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# UN/ECE/WP.29/GRSP
# INFORMAL WORKING GROUP
# ON
# HEAD RESTRAINTS

1ST PROGRESS REPORT
(PRESENTED BY MS. SUSAN MEYERSON,
CHAIR OF THE INFORMAL WORKING GROUP)

DRAFT

## 1. INTRODUCTION

During the 126th session of WP.29 of March 2002, the Executive Committee of the 1998 Global Agreement (1998 Agreement) 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.) volunteered to lead the group's efforts and develop a document detailing the recommended requirements for the gtr. The U.S. 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 (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 February 1 – 2, 2005 and on April 11-13, 2005 in Paris, France. The next two meetings will be held on June 13-15, 2005 in Washington, D.C., USA and September 7-9, 2005 in Cologne, Germany. A proposed schedule of efforts is outlined in Section 2 of this document.

The Contracting Parties represented on the working group are the Netherlands, France, Canada, Japan, Germany, 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.

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

## 2. REQUEST TO PROCEED WITH THE DRAFTING OF A GTR

The U. S. recently upgraded its head restraint standard to provide more stringent requirements. In 1982, the U.S. assessed the performance of head restraints installed pursuant to the current

standard and reported that integral head restraints are 17 percent effective at reducing neck injuries in rear impacts and adjustable head restraints are only 10 percent effective. The ECE regulations on head restraints were considerably more stringent than the old U.S. regulation, and were used as a baseline in developing the new upgraded U.S. head restraint regulation.

Due to the U.S. 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 U.S. Federal Motor Vehicle Safety Standard (FMVSS) 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 |
| 5th Working Group Meeting | December 2005 |
| 2nd Progress Report/Draft gtr to GRSP | December 2005 |
| 6th Working Group Meeting | January 2006 |
| 2nd Progress Report to AC.3 | March 2006 |
| 3rd Progress Report/Adoption of Final Draft gtr by GRSP | May 2006 |
| 3rd Progress Report to AC.3 | June 2006 |
| Submittal of Final Draft gtr to AC.3 | November 2006 |

## 3. EVALUATION OF THE SAFETY PROBLEM

In the United States, 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 U.S. and their new requirements in the upgraded FMVSS 202 can be reviewed in Informal Document HR-1-8.

## 4. REVIEW OF EXISTING INTERNATIONAL REGULATIONS

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

- UNECE Regulation 17 - Uniform Provisions concerning the Approval of Vehicles with regard to the Seats, their Anchorages, and any Head Restraints
- UNECE Regulation 25 - Uniform Provisions Concerning the Approval of Head Restraints (Head Rests), whether or not Incorporated in Vehicle Seats
- EU Directive 74/408, concerning interior fittings of motor vehicles
- EU Directive 96/037, adapting to technical progress Council Directive 74/408/EEC relating to the interior fittings of motor vehicles (strength of seats and of their anchorages)
- EU Directive 78/932/EEC, concerning head restraints of seats of motor vehicles
- U.S. 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

Additionally, research and activities being conducted by EEVC Working Group 12, EEVC Working Group 20, and EuroNCAP 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 ECE 17 and US FMVSS No. 202 is provided in the Appendix of this document.

### 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 1.

There has been limited discussion of the applicability of this gtr. The application of US FMVSS No. 202 is different than ECE 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. ECE 17 requires head restraints in all front outboard seating positions of vehicles of category M1, vehicles of category M2 up to 3500 kg and vehicles of category N1 and regulates head restraints optionally installed in all seating positions, in all vehicles. There is consensus to recommend that the gtr should recommend head restraints in all front outboard seating positions for Category 1-1 vehicles. Vehicles of category 1-2 and 2 need

more discussion especially on the weight limit. It was proposed that the gtr, as it pertains to front outboard seats, should apply to vehicles up to 4,536 kg and justification for this will be provided at the June 2005 working group meeting. This discussion will continue at the upcoming meetings and is dependent on the requirements of the gtr.

5.2. Scope

In the working group meetings, it was proposed that the scope of the gtr should specify requirements for head restraints to reduce the frequency and severity of neck injury in low speed rear-end and other collisions. The delegates and representatives were requested to review the proposal for the planned June 2005 meeting.

5.3. Height of the Head Restraint

5.3.1. Front Outboard

Both ECE 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 US have increased over the last 10 years and a higher head restraint is needed to protect these occupants. There is some resistance to requiring a minimum height of 850 mm rather than 800 mm for the front head restraints, citing concerns with roof interference, evacuation in case of emergency, and visibility. In addition, there were concerns expressed over measuring active head restraint systems using the same methods to measure passive systems. The item is still under discussion.

5.3.2. Rear Outboard

There was general consensus to recommend that optionally installed rear outboard head restraints be required to meet a minimum set of requirements. If a vehicle has rear outboard head restraints, it is recommended that they meet the requirements and have a minimum height of 750 mm. One proposal was made 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. Further discussion is needed to clarify this requirement. Additionally, the application of this requirement to all vehicles is still under discussion.

5.3.3. Front Center/Rear Center

It has been proposed to include in the gtr the ECE 17 requirement to regulate optionally installed head restraints in all seating positions, including front and rear center seats. Concerns about rearward visibility were expressed. This item is still under discussion.

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.” Further definition of “backlight” (i.e., “rear window”) and inclusion of padding in the roofline is still needed. In addition to the clearance exemption, it was also suggested to incorporate the UNECE R.17 requirement for a minimum height of the rear seat. It was also requested that the working group consider convertible roofs as they are retracted.

5.4. Adjustable Front Head Restraints – Front Surface Height

It has been proposed to include in the gtr the ECE 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 ECE 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. This issue is still under discussion.

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. Justification for this requirement has been requested. There are also concerns about rearward visibility with these wider restraints and the definition of "bench seats."

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 manufacturers recommended seating position as detailed in ECE 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 U.S. procedure allows for results of height and backset to be compared from vehicle to vehicle. The ECE 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 indeed been raised that the US procedure would result in high variations at certification. UNECE 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.

5.7. Backset

It was proposed to recommend a maximum backset of 55 mm for front outboard head restraints, using the Head Restraint Measuring Device (HRMD), as a measuring tool. There is general consensus to recommend the regulation of backset, but there was concern that the 55 mm requirement is too stringent. Data has been presented with regard to concerns relating to repeatability/reproducibility issues with the test device and with using different technicians to measure the backset. There has also been concern for the comfort of the occupant and measuring active head restraint systems using the same methods to measure passive systems.

5.8. Gaps

5.8.1. Gaps within Head Restraint

It has been proposed that all gaps within the head restraint have a maximum height of 60 mm when measured using a 165 mm sphere. In addition to this requirement, it has also been proposed to allow gaps larger than 60 mm if the displacement tests requirements can be met when the load is applied at the gap. There is general consensus to recommend the sphere measurement requirement. The proposal to use the displacement test to test the gaps is still under discussion.

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 height 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 ECE 17. 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 ECE 17 requirement or gaps that are extremely small. This issue is still being discussed.

5.9. Head Restraint Adjustment Retention Devices (Locks)

There is general consensus to recommend that if a device is adjustable for height, then it should lock 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 lock. 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. As alternative it has been suggested to use the bottom of the head restraint as reference.

5.10. Removability

There is general consensus to recommend the ability for head restraint removal via a deliberate action distinct from any act necessary for adjustment as stated in UNECE 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. This issue is still under discussion.

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 5$^{th}$ percentile female Hybrid III dummy to evaluate these systems is being reviewed.

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. The working group is discussing the expansion of this definition to allow for other types of stowable head restraints system designs.

5.11.2.1. 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 5$^{th}$ percentile female Hybrid III dummy to evaluate these systems is being reviewed.

5.12. Energy Absorption

It has been proposed to recommend the energy absorption test defined in FMVSS No. 202. This test is similar to the test defined in ECE 17, except for the testing device and the requirement to rigidly fix the seat back during testing. Testing is being conducted to show that the test devices in the two regulations are functionally equivalent. Discussions on the test set-up are still ongoing.

5.12.1. Radius of Curvature

It has been proposed to incorporate the UNECE Regulation 17 requirement that after undergoing the energy absorption test, designated parts of the front and the rear of the head restraint shall not exhibit areas with a radius of curvature less than 5 mm. This requirement was not included in FMVSS 202. Discussion on whether to apply this requirement to the rear of head restraints is dependant on the outcome of the discussion on the Scope of the gtr. Discussion of this issue is ongoing.

5.13. Displacement Test Procedures/Adjustable Backset Locking Test

A proposal was made to incorporate into the gtr the displacement test defined in FMVSS No. 202. This test adapted the displacement test procedure in ECE 17 to incorporate an objective evaluation of adjustable backset locking systems. This proposal is being evaluated.

5.14. Dynamic Test

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. A more detailed discussion of this problem can be reviewed in Informal Document HR-2-9. It was stated that the BioRID dummy is preferred in Europe for dynamic testing, but it was acknowledged that it was not ready for regulation. There was some discussion that the dynamic test be a second step to the gtr drafting process. A solution on how to include testing of active head restraints in the gtr remains to be found.

# APPENDIX

## Comparison of Head Restraint Regulations
## ECE 17/FMVSS 202

**Comparison of Head Restraint Regulations ECE 17/FMVSS 202**
**(Current US standard, US Final Rule, and ECE 17)**

| **Head Restraint Component** | **U.S. – FMVSS 202 (current)** | **US FMVSS 202 Final Rule** | **ECE 17** | **Comments** |
|---|---|---|---|---|
| **A. Application** *1. Vehicles* | | | | |
| | Front outboard seating positions in passenger cars, MPVs and trucks with a GVWR ≤ 4536 kg | Front outboard and rear outboard (optional) seating positions in passenger cars, MPVs and trucks with a GVWR ≤ 4536 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 N, and of vehicles of categories M2 and M3, not covered by Regulation No. 80 | -If HR present in rear seat, ECE 17 and 202 Final Rule regulates.<br>-ECE 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 | U.S. – FMVSS 202 (current) | US FMVSS 202 Final Rule | ECE 17 | Comments |
|---|---|---|---|---|
| **a. Height (cont.)**<br>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 | U.S. – FMVSS 202 (current) | US FMVSS 202 Final Rule | ECE 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. | US 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.<br>-In other positions the gap ≤ 60 mm as measured with 165 mm dia. sphere.<br>-Gaps larger than 60 mm are allowed if they pass the energy absorption test. | -ECE 17/25 does not specify load placed on the sphere to measure gap.<br>-ECE 17/25 measures the gap between the HR in the lowest position and seat back differently from the gaps in the HR.<br>-Larger gaps allowed by ECE, but must be tested. |

| Head Restraint Component | U.S. – FMVSS 202 (current) | US FMVSS 202 Final Rule | ECE 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 (ECE 17, 5.1.1). No downward test required. | ECE has no downward testing requirement. |
| 2. Backset | Not specified | Under applied rearward moment, while adjusted to 800mm for front and 750mm 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 | U.S. – FMVSS 202 (current) | US FMVSS 202 Final Rule | ECE 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 700mm must be maintained. | -In ECE the 25 mm gap is measured from any vehicle structure, not just roofline or rear window as in FR.<br>-ECE 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". | US rule defines "clearly recognizable" as being rotated forward or rearward 60°. |
| **j. Radius of Curvature** | | | | |
| | Not specified | In NPRM, requirement was same as ECE 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.<br>No commenter had info to support reg. |

| Head Restraint Component | U.S. – FMVSS 202 (current) | US FMVSS 202 Final Rule | ECE 17 | Comments |
|---|---|---|---|---|
| **k. Energy Absorption** | | | | |
| | Not specified | Front of HR impacted with head form at v=24.1 km/h. 3ms deceleration of head form must not exceed 80gs . 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 ECE 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. $95^{th}$ male dummy used, max rotation 45°. | New corridor based on scaled version 208 sled test. Target pulse the same as 202. $50^{th}$ male dummy used in any seat, HR adjusted midway between lowest and highest position and any backset position. 12° max rotation. | Not specified | |