EUROPEAN NEW CAR ASSESSMENT PROGRAMME (Euro NCAP)

Euro NCAP Protocol Changes and Additions

June 2011

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Frontal Impact Testing
Changes and additions incorporated in version 5.1, June 2011

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9 TEST PARAMETERS

9.4 Door Opening Force
~~The opening of vehicle doors post test shall be recorded on video.~~

~~**9.5 Video of Dummy Position**~~
~~9.5.1 The post impact positions of the dummies will be recorded on video.~~

10 CALCULATION OF INJURY PARAMETERS

Ringing or other anomalous spikes in the data traces should be removed and peak values/HIC calculated without consideration of the anomaly. A copy of both the original and unmodified traces must always be provided in the data.

10.7 Child Dummies

10.7.1 For the P3 and P1½ dummies, calculate the resultant head and chest acceleration A_R from the three components A_x, A_y and A_z after they have been filtered and determine the maximum value of A_R

$$A_R = \sqrt{A_X^2 + A_Y^2 + A_Z^2}$$

10.7.2 For the P3 and P1½ dummies, determine the level which head and chest resultant accelerations ($+A_R$) exceed for a cumulative time of three milliseconds.

10.7.3 For the P3 and P1½ dummies, determine the level which chest vertical accelerations (+ve & -ve A_Z) exceed for a cumulative time of three milliseconds.

10.7.4 For the P1½ dummy seated rearward facing, determine the level which head ~~and chest~~ vertical accelerations (+ve & -ve A_{RZ}) exceed for a cumulative time of three milliseconds.

Side Impact Testing
Changes and additions incorporated in version 5.1, June 2011

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10 CALCULATION OF INJURY PARAMETERS

Ringing or other anomalous spikes in the data traces should be removed and peak values/HIC calculated without consideration of the anomaly. A copy of both the original and unmodified traces must always be provided in the data.

~~**11 SIDE IMPACT – POLE Test**~~

~~Where a vehicle is fitted with a head protection device, an optional 'pole test' may be commissioned. This option is only available where the head protection was rated as green in the Euro NCAP side impact test.~~

Pole Impact Testing
Changes and additions incorporated in version 5.1, June 2011

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10 CALCULATION OF INJURY PARAMETERS

Ringing or other anomalous spikes in the data traces should be removed and peak values/HIC calculated without consideration of the anomaly. A copy of both the original and unmodified traces must always be provided in the data.

Pedestrian Testing
Changes and additions incorporated in version 5.2.1, January 2011

Page numbering change only.

Changes and additions incorporated in version 5.3, June 2011

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2.2 Detection of Pedestrians

2.2.3.1.2 Acceptable models and codes are detailed in Appendix I.

2.2.3.1.3 Where other numerical models are to be introduced, then the manufacturer must provide supporting evidence showing suitable biofidelity and kinematics of the chosen models.

2.4 Protection at speeds below the deployment threshold

2.4.1.4 The area of the bonnet top considered will be a minimum of 82.5mm inside the side reference lines, see section 10.1.2, and extend rearward from the 1000mm WAD up to 82.5mm forward of the bonnet rear reference line. Child/small adult headforms will apply between 1000mm & 1700mm WAD and adult headforms will apply to bonnet top areas between 1700mm & 2100mm WAD.

4.3 Upper Legform to Bonnet Leading Edge

4.3.1 A test is not required if the calculated impact energy would be less than 200J ~~or less~~.

4.4 Headforms – Structures to be tested

4.4.3.4 The projected points for the headforms shall be a minimum of 82.5mm inside the Bonnet Side Reference Lines, see section 10.1.2, and a minimum of 165mm apart i.e. no two points (as represented on the bonnet surface) either within any sixth or in adjacent sixth should be less than 165mm apart. Where testing on an A-Pillar is involved the minimum distance inside the side reference line for the impact point does not apply. The impact point in this case may be on the side reference line.

2

Look for the most injurious location within the whole impact area.
Choose the worst case locations in every sixth in accordance with Section ~~3.4.3.7.1 & 3.4.3.7.2~~ 4.4.3.6

7.2 Certification

7.2.1 ~~The certification procedures are detailed in EEVC Working Group 17 Report 'Improved Test Methods to Evaluate Pedestrian Protection Afforded by Passenger Cars' December 1998, Annex VII. [This document will follow subsequent changes to the certification procedure detailed above on any levels set provisionally. The Dynamic certification procedures are under review by WG17 at present. Until this review is complete the instructions of the impactor manufacturer should be followed.]~~ The certification procedures are detailed in Regulation (EC) 631/2009 (22nd July 2009).

10 Description of headforms and their instrumentation

10.1.2 The projected points for the headform impactor shall be a minimum of 82.5mm inside the Side Reference Lines (Section 3.5) and a minimum of 165mm apart. These minimum distances are to be set with a flexible tape held tautly along the outer surface of the vehicle in a vertical lateral (y,z) plane. Where testing on an A-pillar is involved the minimum distance inside the Side Reference Lines does not apply to either the adult or child zones.

Appendix I

Pedestrian CAE model		Pedestrian Sizes	Level of Biofidelity	References	Notes
MADYMO	Details see references, ~~in particular TNO report 04.OR.SA.036.1/RDL and TNO report 04.OR.SA.035.1/RDL~~ MADYMO Human Models Manual, Version 7.3, TNO Automotive, Delft, The Netherlands, November 2010	3yo, 6yo, 5th F, 50th M, 95th. These models result from a scaleable mid-size male pedestrian model	Details see references, ~~in particular appendix L Pedestrian model utility matrix (TNO report 04.OR.SA.036.1/RDL)~~ MADYMO Human Models Manual, Version 7.3, TNO Automotive, Delft, The Netherlands, November 2010	~~R. de Lange, A. Barbir: Extended validation of the MADYMO human pedestrian models, TNO report 04.OR.SA.035.1/RDL, 2004~~ ~~R. de Lange, E. van Hassel: Review results VDA 1 pedestrian protection study, TNO report 04.OR.SA.036.1/RDL, 2004~~ ~~Jikuang Yang, Xuejun Liu: Evaluation of Validity of the MADYMO Pedestrian Models, CHALMERS 2000-08-21 (internal)~~ ~~R. Meijer, J. van Hoof, R. Happee: Effects of leg bone bending in car-pedestrian impact evaluated using a Finite Element human leg model, TNO report 01.OR.BV.008.1/RME (internal)~~ ~~Improving Pedestrian Safety Using Numerical Human Models, Jack van Hoof, Ronald de Lange, Jac S. H. M. Wismans(TNO Automotive), 47th Stapp Car Crash Conference Journal, 2003~~ ~~TNO, "MADYMO Human Models Manual, Version 6.0", TNO Automotive, Delft, The Netherlands, 2001~~ MADYMO Human Models Manual, Version 7.3, TNO Automotive, Delft, The Netherlands, November 2010	Commercially available
~~PAMCRASH~~	-	~~3yo, 6yo, 5th F, 50th M, 95th. These models result from a scaleable mid-size male pedestrian model~~	~~model aims to replace Madymo Multi Body Model in case of whole body kinematics and Head contact times (uses the same biomechanical validation corridors as Madymo models)~~	-	~~currently in development for PAMCRASH user to reduce simulation time~~

Whiplash Testing
Changes and additions incorporated in version 3.1, June 2011

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~~**2 REFERENCE DOCUMENT AND TOOLS REQUIRED**~~

~~2.1 The following documents and associated equipment will be required to undertake this procedure:~~

- ~~Manufacturer's specified settings, see Appendix I.~~
- ~~SAE J211 Recommended Practice for Impact Test Instrumentation~~
- ~~SAE J826 Certified pairing of H-Point Mannequin & Head Restraint Measuring Device (HRMD)~~
- ~~Gloria calibration jig for H-point machines, see Appendix II.~~
- ~~BioRID Anthropometric Test Device (ATD), see Section 8.~~
- ~~Electronic tilt sensors fitted in place of head levelling tool~~
- ~~H-Point Alignment Tool (Den/3012) and electronic tilt sensors~~
- ~~Pelvis Angle Gauge (Den/5643)~~
- ~~RCAR Bumper test protocol (where applicable): www.rcar.org/papers.htm~~

All section numbers changed accordingly.

4 3 COORDINATE SYSTEM

~~4.1~~ 3.1 Sled ~~and Dummy~~ Coordinates
The coordinate system used must be an ordinary Cartesian co-ordinate system with 90˚ between the axes. ~~and the sign convention detailed in Table 1:~~

~~Table 1: Coordinate system~~

~~Measure~~	~~Reference~~
~~Positive X~~	~~Horizontally forward from dummy face, parallel to seat rails~~
~~Positive Y~~	~~To the dummy's left-hand side~~
~~Positive Z~~	~~Vertically upward~~

3.2 Dummy Coordinates
The coordinate system for the BioRID instrumentation used must be in accordance with SAE J211.

~~7~~ 6 HEAD RESTRIANT POSITIONS

~~7.6~~ 6.6 install BioRID

~~7.6.1~~ 6.6.1:

The seat should have already been set to give a torso angle of 25º ±1º measured on the H-point machine fitted with HRMD as described in Section 6. Allow the seat to recover for 15 minutes with nothing in it before installing the BioRID. Note, BioRID handling should only be undertaken using dedicated lifting tools and associated locations on the dummy following the BioRID manufacturer recommendations. ~~Positional adjustment should not be undertaken using features such as the H-point tool.~~ Typically, during the installation of BioRID the H-point will

initially be installed further rearward in the seat than is required. Therefore the pelvis should be moved forward to achieve the target set-up positioning.

~~7.6.8~~ 6.6.8:

Adjust the dummy's feet ~~and/or the horizontal position of the adjustable toe board~~ so that the heel of BioRID's shoe is resting on the heel surface. The tip of the shoe shall rest on the toe pan between 230mm and 270mm from the intersection of the heel surface and toe board, as measured along the surface of the toe board. Figure 2 shows proper positioning of the feet. Note, the heel point from a vehicle is not replicated, only heel plane height is set according to vehicle geometry.

~~8~~ 7 BioRID ATD REQUIREMENTS

~~8.2.1~~ 7.3 Adjustment of the dummy extremities

7.3.1 The stiffness of both arms and legs shall be checked and adjusted, where necessary, prior to every sled test. The adjustment procedure is as follows:

~~8.2.1.1~~ 7.3.2 Arms

~~8.2.1.2~~ 7.3.3 Legs

Sled Testing

Changes and additions incorporated in version 2.7, June 2011

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ESC Testing

Changes and additions incorporated in version 1.2, June 2011

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Assessment Protocol – Overall Rating Protocol
Changes and additions incorporated in version 5.1, June 2011

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Adult Occupant Assessment Protocol
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Child Protection Assessment Protocol
Changes and additions incorporated in version 5.3, June 2011

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Pedestrian Protection Assessment Protocol
Changes and additions incorporated in version 5.1, June 2011

Copyright information added.

REFERENCES

1 Prasad, P. and H. Mertz. *The position of the US delegation to the ISO Working Group 6 on the use of HIC in the automotive environment.* SAE Paper 851246. 1985

2 Mertz, H., P. Prasad and G. Nusholtz. *Head Injury Risk Assessment for forehead impacts.* SAE paper 960099 (also ISO WG6 document N447)

3 EEVC WG17 Report, 'Improved Test Methods to Evaluate Pedestrian Protection Afforded by Passenger Cars', ~~December 1998~~ September 2002.

Safety Assist Assessment Protocol

Changes and additions incorporated in version 5.3.1, December 2010

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Changes and additions incorporated in version 5.4, June 2011

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Heavy Vehicles Assessment Protocol
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3.4 Whiplash Scoring

A flowchart in Appendix 1, Figure 1 illustrates the way in which whiplash tests are scored.

3.4.4.1 A maximum of two points is available for the front seating positions. This is calculated as follows. For each front seat, a maximum of two points is available: one point when measured in the test position and one point when measured in the 'down and back' position. For each seat the scores in these two positions are added. The score for the front seats is taken as that of the seat which scores most poorly.

3.4.4.2 A maximum of two points is available for the rear seating positions, where they qualify for assessment. Each rear seat is measured, by a single HRMD drop, in the test position and the down/back position. The rear seat which scores most poorly is then measured, using an average of three HRMD drops, in the test position and in the fully down and back position. A maximum of one point can be scored in each restraint position. The scores from each position are summed.

~~3.4.4.3 If the head restraint of a seat (front or rear) is not adjustable, the geometry will only be measured in the fixed, design position. The score from that test will be taken instead of the two measurements described above. In effect, the score of the single test will be doubled~~.

3.4.4.~~4~~.3 The scores of front and (if applicable) rear seating positions are added. The minimum score possible is zero.

Beyond NCAP

Changes and additions incorporated in version 1.2, June 2011

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Car Specification, Sponsorship Testing and Retesting Protocol

Changes and additions incorporated in version 2.5, June 2011

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