CHILD SAFETY_BACKGROUND INFORMATION

THE ECE-NORM R 44

The UNECE (United Nations Economic Commission for Europe) sets out norms, standards and conventions to facilitate international cooperation within and outside the region. The norm regulating the safety standards of child restraint systems has the ECE-regulation number 44, briefly ECE R 44. Literally it contains “uniform provisions concerning the approval of restraining devices for child occupants of power-driven vehicles”. Due to changes in the automobile sector and innovations in the safety industry, the norms have to be adjusted from time to time. The current version of the ECE R 44 is the fourth (ECE R 44/04), labelled by -04 on car safety seats for children. As there were only slight changes in comparison to the older norm R 44/03, seats labelled by -03 still comply with the current safety requirements. However, new seats should comply with the R 44/04 norm labelled by -04.

Label complying with ECE R 44/04:

What are the requirements of the old and the current norms? What are the differences?

ECE-norms R 44/01 and R 44/02

The ECE R 44/01 started in the beginning of the 1990s: Since it was generally compulsory to use child safety devices, seats could only be sold and used with test certificates – followed by the improved 44/02. As these seats are now at least 13 years old, they do no longer comply with today’s safety standards. Therefore since April 2008 these seats are legally no longer to be sold or used. Sometimes one can find old seats from this period, simple “boosters” without belt guide and without back rest or head rest. These booster seats, along with all other seats of the 01 and 02 norm should be disposed immediately. This applies also to so-called “belt positioning pillows”, which unite pelvic and shoulder belt in the abdominal area. By the way, in case of a road check, users will be fined.

ECE-norm R 44/03

The ECE-norm R 44/03 was introduced in the year 1995. The characteristics of seats fulfilling this norm are as follows:

- stricter requirements in front impact collisions are fulfilled
- the five-point strap system was introduced instead of the four-point strap system common to seats labelled -01 or -02
- the belt guide is clearly represented and colour-coded
- so-called “belt positioning pillows” in compliance with older norms (labelled -01 or -02) do no longer comply with the requirements of the norm ECE-R 44 and are forbidden
- in order to accommodate bigger children in infant carriers, the group 0+ (up to 13 kg) was introduced

Seats labelled by the ECE-norm R 44/03 can still be used without limitation, but the use of older seats labelled -01 or -02 is no longer allowed, because they are too old and do not comply with the requirements of the current norm. This applies to booster seats without back rest as well. Generally, safety organizations such as the German automobile club ADAC advise strictly against the usage of booster seats without backrest, as they offer no protection at all in a side impact collision. Depending on the country, products labelled by -03 are either already prohibited or will be prohibited soon.

ECE-norm R 44/04

The ECE-norm R 44/04 was introduced in the year 2005 and the main difference to the ECE-norm R 44/03 is that manufacturers must fulfil higher safety and quality standards. Quality seat manufacturers like CYBEX have already been doing so for years and every single product is tested according to the "04" standards. When buying a new car safety seat make sure to only look for seats labelled "04".

CHILD SAFETY_GERMAN ORGANISATIONS:

ADAC

Organisation:

"**A**llgemeiner **D**eutscher **A**utomobil **C**lub", i.e. German Automobile Club. With over 16 million members it is the biggest automobile organisation in Europe. With a circulation of 14,000,000 copies their monthly magazine "ADAC Motorwelt" is the most far reaching title in Europe.

Awards:

This is the most known and important test for child restraint systems in Europe. Once or twice a year the ADAC tests car seats of each group in a crash simulation of front as well as side impacts. Front crash is tested at 64 km/h and side impacts at 50 km/h. Different sized dummies are used to simulate different age/weight groups of children. Apart from the safety aspect other criteria that determine the test result of each seat are handling & ergonomics, cleaning & workmanship as well as test for harmful substances (see more details below under "crash tests in more detail"). The ranking follows the German school grading system, i.e. "sehr gut" (very good), "gut" (good), "befriedigend" (average), "ausreichend" (bare minimum) and "mangelhaft" (poor).

The test criteria are considerably stricter than that of the ECE-R 44 norm. The data of this test is used by various automobile clubs and consumer testing organisations across Europe. Please note that even though the testing data is the same the outcome may vary as certain criteria might be interpreted differently and/or have different weight.

Test logo:

CYBEX results in the ADAC test:

Test June/2006:
Solution/Solution + are awarded "gut" (good) and came out best car seats of group II/III of that year

Test June/2008:
Solution X is awarded "gut" (good) and came out best car seat of group II/III of that year

Test June/2009:
Aton and Solution X-fix awarded “gut” (good). Aton as top infant carrier without base and Solution X-fix best Gr. II/III child seat.

Test June/2010:
Pallas and Free-fix awarded “gut” (good).

Test June/2011:
Aton awarded “gut” (good) with 1.9. Aton with belted base awarded “gut” (good) with 1.8
Pallas 2-fix awarded “gut” (good) with 1.9
Solution X2-fix awarded “gut” (good) with 1.7. Solution X2-fix with BEST MARK in Group II/III.

Stiftung Warentest

Organisation:

Germany’s leading consumer goods testing organisation founded in 1962. Their publication “test” sells over 10,000,000 titles each year. The Stiftung Warentest does not accept advertising and is partly publically financed to guarantee independence.

Awards:

Together with the ADAC this is the most recognised award with regard to child safety in Central Europe. Based on the testing data provided mainly by the ADAC the Stiftung Warentest gives out their recommendations. In the category “Safety” is made up from the individual performances in the front crash, side crash as well as safety of the seat construction and accounts for 50% of the overall test result. The second category “Handling and Ergonomics” is made up of the sub-categories misuse, comfort for the child, installation, buckling up, size/height adjustment, space for the child, seat position, user manual and cleaning/workmanship and accounts for the other 50%. Testing for harmful substances is a new category introduced in 2011, testing for Polycyclic Aromatic Hydrocarbons, softeners, phosphates, phenolic compounds, organotin compound and dystuffs. This category does not count into the overall result, however, when levels are over the legally permitted threshold the overall result will be downgraded.

The overall results are similar to the German school grades, i.e.:

- sehr gut (very good)
- gut (good)
- befriedigend (satisfactory)
- ausreichend (bare minimum)
- mangelhaft (poor)

Test logo:

CYBEX results in the Stiftung Warentest tests:

Test June/2006:
Solution+ awarded 2.1 “gut” (good). Best group II/III child restraint system

Test June/2008:
Solution X awarded 1.9 “gut” (good). Best group II/III child restraint system

Test June/2009:
Aton awarded 1.8 “gut” (good) and Solution X-fix awarded 1.8 “gut” (good). Aton test winning infant carrier without base and Solution X-fix test winner of group II/III

Test June/2010:
Pallas awarded 2.2 “gut” (good) and Free-fix awarded 2.3 “gut” (good).

Test June/2011:
Aton awarded “gut” (good) with 1.9. Aton with belted base awarded “gut” (good) with 1.8
Pallas 2-fix awarded “gut” (good) with 1.9
Solution X2-fix awarded “gut” (good) with 1.7 Named “best affordable seat in Group II/III”.

AutoBild and **Autobild.de**

Organisation:

AutoBild is Europe’s biggest car magazine with a circulation of 900,000 copies (weekly). AutoBild is published in 33 countries. Since 1995 Autobild.de is the online edition of AutoBild. Apart from publishing the magazine’s articles, they maintain an own editorial team. The most common car seats are tested by test families and the results are published in their online database.

Awards:

A) AutoBild: sporadic crash tests for selected seats
B) Autobild.de: consumer tests for most car seats which are published on the website www.autobild.de

Test logos:

CYBEX car seats:

A) Magazine 33/2005: CYBEX Solution awarded best grade “vorbildlich” (exemplary)
Magazine 09/2020: CYBEX Solution X-fix awarded best grade “vorbildlich” (exemplary)
Magazine 09/2010 : CYBEX Pallas awarded best grade “vorbildlich” (exemplary)

B) 12/2007 CYBEX Solution X awarded “sehr gut” (very good)
09/2008 CYBEX Aton awarded “sehr gut” (very good)
09/2008 CYBEX Solution X-fix awarded “sehr gut” (very good)
09/2009 CYBEX Pallas awarded “sehr gut” (very good)
12/2009 CYBEX Free-fix awarded “sehr gut” (very good)
12/2009 CYBEX Free awarded “gut” (good)
08/2010 Pallas-fix awarded “sehr gut” (very good)
05/2011 Pallas 2-fix awarded “sehr gut” (very good)
05/2011 Solution X2-fix awarded “sehr gut” (very good)

auto, motor und sport (ams)

Organisation:

This car magazine founded in 1946 (then called “das Auto”) boasts a circulation of approx. 445,500 copies. Auto Ams is published biweekly and with 2.33 million readers it is one of the most widely distributed motor titles in Europe.

Awards:

Sporadic crash tests in cooperation with the TÜV (German Technical Inspection Association). For 18 years now auto motor und sport has been testing child car seats together with the TÜV South. At the moment, the crash tests are performed on a VW Golf body. Every seat is mounted on the right backseat according to the guidelines of the manual. The crash situation is simulated at a speed of 51 km/h.

Test logo:

CYBEX car seats:

03/2010 CYBEX Solution X awarded best grade “empfehlenswert” (recommendable)

CHILD SAFETY_INTERNATIONAL ORGANISATIONS:

Which? (UK)

Organisation:

With over 50 years of history Which? is now the largest consumer body in the UK, with over 650,000 members. Which? is a completely independent consumer testing organisation.

Awards:

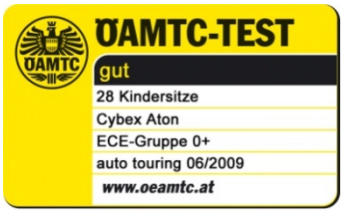
Which? “Best Buy” status is awarded to the very best products and services tested by Which? This well regarded accolade is only awarded to products or services which achieve the highest results after the rigorous comparative testing and analysis by Which?

Test logo:

ÖAMTC (Austria):

"**Ö**sterreichischer **A**utomobil-, **M**otorrad- und **T**ouring **C**lub", i.e. Austrian Automobile, Motorbike and Touring Club. With more than 1.5 million members and over 2 million readers of their magazine, Austria's biggest automobile organisation. Sister organisation of the German ADAC.

Test logo:



TCS (Switzerland):

With more than 1.6 million members the **T**ouring **C**lub **S**witzerland is the leading body with regards to assistance, road help and traffic safety in Switzerland.

Test logo:

OTHER INTERNATIONAL AWARDS:

red dot

The red dot design award is a large and coveted international product design prize awarded by the Design Zentrum Nordrhein Westfalen in Essen, Germany. The aim of the prize is to honour outstanding design quality and trendsetters. Since 1955, designers and producers can apply for the prizes with the winners being presented in an annual ceremony. Winning products are presented in the red dot design museum on the premises of the Zollverein World Cultural Heritage site in Essen.
With more than 11,000 submissions from 61 countries, the international "red dot design award" is the largest and most renowned design competition in the world.

Test logo:

CYBEX results at the red dot:

2008: Honourable mention for the Solution X
2009: Red dot design award winner for the Solution X-fix
2010: Honourable mention for the Pallas
Red dot design award winner for the Callisto travel system
Red dot design award winner for the first.GO

CRASH TESTS IN MORE DETAIL

The most renowned crash test series are those conducted by the prominent automobile clubs and consumer test organisations as well as car magazines like auto, motor und sport in cooperation with the TÜV South. In the following, the most renowned tests will be explained in more detail.

ADAC

Test results are listed in an overview table and for each seat there is a verbal evaluation detailing advantages and disadvantages for all relevant criteria available on the ADAC website. The results are displayed in five grades: “very good”, “good”, “average”, “bare minimum” and “poor”.

Which products are tested?

The ADAC only chooses new products with a considerable market presence. The aim is to choose a wide range of different types of car seats. Models tested in previous years are not tested again if there are no construction changes. Unfortunately, new or modified seats launched just a few months before the test cannot be considered, because the preparations for the crash tests take about 6 months or longer. These models are then tested in the next test.

How is the crash test conducted?

The seats are installed in the rear of an VW Golf VI chassis (until 2010 Opel Astra H). Two scenarios are tested: the front impact and the side impact. The speed in a frontal collision is exactly 64 km/h (40 mph), in a side impact collision 50 km/h (30 mph). These tests are considerably stricter than the legal threshold defined by the child safety norm ECE-R44. The critical loads are tested for each child seat using different size dummies. Also tested are the belt routing, the height adjustment, stability of the seat in the car, the head support and since 2011 the ergonomics of the child seat (space for the child, sitting position and space needed in the vehicle). Installation and static checks are conducted for each seat in a 2-door and 4-door vehicle as well as a van. Newly introduced in 2011 is a testing for harmful substances of all parts with which the child may have direct contact (covers). With reference to the GS-test “REACH” guidelines and Ökotex 100 the content of Polycyclic Aromatic Hydrocarbons, softeners, phosphates, phenolic compounds, organotin compound and dystuffs are measured and marked.

What are the test criteria?

The criteria of the ADAC fall into four categories: 1) safety, 2) handling, 3) ergonomics and 4) cleaning/workmanship (weighting is 50/40/10/0). The final grade is comprised only of the categories safety, handling and ergonomics, as they are the most important. Each of the four categories gets a group result made up of the individual evaluations. The percentage of every single evaluation can be found in the brackets:
“Safety” is comprised of front crash test at 64km/h (40%) and side impact protection at 50km/h (40%), size adjustment and belt routing (10%) as well as stability in the car (10%).
“Handling” is tested with children as well as crash test dummies using the passenger seat, side back seat and middle back seat. The category result is composed of misuse (40%), fastening and unbuckling the child (20%), installation and taking the car out of the car (20%), conversion of the car seat (10%), user manual (10%).
“Ergonomics” comprises the fastening/unbuckling on the passenger seat the side and middle back seat, if homologated for that car seat. The test are conducted with children as well as crash test dummies.

The category space in the seat accounts for 40% of the mark, space needed in the vehicle for 20%, sitting position for the child for 20% and comfort.
“Cleaning/Workmanship” is valued through subjective judgement of various experts. “Cleaning” and “Workmanship” account for 50% each.
Both “handling” and “safety” limit the overall rating – e. g. to get a “good” overall rating both, handling AND safety, must be at least “good”. A high value of harmful substances leads to a degradation of the result.

The ADAC rating system at a glance:

- to get “very good”, safety and handling have to be “very good”
- to get “good”, safety and handling have to be at least “good”
- to get “average”, safety and handling have to be at least “average”
- to get “bare minimum” safety and handling have to be at least “bare minimum”
- if safety or handling is “poor”, the seat is graded “poor” in the final evaluation

To make sure that the final mark does not distort the real results, there are downgrading effects, e. g. a “poor” frontal or side impact rating will lead to a “poor” safety rating. Seats out of all five ECE weight groups (Group 0, 0+, I, II, III) are tested. If a seat covers several weight groups, all weight groups are tested and rated separately. However, there is only one overall rating for each product, even if a seat covers more than one ECE-group. In this case, the worst result in any of the weight groups is evaluated by the ADAC. Why? A seat for several weight groups has to provide maximum protection in every group. ISOFIX seats are tested twice – with ISOFIX and without. Without ISOFIX, the three-point belt of the car is used to fasten the seat. For the final evaluation, the results of the crash test with ISOFIX are relevant, because parents buying an ISOFIX seat are usually using the seat with ISOFIX.

Stiftung Warentest

The Stiftung Warentest name stands for high quality, trust and safety. For 45 years now, one out of three Germans relies on the most important independent consumer organisation. Based on the German school grading system, about 80,000 products of almost every category are rated from “very good” to “poor”. The results are published in the organisation’s own magazine “test”, including child restraint systems. In the following you will find information about how the tests are conducted and the evaluation of the products.

Which products are chosen?

The goods are bought anonymously in retail shops in order to make sure that the test results won’t be distorted or otherwise affected. For Stiftung Warentest it is important that they are seen as being a neutral organisation. That is also the reason why they do not allow any advertising in their magazine “test”.

How do they test?

The crash tests are the same ones as of the ADAC, as they are conducted together with the ADAC and other European consumer organisations. This means that every organisation uses the same test data but use their own evaluation system, test logo, publication etc. However, even if the focus is put differently the final test results are almost the same. The organisations belong to a joint test consortium of the European Automobile Clubs and a Worldwide Association of Consumer Organisations and call themselves the European Test Consortium (ETC) for Child Restraint Systems (CRS). The ETC consists currently of 36 partners working together on the topic of child safety since 2003. They perform more than 250 crash tests and 2000 handling tests every year.

The seats are installed in the rear of an VW Golf VI chassis. The crash tests are sled tests in allusion to the Euro NCAP tests and are conducted at a speed of 64 km/h in the frontal collision. The side impact collision test is not required by the UN ECE, but conducted by the test consortium. In the side impact crash test, the cross-mounted car chassis is crashed into a fixed obstacle at 50 km/h.

What are the test criteria?

The final test result is also known as the test quality decision. The main test criteria “protection in an accident” and “handling & ergonomics” count fifty-fifty. The new criteria “testing for harmful substances” does not count into the overall result but may cause a downgrading if the measured values are over the legal limit.
The mark for each criteria is made up of the sum of various tests and evaluations. The “protection in an accident” result is based on data of crash tests. The measured values are forward displacement and deceleration of the head and the chest, as well as the risk of abdominal injuries. The values collected by the instruments installed in the dummies and by a high speed camera are recorded and evaluated.

Experts also evaluate the stability of the seat construction. Here, they test the positioning of the belt, the stability of the seat in the car and the head rest. The second main criteria “handling & ergonomics” is composed of the handling and comfort provided by the seats. This point covers the prevention of misuse tested by three experts and three non-professionals. This result is important, because only a seat mounted correctly can provide the same protection as the seat tested in the actual crash test, where the seat was installed by experts.

Furthermore, the team of experts test fastening, installation and height adjustment in different sized cars (Renault Espace, Opel Astra, Ford Fiesta), as well as the comfort for the child, user manual, cleaning and workmanship. One essential aspect is that the manual contains the necessary warnings required by the norm.

All in all, the test quality decision is an average mark of the individual test criteria, but Stiftung Warentest pays attention that serious deficiencies in the single results can be seen in the final mark as well: If this happens, the final mark will be devaluated. Devaluation means the following: A “very good” quality decision can only be achieved if protection in an accident, handling and comfort are "very good", too. If “protection in an accident” or “handling & ergonomics” is “satisfactory” or worse, the test quality decision cannot be better. Test quality decision and “protection in an accident” can only be one mark better than front or side impact collision. Test quality decision and “handling & ergonomics” can only be one mark better than “prevention of failure”. If the result for “fastening” is “bare minimum”, “handling & ergonomics” cannot be better.

auto, motor und sport

In January 2010, the crash test of the car magazine auto, motor und sport caused a sensation: For the first time in 18 years, five seats failed the test completely. The last restraint system that failed was in 2003. System failures were more common in the past, but nowadays they should not happen at all. Despite these disastrous results, the CYBEX Solution X-fix achieved outstanding results and come out one of the best seats in the test. In the following, you will see how a crash test of auto, motor und sport looks like.

How do they choose the seats?

Similar to Stiftung Warentest, the team from auto, motor und sport wants to reconstruct the circumstances of a consumer buying a safety seat in a retail shop. In particular, they are looking for new and revised seats with high relevance for the market. Sometimes, they are testing unusual (“exotic”) seats, cheap discounter seats and used child seats. However, in the case of second hand seats the previous owner and accident-free history of the seat are known. In the January 2010 test, the used seat belonged to a member of the editorial team and was without any damages.

How do they conduct the test?

Since the first crash test 18 years ago, auto, motor und sport tests child restraint systems in cooperation with the TÜV South. Since the first crash test in 1992, they have tested 154 car safety seats. The TÜV set-up looks as follows: The safety seats are installed according to the manual in the rear of a car chassis. The chassis is reinforced with long steel tubes and is fixed on a massive steel sled. The first car chassis was an Opel Astra, followed by a VW Golf IV. Since 2006, the chassis is of a VW Golf V. The

crash test simulates a frontal collision at a speed of up to 51 km/h. The frontal crash test is required by the ECE and is the minimum child restraint systems have to fulfil.

The values are measured by the sensible instruments of the test dummies and recorded by a high speed camera and two further cameras outside the car body. The high speed camera records 1,500 pictures a second and is located on a platform attached to the chassis. The car chassis is decelerated with maximum 33 g (g stands for gravity). The crash simulation is very close to a real crash. The worst case that can happen in the crash test: The restraint system fails. In this case it is no longer relevant if any of the measured test criteria are good or not.

What are the test criteria?

The measured values (Head Injury Criteria “HIC”, acceleration of head and chest, forward displacement and forces on the neck) show the risk of severe injuries in general and with regard to head, neck and chest in particular. Auto, motor und sport does not have a grading system like ADAC or Stiftung Warentest. They award the best seats the attribute “Recommendable”. Besides, there is also the attribute “Partly recommendable”.

A restraint system that fails in the crash test is automatically “Not recommendable”, even if some of the measured values were good. A system failure is for example the breakage of a seat. Indeed, smaller damages can appear on “Recommendable” seats as well, but only if they are not critical in an accident. How do they find out the damages? The seats are taken apart after every crash and checked. Smaller damages can sometimes be a positive sign, because they show that the seat has provided as much protection as possible. Apart from the crash test values also handling, installation and the risk of misuse with regards to the correct understanding of the user manual are tested.

ALL ABOUT CRASH TEST DUMMIES

The consumer organisations Stiftung Warentest and ADAC use the same type of dummies – the Q-series dummies produced by First Technology Safety Systems.
The older P-series dummies are used as well because the equivalent in the Q-series is not finished yet. As there is no Q10 up to now – “Q” stands for the new series and “10” for the age group – ADAC and Stiftung Warentest still use the P10 for example – even if the P-series disposes of less possibilities to measure the required values. The following chart shows the different dummies of the two series used in safety seat crash tests. Both, ADAC and Stiftung Warentest include front and side impact collisions.

	P-Series		Q-Series	
age		weight		weight
newborn	P0	3.4 kg	Q0	3.4 kg
9 months	P¾	9 kg	-	-
12 months	-	-	Q1	9,6 kg
18 months	P1.5	11 kg	Q1.5	11.1 kg
3 years	P3	15 kg	Q3 (Q3s)	14.5 kg
6 years	P6	22 kg	Q6 (Q6s)	22.9 kg
10 years	P10	32 kg	-	-

History of the Q-dummy family

In the late 1970's and early 1980's, TNO (Netherlands Organisation for Applied Scientific Research) and others developed the P-dummies, a series of child dummies that covers almost the complete child age range up to 12 years. The P-series dummies are still test tools for the European regulation ECE-R44 and have also been adopted by many other standards. In 1993 the International Child Dummy Working Group started with the development of the Q-series of child dummies as successor to the P-series. The 3 year old version, Q3, is the first dummy of the Q-series.

The Q3 differs considerably from the P-dummies. It is developed to be used in both front and side impact testing, making it the first “multidirectional” (child) dummy. The instrumentation for Q3 is interchangeable within the dummy and between members of the Q-series and consists among others of the newly developed, compact load cells. For the construction, X-ray information of real children was used and as far as it was possible, the constitution of a human body was copied, e.g. the imitation of the neck’s mobility. In addition, the Q3 is provided with a soft jacket, not simulating an anatomical structure but representing the combination of skin and clothing.

The P-series dummies

The construction of **P0** is different from the other child dummies: The newborn dummy comprises a head, torso, arms and legs as a single unit. The newest addition to the P-series is the **P1.5** (18 months dummy, specified for the evaluation of restraining devices in the 0+ group of ECE-R44). The P1.5 consists of a plastic skeleton covered with flesh and skin simulating plastics. Unlike the other dummies in the P-series, the P1.5 dummy contains only few metal parts.

The head of the **P¾, P3, P6** and **P10** dummies is a hollow plastic form reinforced with a steel plate frame. The torso is a steel T-shaped frame covered with foam. There is a vertical tube in the torso to accommodate the spine cable. The spine cable consists of threaded steel rods, connected by flexible steel cables. There is also an abdominal insert which is a soft open cell foam shape that fills the opening at the front of the lumbar spine between the upper torso and the lower torso.