing an occupant to move the head restraint out of the non-use position (HR-5-5). Based on the results of this study, the working group agreed to recommend the 10º torso angle change option as an alternative.

To use of labels to determine a non-use position was evaluated. Some representatives and delegates support the use of labels since these head restraints are optional, and a label in a non-use position is better than no label at all. Additional, the need for labels was suggested because the use of the torso angle change method or discomfort metric may be incompatible with the installation on child restraints. Some delegates do not support the use of labels, because there are already too may labels in the vehicles and, based on the US study, the labels were ineffective in causing the occupant to move the head restraint out of the non-use position, although 50% of those questioned understood what the label meant, and an additional 30% understood that the head restraint was adjustable. To accommodate all views, in the GTR labels will be recommended as an optional method to be accepted by the Contracting Party. Based on the available data, Contacting Parties can choose the level of risk they are comfortable with.

Another proposal under consideration is a "discomfort metric" which defines the zone the head restraint is in when it is in the non-use position. This concept was accepted for recommendation by the working group, but the appropriate dimensional criteria needs to be determined. Two studies were conducted by OICA to evaluate the criteria. One study (HR-8-11) showed that the thickness of the head restraint is more important than the height of the lower edge of the head restraint in causing the occupant to move the head restraint from a non-use position to an in-use position. It also showed that when dimensions of the “discomfort metric” are such that they would produce a 10 degree torso angle change, the occupant responses are similar. The other study showed when the discomfort metric dimensions are the same as current seat designs, a large percentage of small females can recognize the head restraint is out of position.

The informal working group is reviewing the data presented at the last meeting and will evaluate the proposals for the next meeting.

5.11.2.2. Automatically adjusted non-use positions

There is consensus, for the rear seats, to recommend regulation of non-use positions that automatically return to the proper position when the seat is occupied. A test procedure using the 5th percentile female Hybrid III dummy or a human surrogate to evaluate these systems has been added to the gtr.

5.12. Energy absorption

5.12.1. Impactor

It has been proposed to recommend the energy absorption test defined in FMVSS No. 202. This test is similar to the test defined in UNECE Regulation No. 17, except for the testing device and the requirement to rigidly fix the seat back during testing. Data was presented (see HR-4-8) showing that the free motion head form produces equivalent results as a pendulum impactor on rigidly supported head restraint foam. Additional testing was presented at the January meeting on the comparison of pendulum and linear impactor and the effect of rigidly fixing the seat back.

The working group agreed to recommend a test procedure that did not specify a type of impactor, but rather a required energy. This would allow the linear impactor, the free motion impactor, or the pendulum impactor to be used for testing. Additionally, the working group agreed to recommend running the test without fixing the seat back.

5.12.1. Radius of curvature

It has been proposed to incorporate the UNECE Regulation No. 17 requirement that designated parts of the front of the head restraint shall not exhibit areas with a radius of curvature less than 5 mm pre- and post-test. Justification suggested for the post-test evaluation is that there could be interior breakage that would produce a sharp edge. There is concern for the protection of occupants from secondary impacts. It was suggested that the pre-test requirement is very difficult to conduct under self-certification. Applying this to the rear of the head restraint is not within the scope of the gtr.

An objective test procedure was not developed to measure radius of curvature and the group recommends that the concerns for this evaluation be addressed in the technical rational of this gtr.

5.13. Displacement test procedures/adjustable backset locking test

A proposal was made to incorporate in the gtr a test procedure that combines the displacement test evaluation with an evaluation of adjustable backset locking systems. This test is similar to the displacement test in UNECE Regulation 17, but it requires specific measurements to be taken throughout the testing to insure an adjustable backset held in its forwardmost position of adjustment.

In the original proposal it was recommended that the testing be conducted when the seat back is rigidly fixed. The reason for the fixation was to address concerns about the variability in the return to an inital reference load. It was found that the test procedure was more repeatable when the seat back was braced. The UNECE Regulation No. 17 displacement test combines seat back and head restraint movement. From this perspective, it was suggested that fixing the seat back would be a much more severe test. However, it is unknown which is more stringent in terms of displacement. Therefore, it is recommended that the testing be conducted without rigidly fixing the seat back.

There had been considerable discussion on whether to include the backset retention requirements. Some believe that if an occupant adjusts their head restraint backset so that it is less than the requirement, then they should have some assurance that it will maintain that position when loaded. Some delegates and representatives disagree with this concept stating that it would eliminate adjustable backsets and that the head restraint already has to meet the backset requirement. Other delegates support this requirement, but only for the required head restraints and not the optionally installed head restraints. It was suggested that there may be incompatibilities with non-use positions methods and the retention requirements. In this discussion it was noted that in the US test, on which theoriginal proposal was based, the evaluation of the adjustable retention requirement was performed on all head restraints, regardless of whether they were adjustable or not. It was suggested that, although a head restraint can be designed to pass the test, it will unnecessarily drive firmer head restraints. The gtr will be drafted so that the UNECE Regulation 17 test can be used for all seats and the Contacting Party can choose to apply the modified US test only when adjustable backsets are present.

5.14. Dynamic Test/Evaluation of Non-Static Systems

With the incorporation of a static backset requirement, it is important to provide an alternative way to evaluate active/re-active head restraint systems. These systems, by the function of their design, reduce the backset only when needed for the protection of whiplash injuries in a rear impact crash. When these systems are in their normal drivng position, they may have a larger static backset.

A proposal was made to recommend incorporation of the optional dynamic test defined in FMVSS No. 202 into the gtr as an option to the static requirements. Data was presented positively correlating the dynamic test to real-world data. There was a great deal of concern expressed by some delegates and representatives with respect to using the Hybrid III dummy in a dynamic test because the spine is not human like and the dummy does not have humanlike motion in a dynamic test. Additionally, there was a discussion on the injury criteria. The US recommended a 12 degree head-to-torso rotation limit. Many countries and representatives would suggest a 20 degree head-to-torso rotation criteria. US data shows that increasing the rotation limit would increase the risk of injury from 7% to 10%. A question was asked of all countries…what is an acceptable risk? Consensus was not reached on this issue.

It was suggested that the BioRID dummy is preferred for dynamic testing, but it was acknowledged that it was not ready for regulation. The working group considered using the BioRID dummy as a tool to activate the non-static systems under the same testing conditions as the US dynamic test, but consensus could not be reached on injury criteria and their were still outstanding concerns on the reproducibility of the BioRID data.

A fully regulated dummy and a dynamic whiplash evaluation test are considered to be a longer term solution to the whiplash problem. To address the injuries quickly, it was suggested that the US dynamic test could be an iterative step, and the gtr can be amended when a better dummy and test procedure are available. Unfortunately, the working group reached an impass concerning this proposal.

To resolve the issue of developing a regulation that would not hinder the production of active/re-active systems, it was suggested that these systems be measured staticly. A procedure to measure these systems in the activated/deployed position was considered, but concensus could not be reached on how to activate/deploy the system. This impass was similar to that above. Some delegates wanted to use the BioRID dummy, and other delegates could not accept this dummy because it is not regulated.

It was suggested that the non-static (active/re-active) systems be measured statically, but that they would be required to meet a less stringent backset requirement. To realize this suggestion a definition of either a static system or a non-static system is needed. Additonally, a justified proposal for a backset limit is needed. For the group to fully support this direction, an action plan, with a timeline, for the development of a dynamic whiplash evaluation test and regulated dummy would need to be discussed in the gtr Final Report and gtr technical rational. OICA has been tasked to develop a definition for either a static or non-static system by the end of January 2007. Further discussion on this issue will continue after the proposed language is submitted.

For the long term solution to reducing whiplach injuries, the working group recommends that research continue towards the development of a whiplash evaluation test and a whiplash dummy. The ongoing work in EEVC was acknowledged, but cooperation of countries outside of Europe was strongly encouraged. It was suggested that the GRSP would be an appropriate place for a centralized international cooperation.

6. LIST OF INFORMAL WORKING GROUP DOCUMENTS

HR-1-1	Attendance List, Paris, 1-2 February 2005
HR-1-2	(USA) Final Rule
HR-1-3	(USA) Final Regulatory Impact Analysis - FMVSS No. 202 Head Restraints for Passenger Vehicles
HR-1-4	(USA) Comparison of Head Restraint Regulations FMVSS 202 (Current standard, Final Rule, and UNECE Regulation No. 17)
HR-1-5	{Blank}
HR-1-6	Head Restraints for Rear Seating Positions
HR-1-7	(OICA) Abstract from ACEA Whiplash Test Series on Repeatability and Reproducibility of Proposed Test Procedures
HR-1-8	(USA) United States FMVSS No. 202 Final Rule

HR-1-9	GRSP informal group on head restraints 1st Meeting, Paris, 1-2 February 2005 Draft Summary Report
HR-1-9-Rev.1	GRSP informal group on head restraints 1st Meeting, Paris, 1-2 February 2005 Draft Summary Report
HR-2-1	(USA) The Displacement Test as an Alternative to the 60 mm Gap Requirement
HR-2-2	Head Restraint Informal Working Group Meeting - Agenda 11-13 April 2005, OICA Offices, Paris, France
HR-2-3	(Netherlands) Static geometric measurements on head restraints
HR-2-4	(USA) Justification for 254 mm width of Head Restraints on Bench Seats
HR-2-5	(Japan) Japan's Comments on Backset Requirements of FMVSS 202aS – Final Rule - Study of Variations in Backset Measurements
HR-2-6	(USA) Head Restraint Height Measurement - H-point vs. R-point
HR-2-7	(USA) Correlation of Dynamic Test - Procedure to Field Performance
HR-2-8	(USA) Justification for Load Values - FMVSS No. 202 Final Rule – Backset and Height Retention Testing
HR-2-9	BioRID ATD - Part of a Presentation from Matthew Avery / Thatcham for an EEVC WG12/20 joint meeting
HR-2-10	Neck Injuries - Real World Data - Male/Female Comparison - Raimondo Sferco / Bernd Lorenz - Ford Motor Company/BASt
HR-2-11	(Germany) Current Status of the Euro NCAP Whiplash Subgroup Bundesanstalt für Straßenwesen - Federal Highway Research Institute
HR-2-12	(Germany) Current Status of the EEVC WG 20 "Rear Impact test procedure(s) and the mitigation of neck injury" Bundesanstalt für Straßenwesen - Federal Highway Research Institute
HR-2-13	(OICA) Comment for Non Use Position of Non Use Position of Head Restraint gtr
HR-2-14	(Netherlands) Needed Height for Head Restraints
HR-2-15	Attendance List - GRSP Informal Group Meeting on Head Restraints Paris, 11-13 April 2005
HR-3-1	Head Restraint Informal Working Group Meeting - Agenda, 13-15 June 2005, NHTSA Office, Washington, D.C., USA
HR-3-2	Japan's Comments on Draft Action Items for June 2005 - Head Restraints gtr Meeting
HR-3-3	Japan's Comments on Backset Requirements of FMVSS 202aS - Final Rule
HR-3-4	Japan's Comments on Head Restraint Height Proposal from the Netherlands
HR-3-5	Height of Head Restraint - Impact of increased height threshold of head restraints
HR-3-6	(Netherlands) Calculation needed head restraint height
HR-3-7	(Japan) Biomechanical Responses of HY-III and BioRID II (Part 1)
HR-3-8	(Japan) Biomechanical Responses of HY-III and BioRID II (Part 2)
HR-3-9	(USA) Laboratory Test Procedure for FMVSS 202aS - Head Restraints – Static Requirements
HR-3-10	(OICA) Alliance of Automobile Manufacturers - Head Restraint gtrInput
HR-3-11	Attendance List - GRSP Informal Group Meeting on Head Restraint – Washington, D.C., 13-15 June 2005
HR-3-12	(USA) Final Rule
HR-3-13	(USA) Final Regulatory Evaluation: Extension of Head Restraint Requirements to Light Trucks, Buses, and Multipurpose Passenger Vehicles withGross Vehicle Weight Rating of 10.000 pounds or Less (FMVSS 202)

HR-3-14	(USA) An Evaluation of Head Restraints Federal Motor Vehicle Safety Standard 202, February 1982
HR-4-1	Agenda of the Head Restraint Informal Working Group Meeting – 7-9 September 2005, OICA Office, Paris, France
HR-4-2	(USA) United States' analysis of the need to raise the head restraint height to 850 mm
HR-4-3	(Japan) Japanese Backset Raw Data Revision B
HR-4-4	(USA) Extending the Applicability of United States FMVSS 202 to Light Trucks and Vans - Summary of HR-3-12 and HR-3-13
HR-4-5	(USA) United States Justification for "Other Collisions" in the Proposed Scope
HR-4-6	Draft Global Technical Regulation on Head Restraints
HR-4-7	(CLEPA) Head Positions, Summary of UMTRI Study and Vehicle Examples
HR-4-8	(CLEPA) Comparison between the Pendulum and the Free Motion Headform (FMH) energy dissipation test
HR-4-9	(Japan) Japan's Comments on Backset Requirements of FMVSS 202aS – Final Rule
HR-4-10	(Japan) Japan Accident Analyses for Application and Height on Head Restraints gtr
HR-4-11	(Japan) Japan Research Status for Bio-RID II Injury Parameters on HeadRestraints gtr
HR-4-12	(Japan) Japan Research Status for Bio-RID II Dummy Repeatability and Reproducibility on Head Restraints gtr
HR-4-13	(OICA) Head Restraint gtr Informal Working Group - OICA Data Submission, 7-9 September 2005
HR-4-14	(UK) UK Population Stature 1993-2003
HR-4-15	(OICA) Draft Proposal on Roof Clearance for Tip Forward Seat Backs
HR-4-16	(Netherlands) Netherlands' Comparison of Two Different Calculations of "Needed Head Restraint Height".
HR-4-17	HR-4-6 (202 Draft gtr) revised as of 9 September 2005 (HR-4-17)
HR-4-18	(OICA) Head Restraint Definition
HR-5-1	Meeting Agenda
HR-5-2	Draft GTR regulatory text
HR-5-3	(OICA) Non-Use Position proposal
HR-5-4	US Measurement Variability Presentation
HR-5-5	US Non-Use Position Study
HR-5-6	US Energy Absorption Test
HR-5-7	(OICA) Head Restraint Height Clearance
HR-5-8	(UK) Rear Impact Dummy Research
HR-5-9	(OICA) Backset Complaint Data
HR-5-10	US Measurement Variability Comparison
HR-5-11	(OICA) Dummy Performance Comparison
HR-5-12	(CLEPA) Dynamic tests with control yielding seats
HR-5-13	(OICA) Head Restraint Applicability data
HR-5-14	(Canada) Head Restraint Comparison Methods
HR-5-15	Status of Euro NCAP
HR-5-16	ESV Paper: The Role of Seatback and Head Restraint Design Parameters on Rear Impact Occupant Dynamics
HR-5-17	US Energy Absorption Test report
HR-5-18	(Japan) Presentation on Accident Data
HR-5-19	(Japan) Presentation on Reproducibility of Dummy Data
HR-5-20	Meeting Minutes – January 2006

HR-5-21	GTR regulatory text at end of meeting 1/27/06
HR-5-22	Draft GTR regulatory text for Height Retention of Head Restraints
HR-5-23	US Head Restraint Non-Use Position Report
HR-6-1	Meeting Agenda
HR-6-2	Draft GTR regulatory text - April 14, 2006
HR-6-3	(OICA) Test procedure for backset measurement from R-point
HR-6-4	Draft GTR regulatory text - April 21, 2006
HR-6-5	(Japan) Hybrid III T1G for whiplash evaluation in a dynamic test
HR-6-6	(OICA) Dimensional drawings for document HR-6-3
HR-6-7	(France) Consideration for measuring active head restraints
HR-6-8	(CLEPA) Test Procedures for Energy Dissipation Test
HR-6-9	(CLEPA) Foam Influence on height retention
HR-6-10	(Japan) Example of Gap greater than 60 mm
HR-6-11	(UK) Head Restraint Height Calculations

Note: All the documents of the informal group on head restraints are available at: http://www.unece.org/trans/main/welcwp29.htm

Appendix 1

Comparison of head restraint regulations UNECE Regulation No. 17 / FMVSS No. 202
(Current US standard, US final rule, and UNECE Regulation No. 17)

Head Restraint Component	US – FMVSS No. 202 (current)	US FMVSS No.202 Final Rule (FR)	UNECE Regulation No 17	Comments
A. Application 1. Vehicles				
	Front outboard seating positions in passenger cars, MPVs and trucks with a GVWR ≤ 4,536 kg	Front outboard and rear outboard (optional) seating positions in passenger cars, MPVs and trucks with a GVWR ≤ 4,536 kg, with added exclusion for seating position adjacent to aisle on buses (more than 10 seats)	Front outboard and rear (optional) seating positions in vehicles of categories M1 and N1, and of vehicles of categories M2 up to 3,500 kg (paras. 5.3.1. to 5.3.2)	-If head restraints (HR) present in rear seat, UNECE Regulation No. 17 and 202 Final Rule regulates. -UNECE Regulation No. 17 regulates rear center head restraints if available.
2. Requirements				
a. Height				
1. Front outboard				
A. Fixed	At least 700 mm above H-point as measured parallel to the torso reference line.	Increased to 800 mm above H-point and measured with a SAE J826 manikin. Seat back angle set at 25 degrees. Seat cushion at highest position.	Same height as FR, but measured from R-point. Seat back angle is 25 degrees or manufacturer specified. Seat cushion at lowest position	Different seat set-up and measuring techniques used.
B. Adjustable	Same as 202-fixed	Must achieve a height of 800 mm and cannot be adjusted below 750 mm. Measured with a SAE J826 manikin. Seat back angle set at 25 degrees. Seat cushion in highest position.	Same height as FR, but measured from R-point and at manufacturer's suggested angle or 25 degrees. Seat cushion in highest position.	Different seat set-up and measuring techniques used.

Head Restraint Component	US – FMVSS 202 (current)	US FMVSS 202 Final Rule	UNECE Regulation No. 17	Comments
a. Height (cont.) 2. Rear outboard	(202 Final Rule: Rear head restraint means a rear seat back, or any independently adjustable seat component attached to or adjacent to a seat back, that has a height equal or greater than 700 mm, in any position of backset and height adjustment.)			
A. Fixed	Not specified	If provided, minimum height of 750 mm above H-point. Measured with SAE J826 Manikin.	If provided, same height as FR, but measured from R-Point	Different seat set-up and measuring techniques used.
B. Adjustable	Not specified	If provided, no adjustment below 750 mm from H-point. Measured with SAE J826 Manikin.	If provided, same as FR, but measured from R-Point	Different seat set-up and measuring techniques used.
3. Rear Center				
	Not specified	Not specified	If provided, minimum height of 700 mm above R-point	
b. Backset				
1. Front outboard positions	Not specified	Backset limited to a maximum 55 mm as measured with HRMD. Head restraint in at any height adjustment between 750 and 800 mm, inclusive. Seat back angle set at 25 degrees. Seat cushion at highest position.	No backset specified, but there is a general requirement for the seat back angle to be set at manufacturer's suggested angle or 25 degrees and the seat cushion to be in the lowest position.	Different seat set-up and measuring techniques used.

Head Restraint Component	US – FMVSS 202 (current)	US FMVSS 202 Final Rule	UNECE Regulation No. 17	Comments
c. Width				
1. Front outboard	Minimum of 171 mm on single seats and 254 mm on bench seats	Minimum of 170 mm on single seats (outboard seats with no seat in between) and 254 mm on bench seats (outboard seats with seat in between).	Minimum of 170 mm for all seat types.	United States requires wider HRs on front outboard seats with a center seat between them.
2. Rear outboard	Not specified	If provided, minimum of 170 mm for all seat types	If provided, minimum of 170 mm.	
d. Height of adjustable head restraint front surface				
	Not specified	Not specified	Minimum height of 100 mm	
e. Gaps				
1. All outboard positions	Not specified	In all positions, gap between HR and seat back and within the HR is ≤ 60 mm. A 165 mm sphere is pressed against the gap with a load no more than 5 N	-In lowest position, gap is ≤ 25, with no reference to backset adjustment. Measured along straight line between HR and seat back. -In other positions the gap ≤ 60 mm as measured with 165 mm dia. sphere. -Gaps larger than 60 mm are allowed if they pass the energy absorption test.	-UNECE Regulation Nos. 17 and 25 does not specify load placed on the sphere to measure gap. UNECE Regulation Nos. 17 and 25 measures the gap between the HR in the lowest position and seat back differently from the gaps in the HR. -Larger gaps allowed by UNECE, but must be tested.

Head Restraint Component	US – FMVSS 202 (current)	US FMVSS 202 Final Rule	UNECE Regulation No. 17	Comments
f. HR Adjustment Retention Devices (locks)				
1. Height	Not specified	Must maintain height in highest position and at 800 mm and 750 mm for front and rear seats (if HR provided), respectively, while a downward force is applied. Seat back is rigidly constrained.	If adjustable, requires automatic locking system (UNECE Regulation No. 17, para. 5.1.1). No downward test required.	UNECE has no downward testing requirement.
2. Backset	Not specified	Under applied rearward moment, while adjusted to 800 mm for front and 750 mm for rear (if provided), HR must maintain any position of backset adjustment. Seat back is rigidly constrained.	Not specified.	
g. Removability				
1. Front	Not specified	Can be removed with deliberate action distinct from any act necessary for adjustment.	Same as 202 FR	
2. Rear	Not specified	Can be removed with deliberate action distinct from any act necessary for adjustment.	Same as 202 FR	

Head Restraint Component	US – FMVSS 202 (current)	US FMVSS 202 Final Rule	UNECE 17	Comments
h. Clearance				
	Not specified	25 mm clear space allowed where rear HRs, when seat is occupied, interfere with roofline or rear window.	If HR provided, 25 mm clear space allowed where interference with vehicle structure. Seat does not need to be occupied. Minimum height of 700 mm must be maintained.	-In UNECE the 25 mm gap is measured from any vehicle structure, not just roofline or rear window as in FR. -UNECE requires a minimum seat height if HR is present. FR defines a rear HR as having a height greater than 700 mm
i. Non-use positions				
1. Front	Not specified	Not allowed	Allowed, provided HR automatically returns to proper position when seat is occupied.	
2. Rear	Not specified	Allowed, provided HR automatically returns to proper position when seat is occupied or the HR is rotated a minimum of 60° forward or rearward.	Allowed as long as non-use position is "clearly recognizable to the occupant".	United States rule defines "clearly recognizable" as being rotated forward or rearward 60°.
j. Radius of Curvature				
	Not specified	In NPRM, requirement was same as UNECE Regulation No. 17. Requirement was deleted in final rule.	Parts of front and rear of HR shall not exhibit a radius of curvature less than 5 mm.	Deleted in FR because enforcement outweighs benefits. No commenter had info to support reg.

Head Restraint Component	US – FMVSS 202 (current)	US FMVSS 202 Final Rule	UNECE Regulation No. 17	Comments
k. Energy Absorption				
	Not specified	Front of HR impacted with head form at v=24.1 km/h. 3 ms deceleration of head form must not exceed 80 gs. Impactor is linear head form with mass of 6.8 kg.	Similar to FR: Uses pendulum impactor with same weight and velocity as linear impactor. Front and rear of HR tested.	Tests in UNECE and FR are functionally equivalent. Except FR does not test rear of HR.
l. Displacement Test Procedures				
	Load is applied to back pan of seat, load is applied to head restraint after seat load is removed. 102 mm of displacement allowed with 373 Nm moment. Load is increased until 890N or seat back fails. Use spherical or cylindrical form to apply load.	Test procedure modified from 202. Seat back and HR loaded together. Moments and displacements same. Maximum load the same, seat back cannot fail. Use spherical form to apply load	Same load and displacement requirements as FR.	FR provides a detailed test procedure, including load hold times.
m. Dynamic sled test (optional)				
	Seat accelerated so the pulse falls in a corridor defined by 2-½ sine waves with amplitudes of 78 m/s^2 and 86 m/s^2. Corridor cannot be met. 95th male dummy used, max rotation 45°.	New corridor based on scaled version 208 sled test. Target pulse the same as 202. 50th male dummy used in any seat, HR adjusted midway between lowest and highest position and any backset position. 12° max rotation.	Not specified	

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