EUROPEAN NEW CAR ASSESSMENT PROGRAMME (Euro NCAP)

Euro NCAP Protocol Changes and Additions - June 2008

Frontal Impact Testing Protocol

Changes will be applied immediately and incorporated in protocol version 4.2, May 2008

Deleted text has been struck through: ~~Example~~
New text is underlined

Preface

• Where text is contained within square brackets this denotes that the procedure being discussed is currently being trialled in Euro NCAP. Its incorporation in the Test Protocol will be reviewed at a later date. ~~These areas are Measurement of Footwell Intrusion~~.

• During the test preparation, vehicle manufacturers are encouraged to liaise with the laboratory and to check that they are satisfied with the way cars are set up for testing. Where a manufacturer feels that a particular item should be altered, they should ask the laboratory staff to make any necessary changes. Manufacturers are forbidden from making changes to any parameter that will influence the test, such as dummy positioning, vehicle setting, laboratory environment etc.

It is the responsibility of the test laboratory to ensure that any requested changes satisfy the requirements of Euro NCAP. Where a disagreement exists between the laboratory and manufacturer, the Euro NCAP secretariat should be informed immediately to pass final judgment. Where the laboratory staff suspect that a manufacturer has interfered with any of the set up, the manufacturer's representative should be warned that they are not allowed to do so themselves. They should also be informed that if another incident occurs, they will be asked to leave the test site.

Where there is a recurrence of the problem, the manufacturer's representative will be told to leave the test site and the Secretary General should be immediately informed. Any such incident may be reported by the Secretary General to the manufacturer and the person concerned may not be allowed to attend further Euro NCAP tests.

Section 1.4 Vehicle Preparation

1.4.1 Ensure that ~~a live~~ the vehicle's battery is connected ~~if possible in its standard position and that the driver airbag is connected~~ to the vehicle's electrical circuit in its standard position. Check that the dashboard light for the airbag circuit functions as normal. ~~The vehicle battery may be replaced with a dummy unit and a live battery placed in the luggage compartment of the vehicle. This action is at the test lab's discretion, but the manufacturer must be consulted to ascertain if this is likely to cause problems with any of the vehicle's systems.~~ Alternatively, the vehicle battery acid may be drained or an additional live battery may be placed in the luggage compartment of the vehicle. If the supply from the drained battery is not supported by an additional battery, the test must be conducted within fifteen minutes after draining the battery. Where any additional battery is used it must be connected directly to the original battery so that the vehicle's original electrical system, cable routing and connections remain unaltered. The power cables connecting both batteries must be positioned on the non-struck side of the car in such a way to minimise the risk of the cable being cut during the impact. The cable used to connect both batteries must have a minimum cross section of $5mm^2$ to ensure a minimum voltage drop. The current supplied to the vehicle must be monitored throughout the impact across the original battery. Where an additional battery is to be used the vehicle manufacturer will be required to indicate the minimum voltage/current needed during the test for all systems to operate as intended. The manufacturer will be asked to confirm that the laboratory modifications are suitable for use in the vehicle being tested and will not influence any of the vehicle systems.

Section 3.1 General

3.1.2 A TNO/Ogle P1½ child dummy, in a suitable Child Restraint System (CRS) (see Section 7.6), ~~should~~ shall be used in the rear passenger side seating position ~~(or the rear centre seating position if the vehicle manufacturer prefers).~~

3.1.3 A TNO P3 child dummy, in a suitable CRS (see Section 7.6), ~~should~~ shall be used in the rear driver's side seating position ~~(or the rear centre seating position if the vehicle manufacturer~~

~~prefers).~~

~~3.1.4 If either child dummy is placed in the rear centre seating position the other dummy must be placed on the struck side of the vehicle.~~

6 PASSENGER COMPARTMENT ADJUSTMENTS

Adjustment	Required Setting	Notes	Methods
Seat belt anchorage (where adjustable)	Initially, manufacturer's 50th percentile design position	If no design position then set to mid-position, or nearest notch upwards	

Section 7.1 Determine the H-point of the driver's seat

7.1.1 Set the seat back so that the torso of the dummy is as close as possible to the manufacturer's reasonable recommendations for normal use. In absence of such recommendations, an angle of 25 degrees towards the rear from vertical will be used.

7.1.1.1 The driver and passenger seatback angle and seat base shall be set to the same position.

7.1.1.2 Where one seat is height adjustable and the other is fixed, the relative angle between the seat back and the ground should be the same for both seats.

7.1.1.3 Where both seats are adjustable, the manufacturer is asked to supply recommended settings. These should not differ from the nominal settings by more than a reasonable amount. In any of the above situations, the manufacturer may provide convincing information that the seat adjustments should be different from that specified here. If so the fully supported request to vary the set up should be made to the Secretariat.

Section 7.4 Dummy Placement

~~7.4.3 Carefully place the seat belt across the dummy and lock as normal.~~

~~7.4.3.1 Apply a small rearwards force to the lower torso and a small forwards force to the upper torso to flex the upper torso forwards from the seat back. Then rock the torso left and right four times, going to between 14 and 16 degrees to the vertical.~~

~~7.4.3.2 Maintaining the small rearwards force to the lower torso, apply a small rearwards force to the upper torso to return the upper torso to the seat back. Slowly remove this force.~~

Section 7.5 Dummy Positioning

7.5.9 *Seat belt*

7.5.9.1 Where possible, initially position the upper seat belt anchorage in the manufacturers 50^{th} percentile design position. If no design position is provided, set the adjustable upper seat belt anchorage to the mid-position or nearest notch upward.

7.5.9.2 Carefully place the seat belt across the dummy and lock as normal. It will be necessary to re-position the hands as described in Section 7.5.5.

7.5.9.3 Remove the slack from the lap section of the webbing until it is resting gently around the pelvis of the dummy. Only minimal force should be applied to the webbing when removing the slack. The route of the lap belt should be as natural as possible.

7.5.9.4 Place one finger behind the diagonal section of the webbing at the height of the dummy sternum. Pull the webbing away from the chest horizontally forward and allow it to retract in the direction of the D-loop using only the force provided by the retractor mechanism. Repeat this step three times, only.

7.5.9.5 After following the above steps, the seatbelt should lie in a natural position across the dummy sternum assembly and shoulder clavicle. Where this is not the case, for example the belt is close to or in contact with the neck shield or the belt is above the shoulder rotation adjustment screw, and the upper belt anchorage is adjustable the anchorage should be lowered and steps 7.5.9.3 and 7.5.9.4 repeated.

7.5.9.6 The upper anchorage should be lowered by a sufficient amount to ensure a natural belt position following the repetition of .steps 7.5.9.3 and 7.5.9.4 repeated. This may require multiple attempts.

7.5.9.7 Once the belt is positioned the location of the belt should be marked across the dummy chest to ensure that no further adjustments are made. Mark also the belt at the level of the D-loop to be sure that the initial tension is maintained during test preparation.

7.5.9.8 Measure the vertical distance between the dummy nose and the diagonal webbing.

7.5.9.9 Measure the horizontal distance between the diagonal webbing and the door/window.

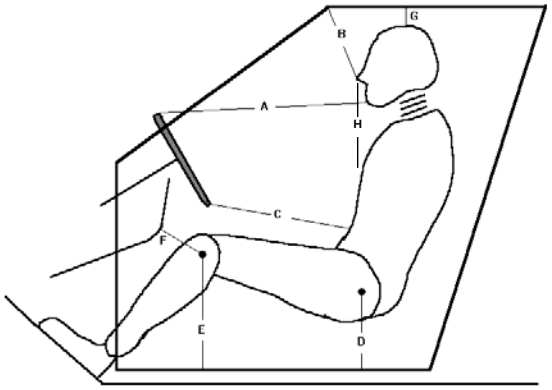
7.5.9.10 Where the fitment of the shoulder belt loadcell (Section 4.2.5) significantly influences the natural position of the belt, the loadcell may be supported from above with the use of a weak non metallic wire or thread.

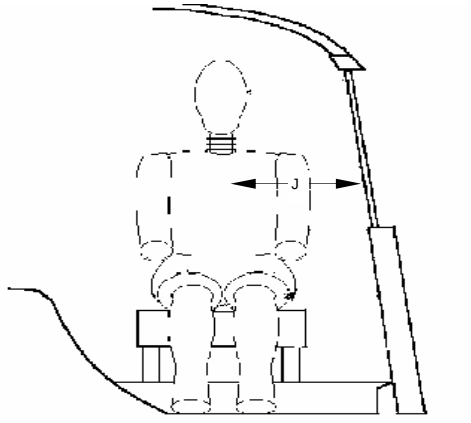
Section 7.6 Child Restraint System (CRS) Installation and Child Dummy Placement

Two CRS's are to be fitted in the rear seat, one suitable for a 3 year old child, the other for an 18 month old infant. Each will be the system recommended by the manufacturer for that size of child. The type of system to be fitted will be determined from the manufacturer. ~~Before testing begins the manufacturer must provide the approval licence for all vehicle specific CRS.~~ There must be sufficient space between the vehicle interior and CRS to allow for proper installation of the restraint without the need for excessive force. The restraint must not be prevented from sitting in its 'normal' orientation, for example the vehicle interior trim must not cause any obstruction. The dummies must also be allowed to rest in a 'normal' position.

Section 7.7 Dummy Measurements

The following measurements are to be recorded prior to the test after the dummy settling and positioning procedures have been carried out.





Driver's Side		Passenger's Side	
A	Chin to top of rim	A	Chin to facia
B	Nose to top edge of glass	B	Nose to top edge of glass
C	Stomach to rim	C	Stomach to facia*
D	H-point to top of sill	D	H-point to top of sill
E	Knee bolt to top edge of sill	E	Knee bolt to top edge of sill
F	Knee bolt to top edge of bolster	F	Knee bolt to top edge of bolster*

G	Head to roof surface	G	Head to roof surface
H	Nose to webbing (vertically)	H	Nose to webbing (vertically)
J	Belt webbing to door (horizontally)	J	Belt webbing to door (horizontally)
θ	Neck Angle	θ	Neck Angle
	H-Point Co-ordinates (to vehicle)		H-Point Co-ordinates (to vehicle)
α	Seat back angle (as defined by torso angle)	α	Seat back angle (as defined by torso angle)

Side Impact Testing Protocol

Changes will be applied immediately and incorporated in protocol version 4.2, May 2008

Deleted text has been struck through: ~~Example~~
New text is underlined

Preface

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• During the test preparation, vehicle manufacturers are encouraged to liaise with the laboratory and to check that they are satisfied with the way cars are set up for testing. Where a manufacturer feels that a particular item should be altered, they should ask the laboratory staff to make any necessary changes. Manufacturers are forbidden from making changes to any parameter that will influence the test, such as dummy positioning, vehicle setting, laboratory environment etc.

It is the responsibility of the test laboratory to ensure that any requested changes satisfy the requirements of Euro NCAP. Where a disagreement exists between the laboratory and manufacturer, the Euro NCAP secretariat should be informed immediately to pass final judgment. Where the laboratory staff suspect that a manufacturer has interfered with any of the set up, the manufacturer's representative should be warned that they are not allowed to do so themselves. They should also be informed that if another incident occurs, they will be asked to leave the test site.

Where there is a recurrence of the problem, the manufacturer's representative will be told to leave the test site and the Secretary General should be immediately informed. Any such incident may be reported by the Secretary General to the manufacturer and the person concerned may not be allowed to attend further Euro NCAP tests.

Section 1.4 Vehicle Preparation

1.4.2 Ensure that ~~a live~~ the vehicle's battery is connected, if possible in its standard position. Check that the dashboard light for the airbag circuit functions as normal.

Section 2.1 General

2.1.2 A TNO/Ogle P1½ child dummy, in a suitable Child Restraint System (CRS) (see Section 6.4), ~~should~~ shall be used in the rear driver side seating position ~~(or rear centre seating position if the vehicle manufacturer prefers).~~

2.1.3 A TNO P3 child dummy, in a suitable CRS (see Section 6.4), ~~should~~ shall be used in the rear passenger side seating position ~~(or rear centre seating position if the vehicle manufacturer prefers)~~.

~~2.1.4 If either child dummy is placed in the rear centre seating position the other dummy must be placed on the struck side of the vehicle.~~

5 PASSENGER COMPARTMENT ADJUSTMENTS

Adjustment	Required Setting	Notes	Methods
Seat belt anchorage (where adjustable)	Initially, manufacturer's 50th percentile design position	If no design position then set to mid-position, or nearest notch upwards	

Section 6.1 Determine the H-point of the Driver's seat

6.1.1 Set the seat back so that the torso of the dummy is as close as possible to the manufacturer's reasonable recommendations for normal use. In absence of such recommendations, an angle of 25 degrees towards the rear from vertical will be used.

6.1.1.1 The driver and passenger seatback angle and seat base shall be set to the same position.

6.1.1.2 Where one seat is height adjustable and the other is fixed, the relative angle between the seat back and the ground should be the same for both seats.

6.1.1.3 Where both seats are adjustable, the manufacturer is asked to supply recommended settings. These should not differ from the nominal settings by more than a reasonable amount. In any of the above situations, the manufacturer may provide convincing information that the seat adjustments should be different from that specified here. If so the fully supported request to vary the set up should be made to the Secretariat.

Section 6.3 Dummy Placement

6.3.1 *H-point*

Note that the H-point of the ES-2 dummy is situated 21mm forward of that of the H-point determined by the H-point manikin (Section 6.1). The H-point of the manikin is indicated by 'Hm' on the H-point back plate of the dummy.

6.3.1.1 Position the dummy in the seat, with its back against the seat and its centreline coinciding with the seat centreline.

~~6.3.1.2 Carefully place the seat belt across the dummy and lock as normal.~~

6.3.1.3 Manoeuvre the dummy until its "Hm" position is in a circle with a radius of 10 mm round the H-point of the H-point Manikin as determined in Section 6.1.

6.3.5 *Seat belt*

6.3.5.1 Where possible, initially position the upper seat belt anchorage in the manufacturers 50th percentile design position. If no design position is provided, set the adjustable upper seat belt anchorage to the mid-position or nearest notch upward.

6.3.5.2 Carefully place the seat belt across the dummy and lock as normal.

6.3.5.3 Remove the slack from the lap section of the webbing until it is resting gently around the pelvis of the dummy. Only minimal force should be applied to the webbing when removing the slack. The route of the lap belt should be as natural as possible.

6.3.5.4 Place one finger behind the diagonal section of the webbing at the height of the dummy sternum. Pull the webbing away from the chest horizontally forward and allow it to retract in the direction of the D-loop using only the force provided by the retractor mechanism. Repeat this step three times, only.

6.3.5.5 After following the above steps, the seatbelt should lie in a natural position across the dummy sternum and shoulder clavicle. Where this is not the case, for example the belt is close to or in contact with the neck or the belt is above the shoulder rotation adjustment screw, and the upper belt anchorage is adjustable the anchorage should be lowered and steps 6.3.5.3 and 6.3.5.4 repeated.

6.3.5.6 The upper anchorage should be lowered by a sufficient amount to ensure a natural belt position following the repetition of .steps 6.3.5.3 and 6.3.5.4 repeated. This may require multiple attempts.

6.3.5.7 Once the belt is positioned the location of the belt should be marked across the dummy chest to ensure that no further adjustments are made. Mark also the belt at the level of the D-loop to be sure that the initial tension is maintained during test preparation.

6.3.5.8 Measure the vertical distance between the dummy nose and the diagonal webbing.

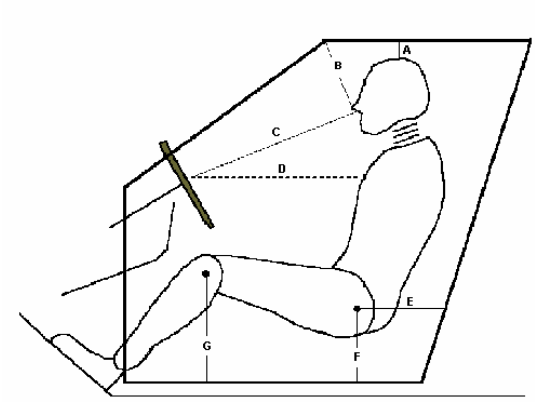
6.3.5.9 Measure the horizontal distance between the diagonal webbing and the door/window.

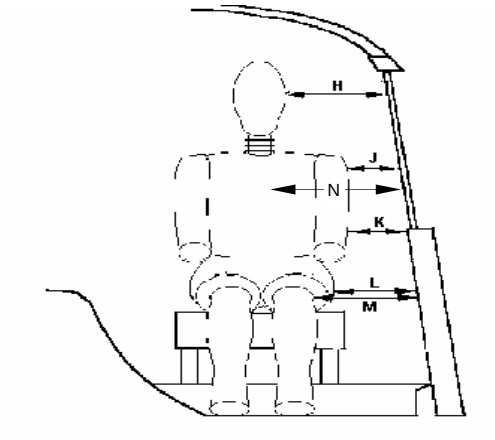
Section 6.4 Child Restraint System (CRS) Installation and Child Dummy Placement

Two CRS's are to be fitted in the rear seat, one suitable for a 3 year old child, the other for an 18 month old infant. Each will be the system recommended by the manufacturer for that size of child. The type of system to be fitted will be determined from the manufacturer. ~~Before testing begins the manufacturer must provide the approval licence for all vehicle specific CRS.~~ There must be sufficient space between the vehicle interior and CRS to allow for proper installation of the restraint without the need for excessive force. The restraint must not be prevented from sitting in its 'normal' orientation, for example the vehicle interior trim must not cause any obstruction. The dummies must also be allowed to rest in a 'normal' position.

Section 6.5 Dummy Positioning Measurements

The following measurements are to be recorded prior to the test after the dummy settling and positioning procedures have been carried out.





Driver measurements	
A	Head/roof panel
B	Nose point/windscreen joint
C	Nose point/centre of the steering
D*	Thorax strap/centre of the steering wheel
E	Hip-joint point/inside opening of the door (horizontal)
F	Hip-joint point/inside opening of the door (vertical)
G	Knee/floor covering (vertical)
H	Head/side window pane (or padding)
J	Shoulder/window pane (or padding)
K	Elbow/door (or padding)
L	Pelvis/door (or padding)
M	Knee/door (or padding)
N	Belt webbing to door (horizontally)

* Horizontal distance from steering wheel centre

Pole Impact Testing Protocol

Changes will be applied immediately and incorporated in protocol version 4.2, May 2008

Deleted text has been struck through: ~~Example~~
New text is underlined

Preface

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• During the test preparation, vehicle manufacturers are encouraged to liaise with the laboratory and to check that they are satisfied with the way cars are set up for testing. Where a manufacturer feels that a particular item should be altered, they should ask the laboratory staff to make any necessary changes. Manufacturers are forbidden from making changes to any parameter that will influence the test, such as dummy positioning, vehicle setting, laboratory environment etc.

It is the responsibility of the test laboratory to ensure that any requested changes satisfy the requirements of Euro NCAP. Where a disagreement exists between the laboratory and manufacturer, the Euro NCAP secretariat should be informed immediately to pass final judgment. Where the laboratory staff suspect that a manufacturer has interfered with any of the set up, the manufacturer's representative should be warned that they are not allowed to do so themselves. They should also be informed that if another incident occurs, they will be asked to leave the test site.

Where there is a recurrence of the problem, the manufacturer's representative will be told to leave the test site and the Secretary General should be immediately informed. Any such incident may be reported by the Secretary General to the manufacturer and the person concerned may not be allowed to attend further Euro NCAP tests.

Section 1.5 Vehicle Preparation

1.5.2 Ensure that ~~a live~~ the vehicle's battery is connected, if possible in its standard position. Check that the dashboard light for the airbag circuit functions as normal.

5 PASSENGER COMPARTMENT ADJUSTMENTS

Adjustment	Required Setting	Notes	Methods
Seat belt anchorage (where adjustable)	Same position as that used in the side impact	~~If no design position then set to mid position, or nearest notch upwards~~	

Section 6.3 Dummy Placement

6.3.1 *H-point*

Note that the H-point of the ES-2 dummy is situated 21mm forward of that of the H-point determined by the H-point manikin (Section 6.1). The H-point of the manikin is indicated by 'Hm' on the H-point back plate of the dummy.

6.3.1.1 Position the dummy in the seat, with its back against the seat and its centreline coinciding with the seat centreline.

~~6.3.1.2 Carefully place the seat belt across the dummy and lock as normal.~~

6.3.5 *Seat belt*

6.3.5.10 Where possible, initially position the upper seat belt anchorage in the manufacturers 50th percentile design position. If no design position is provided, set the adjustable upper seat belt anchorage to the mid-position or nearest notch upward.

6.3.5.11 Carefully place the seat belt across the dummy and lock as normal.

6.3.5.12 Remove the slack from the lap section of the webbing until it is resting gently around the pelvis of the dummy. Only minimal force should be applied to the webbing when removing the slack. The route of the lap belt should be as natural as possible.

6.3.5.13 Place one finger behind the diagonal section of the webbing at the height of the dummy sternum. Pull the webbing away from the chest horizontally forward and allow it to retract in the direction of the D-loop using only the force provided by the retractor mechanism. Repeat this step three times, only.

6.3.5.14 After following the above steps, the seatbelt should lie in a natural position across the dummy sternum and shoulder clavicle. Where this is not the case, for example the belt is close to or in contact with the neck or the belt is above the shoulder rotation adjustment screw, and the upper belt anchorage is adjustable the anchorage should be lowered and steps 6.3.5.3 and 6.3.5.4 repeated.

6.3.5.15 The upper anchorage should be lowered by a sufficient amount to ensure a natural belt position following the repetition of .steps 6.3.5.3 and 6.3.5.4 repeated. This may require multiple attempts.

6.3.5.16 Once the belt is positioned the location of the belt should be marked across the dummy chest to ensure that no further adjustments are made. Mark also the belt at the level of the D-loop to be sure that the initial tension is maintained during test preparation.

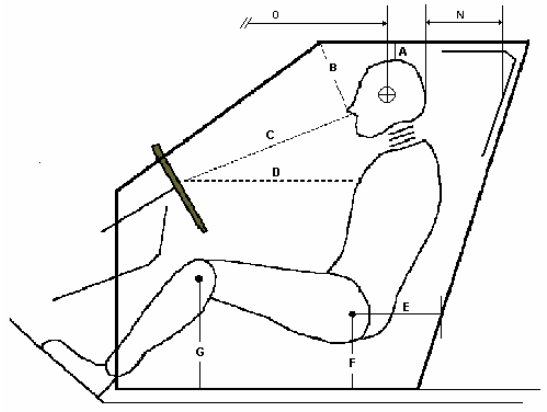
6.3.5.17 Measure the vertical distance between the dummy nose and the diagonal webbing.

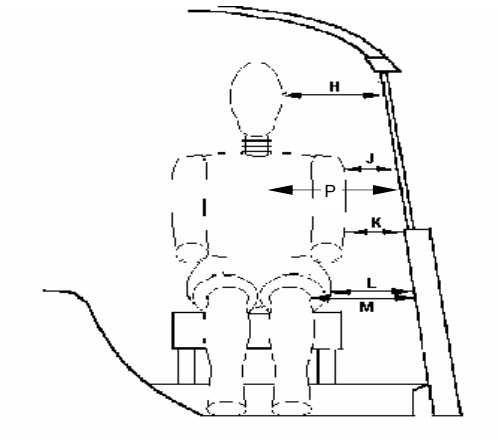
6.3.5.18 Measure the horizontal distance between the diagonal webbing and the door/window.

6.3.6 After positioning the dummy measure and record the dummy position according to Section 6.4 and determine the impact location as described in Section 1.4.

Section 6.4 Dummy Positioning Measurements

The following measurements are to be recorded prior to the test after the dummy settling and positioning procedures have been carried out.





Driver measurements		
A	Head/ roof panel vertical	vertical
B	Nose point / windscreen joint	shortest
C	Nose point / centre of steering	shortest
D	Thorax strap / centre of steering wheel	horizontal
E	Hip joint point / inside opening of the door	horizontal

F	Hip joint point / inside opening of the door	vertical
G	Knee / floor covering	vertical
H	Head / side window pane (or padding)	horizontal
J	Shoulder / window pane (or padding)	horizontal
K	Elbow / door (or padding)	horizontal
L	Pelvis / door (or padding)	horizontal
M	Knee / door (or padding)	horizontal
N	Rearmost point head / daylight opening	horizontal
O	C.o.g. head to front axle	horizontal
P	Belt webbing to door	horizontal

Section 8.1 Carrier

Crumple tubes or a comparable device will decelerate the carrier not earlier than ~~12ms or 100mm~~ 100ms after the moment / point of impact.

Pedestrian Testing Protocol

Changes will be applied immediately and incorporated in protocol version 4.2, June 2008

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• During the test preparation, vehicle manufacturers are encouraged to liaise with the laboratory and to check that they are satisfied with the way cars are set up for testing. Where a manufacturer feels that a particular item should be altered, they should ask the laboratory staff to make any necessary changes. Manufacturers are forbidden from making changes to any parameter that will influence the test, such as dummy positioning, vehicle setting, laboratory environment etc.

It is the responsibility of the test laboratory to ensure that any requested changes satisfy the requirements of Euro NCAP. Where a disagreement exists between the laboratory and manufacturer, the Euro NCAP secretariat should be informed immediately to pass final judgment. Where the laboratory staff suspect that a manufacturer has interfered with any of the set up, the manufacturer's representative should be warned that they are not allowed to do so themselves. They should also be informed that if another incident occurs, they will be asked to leave the test site.

Where there is a recurrence of the problem, the manufacturer's representative will be told to leave the test site and the Secretary General should be immediately informed. Any such incident may be reported by the Secretary General to the manufacturer and the person concerned may not be allowed to attend further Euro NCAP tests.

Assessment Protocol

Changes will be applied immediately and incorporated in protocol version 4.2, June 2008

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Section 1 Introduction

This protocol ~~has been~~ was originally developed jointly by TRL and Vehicle Safety Consultants Ltd., under contract to the UK Department of the Environment Transport and the Regions and International Testing respectively.

Section 6 Frontal Impact Modifiers

Driver

Hazardous airbag deployment

If, within the Head Zone, the airbag unfolds in a manner in which a flap develops, which sweeps across the face of an occupant vertically or horizontally the -1 point modifier for unstable airbag contact will be applied to the head score. If the airbag material deploys rearward, within the "head zone" at more than 90 m/s, the -1 point modifier will be applied to the head score. Further details are contained in Euro NCAP Technical Bulletin TB 001.

Incorrect airbag deployment

Any airbag(s) which does not deploy fully in the designed manner will attract a -1 point modifier applicable to each of the most relevant body part(s) for the affected occupant. For example, where a steering wheel mounted airbag is deemed to have deployed incorrectly, the penalty will be applied to the driver's head (-1). Where, a passenger knee airbag fails to deploy correctly, the penalty will be applied to the knee, femur and pelvis of the passenger (-1). Where the incorrect deployment affects multiple body parts, the modifier will be applied to each individual part. The modifier will be applied even if the airbag was not intended to offer protection in that particular impact. For example, the penalty will be applied if a thorax protecting side airbag deploys incorrectly in the frontal impact. In this case the modifier will be applied to the side impact chest body part.

Knee, Femur & Pelvis

If the Concentrated load modifier is not applied to both of the driver knees, the left and right knee zones (defined above) will both be split into two further areas, a 'column' area and the rest of the facia. The column area for each knee will extend 75mm* from the centreline of the steering column and the remainder of the facia will form the other area for each knee. As a result, the one point penalty for Variable Contact will be divided into two with one half of a point being applied to the column area and one half of a point to the remainder of the facia for each knee.
*[Reducing to 60mm by 2013]

Foot & Ankle

Pedal Blocking

Where the rearward displacement of a 'blocked' pedal exceeds 175mm relative to the pre-test measurement, a one point penalty is applied to the driver's foot and ankle assessment. A pedal is blocked when the forward movement of the intruded pedal under a load of 200N is <25mm. Between 50mm and 175mm of rearward displacement the penalty is calculated using a sliding scale between 0 to 1 points.

Passenger

~~Currently, the only modifiers applied to the front seat passenger are those related to airbag stability and head bottoming out (where present) and the knee impact areas. The assessment is the same as for drivers. For the outboard knee, the lateral range of the knee impact area extends from the centre line of the passenger seat to the outboard end of the facia. For the inboard knee, the area extends the same distance~~

~~inboard of the seat centre line, unless knee contact is prevented by the presence of some structure such as the centre console.~~

The score generated from passenger dummy data may be modified where the protection for different sized occupants or occupants in different seating positions, or accidents of slightly different severity, can be expected to be worse than that indicated by the dummy readings alone. In any single body region, the score may reduce by up to a maximum of two points. The concepts behind the modifiers are explained in a later section. The modifiers applicable to the passenger are:

Unstable Contact on the airbag
Hazardous airbag deployment
Incorrect airbag deployment
Knee, Femur & Pelvis, Variable Contact
Knee, Femur & Pelvis, Concentrated loading

The assessments airbag stability, head bottoming-out (where present) and the knee impact areas are the same as for driver. For the outboard knee, the lateral range of the knee impact area extends from the centre line of the passenger seat to the outboard end of the facia. For the inboard knee, the area extends the same distance inboard of the seat centre line, unless knee contact is prevented by the presence of some structure such as the centre console. The passenger knee zones and penalties will not be divided into two areas even if the Concentrated load modifier is not applied.

Door Opening during the Impact
When a door opens in ~~a frontal~~ the test, a minus one-point modifier will be applied to the score for that test. The modifier will be applied to the overall vehicle score for every door (including tailgates and moveable roofs) that opens. The number of door opening modifiers that can be applied to the vehicle score is not limited.

Concept: The intention is to ensure that the structural integrity is maintained. The underlying principle is to minimise the risks of occupant ejection occurring.
The 'door opening' modifier will be applied if any of the following have occurred:

- the latch has fully released or shows significant partial release, either by release of its components from one another, or effective separation of one part of the latch from its supporting structure
- the latch has moved away from the fully latched condition
- if any hinge has released either from the door or bodyshell or due to internal hinge failure
- if there is a loss of structure between the hinges and latches
- if door or hinges fail whilst the door opening tests are being conducted post impact, as loading from an occupant could have a similar effect.
- if there was any potential risk of occupant ejection and/or partial ejection/entrapment from openings such as sliding doors or moveable roofs. Dynamic opening during the impact of any apertures, such as roofs, will also be considered even if the openings have closed post test.
- if both side doors latch together with no b-pillar or other form of restraint, the modifier may apply to both the front and rear doors.

Section 7 SIDE IMPACT ASSESSMENT CRITERIA AND LIMIT VALUES
The basic assessment criteria used for side impact, with the upper and lower performance limits for each parameter, are summarised below. Where multiple criteria exist for an individual body region, the lowest scoring parameter is used to determine the performance of that region. In any single body region, the score may reduce by up to a maximum of two points. The concepts behind the modifiers are explained in a later section.

Section 8 Side impact modifiers

Incorrect airbag deployment
Any airbag(s) which does not deploy fully in the designed manner will attract a -1 point modifier applicable to each of the most relevant body part(s) for the affected occupant. For example, where a head

curtain airbag is deemed to have deployed incorrectly, the penalty will be applied to the driver's head (-1). Where the incorrect deployment affects multiple body parts, the modifier will be applied to each individual part. For example, where a seat mounted head and thorax airbag fails to deploy correctly for both the head and chest, the penalty will be applied to the head (-1) and the chest (-1). The modifier will be applied even if the airbag was not intended to offer protection in that particular impact. For example, the penalty will be applied if a driver's knee airbag deploys incorrectly in a side or pole impact. In this case the modifier will be applied to both frontal impact driver knee, femur and pelvis body parts.

Backplate

Where the backplate load Fy exceeds 4.0kN, a two point penalty is applied to the driver's chest assessment. Between 1.0kN and 4.0kN the penalty is calculated using a sliding scale from 0 to 2 points. Only loads applied to the backplate, which might unload the chest by accelerating the spine away from the intruding side are counted.

Higher performance limit	
Fy	1.0 kN
Lower performance limit	
Fy	4.0 kN

T12 Modifier

Where the T12 loads Fy and Mx exceed 2.0kN or 200Nm respectively, a two point penalty is applied to the driver's chest assessment. Between 1.5kN – 2.0kN or 150Nm – 200Nm the penalty is calculated using a sliding scale from 0 to 2 points. The assessment is based upon the worst performing parameter. Only loads which are transmitted up the spine, which might unload the chest during the loading phase of the impact, will be considered.

Higher performance limit			
Fy	1.5 kN	Mx	150 Nm
Lower performance limit			
Fy	2.0 kN	Mx	200 Nm

Using SAE J211 sign convention: Fy > 0 and Mx < 0 for LHD vehicles
Fy < 0 and Mx > 0 for RHD vehicles

Door Opening during the Impact

When a door opens in the test, a minus one-point modifier will be applied to the score for that test. The modifier will be applied to the overall vehicle score for every door (including tailgates and moveable roofs) that opens. The number of door opening modifiers that can be applied to the vehicle score is not limited.

Concept: The intention is to ensure that the structural integrity is maintained. The underlying principle is to minimise the risks of occupant ejection occurring.
The 'door opening' modifier will be applied if any of the following have occurred:

- the latch has fully released or shows significant partial release, either by release of its components from one another, or effective separation of one part of the latch from its supporting structure
- the latch has moved away from the fully latched condition
- if any hinge has released either from the door or bodyshell or due to internal hinge failure
- if there is a loss of structure between the hinges and latches
- if door or hinges fail whilst the door opening tests are being conducted post impact, as loading from an occupant could have a similar effect.
- if there was any potential risk of occupant ejection and/or partial ejection/entrapment from openings such as sliding doors or moveable roofs. Dynamic opening during the impact of any apertures, such as roofs, will also be considered even if the openings have closed post test.

- if both side doors latch together with no b-pillar or other form of restraint, the modifier may apply to both the front and rear doors.

9 POLE IMPACT MODIFIERS

~~A one point modifier is applied if the head protection airbag does not deploy fully in the designed manner.~~

Incorrect airbag deployment

Any airbag(s) which does not deploy fully in the designed manner will attract a -1 point modifier applicable to each of the most relevant body part(s) for the affected occupant. For example, where a head curtain airbag is deemed to have deployed incorrectly, the penalty will be applied to the driver's head (-1). Where the incorrect deployment affects multiple body parts, the modifier will be applied to each individual part. For example, where a seat mounted head and thorax airbag fails to deploy correctly for both the head and chest, the penalty will be applied to the head (-1) and the thorax (-1). The modifier will be applied even if the airbag was not intended to offer protection in that particular impact. For example, the penalty will be applied if a driver's knee airbag deploys incorrectly in a side or pole impact. In this case the modifier will be applied to both frontal impact driver knee, femur and pelvis body parts.

Door Opening during the Impact

When a door opens in the test, a minus one-point modifier will be applied to the score for that test. The modifier will be applied to the overall vehicle score for every door (including tailgates and moveable roofs) that opens. The number of door opening modifiers that can be applied to the vehicle score is not limited.

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- if any hinge has released either from the door or bodyshell or due to internal hinge failure
- if there is a loss of structure between the hinges and latches
- if door or hinges fail whilst the door opening tests are being conducted post impact, as loading from an occupant could have a similar effect.
- if there was any potential risk of occupant ejection and/or partial ejection/entrapment from openings such as sliding doors or moveable roofs. Dynamic opening during the impact of any apertures, such as roofs, will also be considered even if the openings have closed post test.
- if both side doors latch together with no b-pillar or other form of restraint, the modifier may apply to both the front and rear doors.

Section 10 WHIPLASH SEAT ASSESSMENT CRITERIA AND LIMIT VALUES

New section.

Section 11 WHIPLASH SEAT MODIFIERS

New section.

Section 14 OVERALL ASSESSMENTS

For pedestrian impact, each of the potential 18 test sites can be awarded up to two points, giving a possible overall score of 36 points. However, if the vehicle manufacturer chooses to fund additional tests either in the legform, upper legform or headform test area the score would be calculated as follows:

Example:

Headform testing:
Euro NCAP test produces a HIC of 1300 = 0.07 points/quarter
Additional test produces a HIC of 1050 = 0.43 points/quarter

Euro NCAP test Score	**Extra Test Score**	**Number of manufacturer nominated quarters**	**Area Score**	
0.07		0	(0.07 x 4)	= 0.29
0.07	0.43	1	(0.07 x 3)+(0.43 x 1)	= 0.64
0.07	0.43	2	(0.07 x 2)+(0.43 x 2)	= 1.00
0.07	0.43	3	(0.07 x 1)+(0.43 x 3)	= 1.36

Legform/upper legform testing (based upon the worst result of any parameter):
Euro NCAP test produces a knee bending angle of 19° = 0.2 points/half
Additional test produces a tibia acceleration 175g = 0.5 points/half

Euro NCAP test Score	**Extra Test Score**	**Number of manufacturer nominated halves**	**Area Score**
0.20		0	0.20 x 2 = 0.40
0.20	0.50	1	0.20+0.50 = 0.70

~~Where a manufacturer has nominated additional test zone(s) and those zone(s) perform worse than the Euro NCAP nominated test zone, the test zone(s) which have not been tested will have the best result applied to them regardless of manufacturer nomination.~~

Where the spacing requirements between impacts prevent the worst case location from being tested, the area in question will be given the most appropriate score from an adjacent area within that particular sixth or half.

Relationship between Points and Stars for Frontal and Side Tests

The overall scores and the balance between side and front scores are then used to generate star ratings. Vehicles which perform very poorly in the frontal or side tests have their star rating restricted to show that they do not provide good all-round protection.

There will be a minimum number of points required in both the frontal and side impact (excluding pole test) assessments to achieve a star rating. The following limits are applied after the individual test scores have been rounded:

Total Points and Balance Applied to Star Values

Provided there is a balance between the Frontal and Side Impacts the following applies:

33 - 40	points	5 stars
25 - 32	points	4 stars
17 - 24	points	3 stars
9 - 16	points	2 stars
1 - 8	points	1 star
0	points	0 stars

However if the balance is lacking then the following hurdles are applied:

Minimum points required in each test (after rounding):	Star rating:
13 points	5
9 points	4
5 points	3
2 points	2

Pedestrian Impact

28 - 36	points	4 stars
19 - 27	points	3 stars
10 - 18	points	2 stars
1 - 9	points	1 star
0	points	0 stars

Whiplash Raw Score

The protocol allows for a maximum score of eleven points as a result of carrying out the three severities of whiplash test, assuming no negative modifiers have been applied. This score is known as the raw score and its components are shown below. When incorporated into the final vehicle rating, an appropriate scaling factor will be applied to the raw score. Currently, the scaling factor is still under consideration.

Dynamic assessments

Each severity of whiplash test pulse results in a maximum of 3 points being awarded based on the measured criteria. Half a point is awarded for each of NIC, Nkm, Head rebound velocity, F_x and F_y. A further half point is awarded on the basis of the best score from either T1 acceleration or head restraint contact time (T-HRC).

If any of NIC, Nkm, Head rebound velocity, neck shear or tension exceed the capping limit, no score is given for that pulse. Additionally, if both T1 and head restraint contact time exceed the higher performance limit and either one also exceeds the relevant capping limit, no score is given for the pulse.

The sum of the scores from the dynamic tests is then subject to the application of the modifiers.

	Points available
Static assessments	
HR geometry	-1 to +1 points
Ease of adjustment	1 point
Dynamic assessments	
Low severity pulse	3 points
Medium severity pulse	3 points
High severity pulse	3 points
Modifiers	
Seatback deflection	-1 point
Dummy artefact loading	-2 points
Maximum points	**11 points**

Section 15 CONCEPTS BEHIND THE ASSESSMENTS
Frontal Impact

Head

CONCEPT: The driver's head should be predictably restrained by the airbag, and should remain protected by the airbag during the dummy's forward movement. There should be no bottoming out of the airbag.

CONCEPT: Hazardous airbag deployment
The deployment mode of the airbag should not pose a risk of facial injury to occupants of any size.

CONCEPT: Incorrect airbag deployment
All airbags that deploy during an impact should do so fully and in the designed manner so as to provide the maximum amount of protection to occupants available. It is expected that, where required, all airbags should deploy in a robust manner regardless of the impact scenario.

Lower Leg

CONCEPT: Pedal blocking
There should be no blocking of any foot operated pedals which have displaced rearward after the impact; blocked pedals represent a greater hazard to the lower limbs of the driver than non-blocked pedals.

Side Impact
CONCEPT: Incorrect airbag deployment
All airbags that deploy during an impact should do so fully and in the designed manner so as to provide the maximum amount of protection to occupants available. It is expected that, where required, all airbags should deploy in a robust manner regardless of the impact scenario.

CONCEPT: Backplate
Poor dummy biofidelity should not be exploited in such a way that compromises other outputs from the dummy.

CONCEPT: T12
Poor dummy biofidelity should not be exploited in such a way that compromises other outputs from the dummy.

Pole impact
CONCEPT: Incorrect airbag deployment
All airbags that deploy during an impact should do so fully and in the designed manner so as to provide the maximum amount of protection to occupants available. It is expected that, where required, all airbags should deploy in a robust manner regardless of the impact scenario.

Whiplash

Geometry assessment
CONCEPT: This is used to encourage front seats to have optimum geometry in terms of both height and backset.

Ease of adjustment
CONCEPT: The head restraint should be ideally placed for optimal dynamic performance without occupants of different size taking any action other than simply adjusting the seat to suit their leg length. This implies that the head restraint should either be fixed, automatically adjust to the optimal position or should be an adjustable restraint that provides optimum position even in its fully down position.

Seatback dynamic deflection

CONCEPT: The seat distortion should be controlled so that a front occupant is not liable to ejection from behind the seat belt in a rear impact and the risk of interaction between the front and rear occupants is minimised.

Dummy artefact loading

CONCEPT: A two point negative modifier will be applied to any seat that, by design, places unfavourable loading on other parts of the body as a result of the head restraint mechanism. This modifier shall also penalise any design feature aimed at exploiting any dummy artefact. This is seen as a clear incentive to avoid such design, and an essential feature to safeguard Euro NCAP's position for future designs.

~~**Section 14 CHILD DUMMY ASSESSMENT CRITERIA AND LIMIT VALUES**~~

~~**Section 15 SIDE IMPACT**~~

Child Protection Assessment Protocol

Changes will be applied immediately and incorporated in protocol version 1.1, May 2008

Deleted text has been struck through: ~~Example~~
New text is underlined

2. PRECONDITIONS

2.1. The CRS must be recommended by the vehicle manufacturer, to their customers, in all ~~25~~ countries of the European Union, where the vehicle is sold.

2.2. The CRS must be available for purchase by the public, in all ~~25~~ countries of the European Union, where the vehicle is sold.

2.3. The CRS must be formally approved to UN ECE Regulation 44.03 or later, for the vehicle being assessed.

4.1. Ejection

4.1.1. If the child dummy is ejected or partially ejected from the CRS, that CRS is awarded zero points for its dynamic performance. Otherwise, points are awarded as given below.

4.1.2. If the CRS is partially or wholly unrestrained by any of the vehicle interfaces, that CRS is awarded zero points for its dynamic performance. The vehicle interfaces of ISOFIX restraints are the two ISOFIX anchorages, top tether anchorage or any other means of rotation limiting device such as a support leg. Seat belt lock-offs, tethers, straps or any other attachments which are specifically used to anchor the CRS to the vehicle will also be penalised, if their failure presents a risk of total or partial ejection of the child or child restraint. Where the CRS is fully restrained, points are awarded as given below.

Section 6.1.2 Airbag Disabling Requirements

If a front seat passenger's frontal protection airbag is fitted and ~~either of~~ the following requirements ~~is~~ are complied with, 2 points are awarded to the Child Protection score.

a) Dealer disconnect is available

b) The airbag can be de-activated by a manual ~~or automatic~~ switch meeting the following requirements:

- Easily visibly information and warnings must be provided for the driver and front seat passenger, showing the status of the airbag. ~~If the information to indicate that the airbag is enabled is provided by an illuminated signal, the signal is only required to be illuminated for a period of 60 seconds, after the ignition is switched on. Information to indicate that the airbag is "disabled" must be permanently displayed, when the ignition is on.~~
- ~~The information must be explicit about the suitability of the seat for use by a child in a rearward facing CRS or for use by an adult.~~
- Text must be in at least one of the languages of the country in which the vehicle is sold. Alternatively, the words 'Passenger AIRBAG OFF/ON' are acceptable where the requirements of 6.1.1 are also met. Note: 'Pass', 'AB' or other abbreviations are NOT acceptable.
- Pictograms are required to indicate the airbag status (ON and OFF).
- If the information to indicate that the airbag is enabled is provided by an illuminated signal, the signal is only required to be illuminated for a period of 60 seconds after the ignition is switched on. The AIRBAG ON pictogram must be the same as that used in the airbag warning label (6.1.1).
- Information to indicate that the airbag is disabled must be permanently displayed, when the ignition is on.

- The switch must be accompanied by text in at least one of the languages of the country which the vehicle is sold. Alternatively, the switch may be labelled with the text 'Passenger AIRBAG OFF/ON' providing it has also been used for the airbag status warning.
- The individual switch positions must be marked with the same pictograms that are used to indicate that airbag status. However, they need not be illuminated on the switch.
- Any labelling/instructions must be permanently attached to the vehicle. The switch labelling/instructions must be adjacent to the switch itself and clearly visible at the time of activation/deactivation.
- The information provided must be clear, without reference to the vehicle's handbook or other source.
- There must be no possibility of the users being given false information.
- If, with the ignition on and with engine running or not, the switch position can be changed, the system must react correctly to the change.

Note: If 'dealer disconnect' is available for a car fitted with a 'manual or automatic switch', the requirements for the switch must also be met for the points to be awarded.

c) The airbag can be de-activated by an automatic switch/system meeting the following requirements:

- Easily visibly information and warnings must be provided for the driver and front seat passenger, showing the status of the airbag.
- Text must be in at least one of the languages of the country in which the vehicle is sold. Alternatively, the words 'Passenger AIRBAG OFF/ON' are acceptable where the requirements of 6.1.1 are also met. Note: 'Pass', 'AB' or other abbreviations are NOT acceptable.
- Pictograms are required to indicate the airbag status (ON and OFF).
- If the information to indicate that the airbag is enabled is provided by an illuminated signal, the signal is only required to be illuminated for a period of 60 seconds after the ignition is switched on. The AIRBAG ON pictogram must be the same as that used in the airbag warning label (6.1.1).
- Information to indicate that the airbag is disabled must be permanently displayed, when the ignition is on.
- Any labelling/instructions must be permanently attached to the vehicle.
- The information provided must be clear, without reference to the vehicle's handbook or other source.
- There must be no possibility of the users being given false information.
- If, with the ignition on and with engine running or not, the airbag status can be changed, the system must react correctly to the change.

~~7~~ 6.6 INTEGRATED CRS

~~7.1.~~ 6.6.1 Two or More Integrated CRS

~~7.2.~~ 6.6.2 One or More Group I-III Integrated CRS