

The SPCT Method - Testing of Dog Crates

Application Area.....	2
References	2
1 Test Sample Selection	2
2 Test Sample	2
3 Testing.....	2
3.1 Frontal Crash Test.....	3
3.1.1 Measuring of the Sample Objects.....	3
3.1.2 Prepare / Connection of Equipment.....	3
3.1.3 Tuning of Speed and Deceleration Pulse	3
3.1.4 Placing the Test Sample.....	3
3.1.5 Photography and Documentation Prior to the Test.....	3
3.1.6 Testing and Evaluation	3
3.1.7 Photography and Documentation of Damage to the Test Sample and Vehicle.....	3
3.1.8 Evaluation of the Criteria	3
3.2 The Testing of a Rear End Collision	4
3.2.1 Measuring of the Sample Object	4
3.2.2 Preparation / Connection of Equipment.....	4
3.2.3 Tuning of Speed and Deceleration Pulse	4
3.2.4 Positioning the dummy and test sample.....	4
3.2.5 Adjustments of the intrusion barrier	4
3.2.6 Photography and Documentation Prior to the Test.....	4
3.2.7 Testing and Evaluation	4
3.2.8 Photography and documentation of damage to the test objects and vehicle interior.....	4
3.2.9 Evaluation of the Criteria	5
3.3 Drop Test in order to Simulate a Roll Over Shock.....	5
3.3.1 Measuring of the sample object.....	5
3.3.2 Preparation and Connection of Equipment.....	5
3.3.3 Suspension of the test sample in the release mechanism	5
3.3.4 Measuring of the vertical drop and the adjustment of appropriate angles	5
3.3.5 Photography and Documentation Prior to the Test.....	6
3.3.6 Testing and Evaluation	6
3.3.7 Photography and documentation of the damages to the test objects.....	6
3.3.8 Evaluation of Criteria.....	6
4 Calculating Criteria	6
5 Measurement Uncertainties	7
6 Reporting	7

Application Area

The SPCT method refers to testing of pet crates for safety of pets and passengers in a collision with a car. It provides instructions how pet crate safety can be tested as there is no applicable standard.

The rear seat strength in a frontal collision is normally tested according to United Nations regulations no. 17 (ECE R17) with wooden blocks. The same frontal impact test is carried out with the dog crate as one of the three stages of the SPCT method.

Studies of statistics regarding the number of families with both dogs and children in Sweden have shown that an increasing number of rear-end collisions with a dog crate in the cargo area will occur as the use of dog crates continue to grow. (Ny metod för analys av hundburars påverkan på bilars säkerhet, Anders Flogård, MIM Construction AB, 2008 -02-22). A test of the crate performance and ability to not transfer energy into the back seat in a rear end collision is one of the test elements.

The robustness of the crate is also taken into account in the testing methodology to prevent injuries to animals and passengers in all types of collision directions.

References

- | | | | |
|-----|---------|--|--|
| [1] | ECE-R17 | <i>APPROVAL OF VEHICLES WITH REGARD TO THE SEATS, THEIR ANCHORAGES AND ANY HEAD RESTRAINTS</i> | Rev.2, Appendix 9,
6 nov. 2009 |
| [2] | ECE-R44 | <i>APPROVAL OF RESTRAINING DEVICES FOR CHILD OCCUPANTS OF VEHICLES</i> | Rev.2, Annex 7 - Appendix 2,
14 feb. 2011 |

1 Test Sample Selection

Test samples are collected by the manufacturer (Customer).

2 Test Sample

Drawings of the test sample shall be submitted along with the test sample.

The maximum permissible load for the test sample shall be stated such as 45 kg or 2x35 kg.

Fasteners and mounting instructions for the vehicle must accompany the test sample.

3 Testing

The testing consists of three parts. A frontal impact test in a car body with the crate located in the cargo area, a barrier collision against the crate and the body simulating a rear end collision and a drop test against a corner of the crate in order to test the robustness of the crate in all types of crash direction.

3.1 Frontal Crash Test

The elements included in the frontal crash test is as follows:

- Measuring of the sample objects
- Tuning of speed and deceleration pulse
- Photography and documentation prior to the test
- Testing and evaluation
- Photography and documentation of damage to the test objects and vehicle interior
- Evaluation of the criteria

3.1.1 Measuring of the Sample Objects

The test sample is being checked for compliance by submitted drawings.

3.1.2 Prepare / Connection of Equipment

Make sure all equipment is calibrated. Check views and operation of high-speed cameras.

3.1.3 Tuning of Speed and Deceleration Pulse

The rear part of a prepared Volvo V70N body is mounted on the crash sled. The rear seat backs mounted in the body must have a 60/40 split and have an aluminum frame (2001-2004). The backs are positioned in the comfort mode.

The speed of the sled and the deceleration pulse simulates a front collision taken from the ECE R17 [2].

3.1.4 Placing the Test Sample

The dog crate should be placed in the luggage compartment in accordance to the manufacturer's instructions (Figure 1, Appendix 1). If the test object consists of a separate area it requires a 45 kg payload and if the test object consisting of two separate areas it requires two payloads of 35 kg each. If permissible load is reduced by the manufacturer that same load should be used during testing.

3.1.5 Photography and Documentation Prior to the Test

The positioning of the test sample is photographed and documented.

3.1.6 Testing and Evaluation

The crash test is performed by accelerating the crash sled with the body to a speed of 48-50 km / h and then slow down the unit by means of a hard braking of 20-28 g simulating the crash. Deceleration is measured by an accelerometer mounted on the crash sled. Deceleration graph is analyzed after the test.

3.1.7 Photography and Documentation of Damage to the Test Sample and Vehicle

Damage to the test sample, the boot floor and seat backs are photographed and documented after the test.

3.1.8 Evaluation of the Criteria

The criteria for the frontal crash test is based on the following:

- Risk of falling out of the test sample during and after the crash?
- Sharp edges after the crash. Can the dog be severely damaged by resulting sharp edges if the car rolls over several times?
- Can the test sample be opened and evacuated after the test without the need of tools and/or excessive force.
- Does the test object have an evacuation hatch. A hatch that can be used if the regular door can't be opened or accessed after an accident.

3.2 The Testing of a Rear End Collision

The elements included in the rear end collision test is as follows:

- Measuring of the sample object
- Preparation / connection of equipment
- Tuning of speed and deceleration pulse
- Placement of dummy and test sample
- Adjustments of the intrusion barrier
- Photography and documentation prior to the test
- Testing and evaluation
- Photography and documentation of damage to the test objects and vehicle interior
- Evaluation of the criteria

3.2.1 Measuring of the Sample Object

The test sample is being checked for compliance by submitted drawings.

3.2.2 Preparation / Connection of Equipment

Make sure all equipment is calibrated. Check that the correct measurement range is set for dummy accelerometers. Check views and function of high-speed cameras.

3.2.3 Tuning of Speed and Deceleration Pulse

The rear part of a prepared Volvo V70N body is mounted on the crash sled. The rear seat backs mounted in the body must have a 60/40 split and have an aluminum frame (2001-2004). The backs are positioned in the comfort mode.

The speed of the sled and the deceleration pulse simulates a rear end collision taken from the ECE R44 [2].

3.2.4 Positioning the dummy and test sample

A Hybrid III 50 percentile crash test dummy is placed in the left rear seat (position 4 in accordance with ISO encoding). The Dummy shall be equipped with a three-axial accelerometer in the head and a single axial accelerometer at the height of the upper thoracic vertebrae, T1 (Figure 4, Appendix 1). The dog crate should be placed in the luggage compartment in accordance to the manufacturer's instructions (Figure 1, Appendix 1). If the test object consists of a separate area it requires a 45 kg payload and if the test object consisting of two separate areas it requires two payloads of 35 kg each. If permissible load is reduced by the manufacturer that same load should be used.

3.2.5 Adjustments of the intrusion barrier

The intrusion barrier is adjusted so that a minimum of clearance against cargo area floor is achieved. The deformation of the test object shall begin at about 100 mm of travel after the crash sled deceleration start (Figure 3, Appendix 1).

3.2.6 Photography and Documentation Prior to the Test

The positioning of the crash test dummy and the test object is photographed and documented.

3.2.7 Testing and Evaluation

The crash test is performed by accelerating the crash sled with the body to a speed of 30-32 km / h and then slow down the unit by means of a braking of 14-21 g. Deceleration is measured by an accelerometer mounted on the crash sled. Deceleration graph is analyzed after the test.

3.2.8 Photography and documentation of damage to the test objects and vehicle interior

Damage to the test sample, cargo area floor and seat backs are photographed and documented. The upholstery on the seat backs must be removed prior to shooting.

3.2.9 Evaluation of the Criteria

The criteria for tests of rear end collisions are given by:

- Head 3 ms acceleration and HIC 36. Acceleration data from the three axial accelerometer in the dummy head should be filtered using a CFC 1000 filter. The HIC 36 and the maximum acceleration during the main 3 milliseconds, multiple peaks, is calculated.
- T1 acceleration. The acceleration of the dummy upper thoracic vertebra is filtered using CFC 180 and the highest value is noted.
- Horizontal deformation of the seat back. The deformation of the seat back measured over the entire seat back flat part, with a reference steel scale or similar positioned towards the top and bottom of the seat back (Figure 5 and 6 , Appendix 1).
- Penetration depth of the seat back. Isolated holes or deformations from penetrating parts are measured in depth compared to the back flat part (Figure 7, Appendix 1).
- Risk of falling out of the test object during and after the crash?
- Sharp edges after the test. Can the dog be severely injured by resulting sharp edges if the car rolls over several times?
- Can the test sample be opened and evacuated after the test without the need of tools and/or excessive force.
- Does the test object have an evacuation hatch. An hatch that can be used if the regular door can't be opened or accessed after an accident.

3.3 Drop Test in order to Simulate a Roll Over Shock

The elements included in the drop test:

- Measuring of the sample object
 - Preparation / connection of equipment
 - Suspension of the test sample in the release mechanism
 - Measuring of vertical drop and the adjustment of appropriate angle
 - Photography and documentation prior to the test
 - Testing and evaluation
 - Photography and documentation of damage to the test objects and vehicle interior
 - Evaluation of the criteria
- **3.3.1 Measuring of the sample object**

The test sample is being checked for compliance by submitted drawings.

3.3.2 Preparation and Connection of Equipment

Make sure all equipment is calibrated. If the test should be recorded with a digital video recorder, check the view and the operation of the camera.

3.3.3 Suspension of the test sample in the release mechanism

A release mechanism that is not likely to affect the subject is being positioned above a rigid fall plate. The test sample is attached with straps to the release mechanism (Figure 8, Appendix 1).

3.3.4 Measuring of the vertical drop and the adjustment of appropriate angles

The test object's weakest corner shall be exposed to the drop test and this point is to be generated by an engineering assessment. The test object's position is adjusted with straps and rotated around the vehicle's intended longitudinal axis 45 ° and then rotates around the vehicle transverse axis 15 ° (Figure 8, Appendix 1). The drop height for the subject's lowest point is adjusted to 70 cm above the rigid fall plate.

If the test object consists of a separate area it requires a 45 kg payload and if the test object consisting of two separate areas it requires two payloads of 35 kg each. If permissible load is reduced by the manufacturer that same load should be used.

3.3.5 Photography and Documentation Prior to the Test

The positioning of the test sample is photographed and documented.

3.3.6 Testing and Evaluation

The test object is released with the help of the release mechanism into the fall plate. The fall velocity is calculated to be around 3.7 m / s at the impact with the floor. The test can be recorded with a digital video recorder upon request to facilitate further analysis.

3.3.7 Photography and documentation of the damages to the test objects

Damage to the test sample is photographed and documented.

3.3.8 Evaluation of Criteria

The criteria for the simulation of the roll-over shock based on the following:

- Risk of falling out of the test sample during and after the crash?
- Sharp edges after the crash. Can the dog be severely damaged by resulting sharp edges if the car rolls over several times?
- Can the test sample be opened and evacuated after the test without the need of tools and/or violence.
- Does the test object have an evacuation hatch. A hatch that can be used if the regular door can't be opened or accessed after an accident.

4 Calculating Criteria

The overall test results from the three test phases are added together to form green, yellow or red results in Table 1 below. Description of the criteria contained in Chapter 3.1.8, 3.2.9 and 3.3.8 above.

Tabell 1

Test	Criteria	Green	Yellow	Red
All test elements	The risk of falling out of the test sample during and after the test	No	-	Yes
	Sharp edges after the test	No	-	Yes
	Test sample openable and evacuation able after the test without tools / violence	Yes	-	No
	Accessible evacuation hatch	Yes	No	-
Rear End Collision	Head 3 ms acc	< 70 g	70-80 g	> 80 g
	HIC 36	< 400	400-500	> 500
	T1-acc	< 70 g	70-80 g	> 80 g
	Horizontal deformation of seat back	< 50 mm	-	> 50 mm
	Depth of penetration into seat back	< 15 mm	-	> 15 mm

In order to get a “Green” result when tested it is required that the entire column "**Green**" is observed. If the test object has no evacuation hatch the result may never be green. If any of the criteria is yellow (and no red), the complete test result is “Yellow”. If any of the criteria is red, the complete test result is “Red”.

5 Measurement Uncertainties

SP works consistently with relative measurement uncertainties, ie. uncertainties are given in percent of displayed or estimated value. To facilitate the reporting process, we specify to the maximum extent possible the same measurement uncertainty for different tests. To achieve this, all instruments is checked for their detailed contributions to the overall measurement uncertainty.

Measurement uncertainty for the frontal crash test and rear end collision test will be determined according to the derivation of the measurement uncertainty of crash testing, and dimensional analysis (length).

Measurement uncertainty for the drop test is determined according to the derivation of the uncertainty of the test case.

6 Reporting

A report completed in accordance with SP's general writing rules shall also include:

- A summary of test result
- Graphs showing the acceleration of the head and neck
- Deformations measured in the backrests and photographs of these
- A description of the cage condition after each of the three test phases
- Graph showing the corridors of the acceleration pulse to ECE R44 and ECE R17
- Result matrix with maximum reference values
- Measurement of uncertainty and how it is calculated
- An overall drawing from drawing documentation for the test sample



Figure 1, Set up Frontal Crash Test



Bild 2, Set up Rear End Collision



Figure 3, The crash barrier position when the crash bars starts deforming (braking)

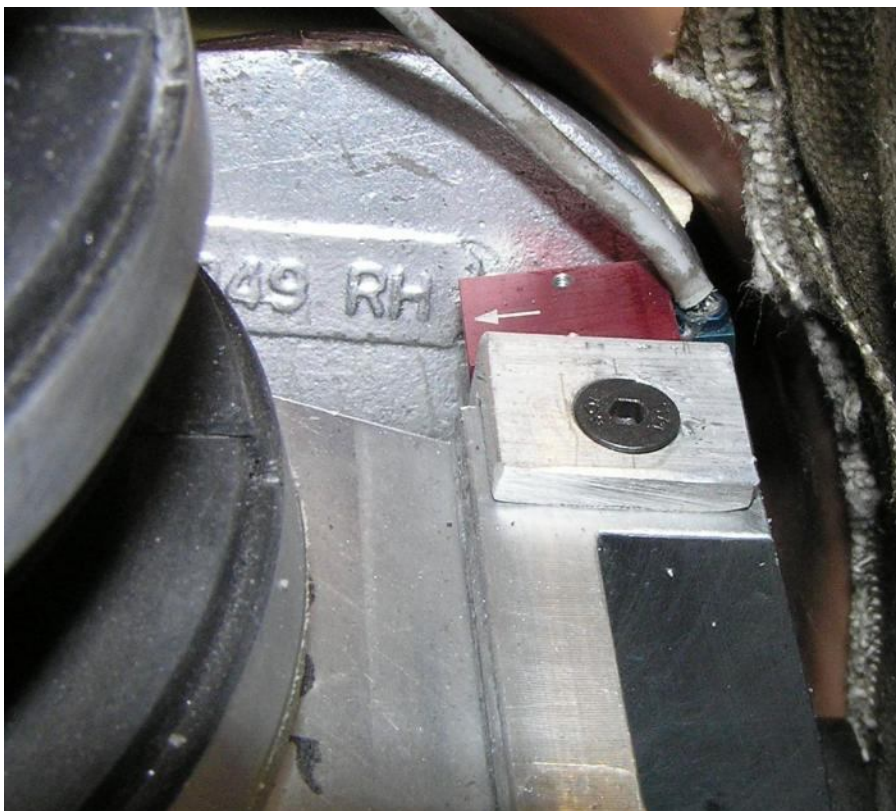


Figure 4, Location of the T1 accelerometer in the dummy



Figure 5, Measuring the horizontal deformation of the seat back



Figure 6, Measuring the horizontal deformation of the seat back

Appendix 1

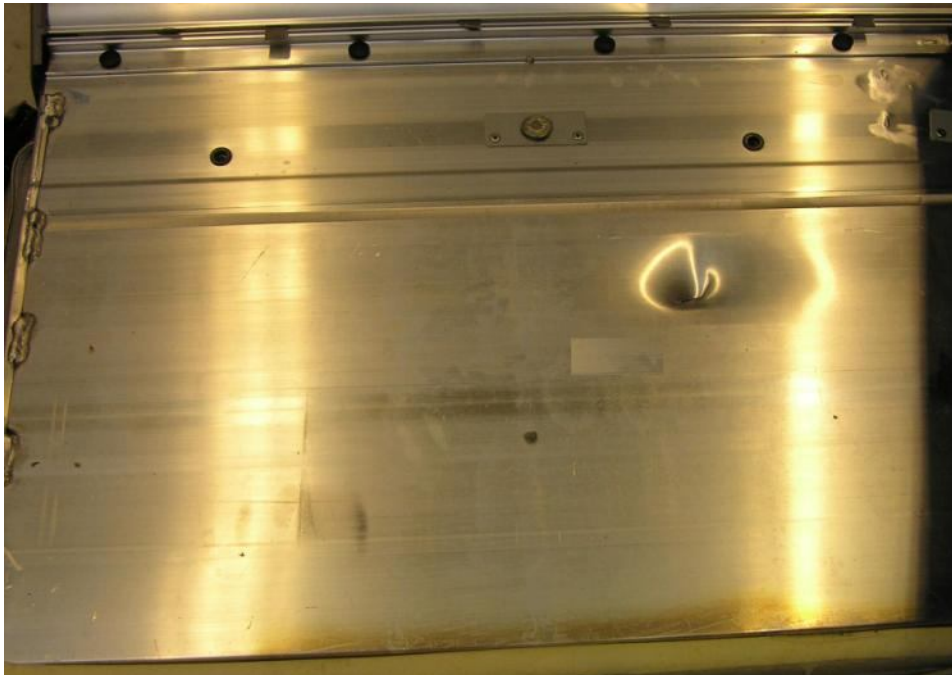


Figure 7, Penetration holes after the rear end test



Figure 8, Angle adjustment of the test objects before the drop test