

New maximum and overload frame tests

High static and excessive loads have been known to cause complete failures of extremely rigid, lightweight carbon designs. Together with interested partners, EFBe has therefore developed new static and overload tests aimed at reducing this risk (see Newsletter 2007-02). The new tests cover the following load conditions:

A: Drops (landing on a gentle hump, bunny hop)

B: One-sided pedal load (crank at bottom dead centre)

The two new EFBe standards focus on the maximum loads determined with test bicycles in corresponding riding situations (see Mountain BIKE 12/2007).

For two-sided pedal loads (drops) the static maximum load – taking into account the usual safety factors – is 4500 N. For one-sided pedal load this value lies at 2300 N. These load levels must not cause fracture or plastic deformation of more than 10 mm.

The maximum load test is immediately followed by an overload test, which aims to determine component behaviour in borderline misuse and accident situations. The overload forces applied during testing exceed the static maximum loads by a defined factor. Although frame fractures and deformations are permissible, the frame must not fail completely. It must retain a certain residual load capacity, which has been set at 2850 N for drops and 6000 N for one-sided pedal loads.

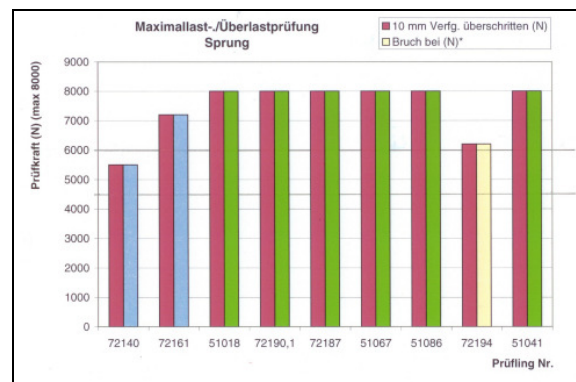
New test trailed on 22 frames

In a series of trial tests, the established requirements of the new standards were assessed for both load conditions.

A Drop scenario

The following nine frames were tested to the EFBe standard:

- 3 MTB, carbon hardtail
- 1 MTB, carbon/aluminium suspension
- 3 MTB, aluminium suspension
- 1 racing bike, carbon
- 1 trekking/city bike, steel



Notes:

- The tests were terminated at 8000 N if no frame failure occurred (green)
- For failed frames: blue = rupture, yellow = residual load capacity

As the graph shows, all frames passed the maximum load test with 4500 N.

The 6000 N overload test was failed by one frame, which ruptured and no longer had a sufficient residual load capacity after testing. The failed frame was a lightweight (1146 g) MTB carbon hardtail. But a 953 g carbon racing frame clearly demonstrated that frames weighing less than 1000 g can still be constructed to conform to the new standard.

Most of the frames tested even exhibited additional safety reserves, with six of the nine frames withstanding an applied force of as much

Bicycle Test Newsletter 2008-01

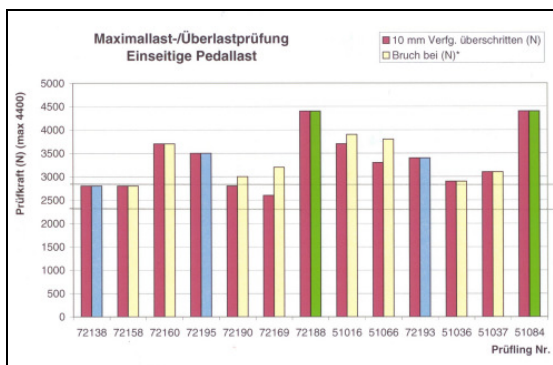
2008-01-11

much as 8000 N. However, with a (desired) permanent deformation of 0.6 to 5.9 mm, the ruptured frames exhibited only small amounts of deformation before failing.

B One-sided pedal load

Thirteen frames were tested to the EFBe standard:

- 4 MTB, carbon hardtail
- 2 MTB, carbon/aluminium suspension
- 3 MTB, aluminium suspension
- 1 racing bike, carbon
- 2 trekking/city bikes, steel
- 1 trekking/city bike, aluminium



Notes:

- The tests were terminated at 4400 N if no frame failure occurred (green)
- For failed frames: blue = rupture, yellow = residual load capacity

Here, too, all frames passed the 2300 N Static maximum load test.

In the 2850 N overload test two frames ruptured, one of which no longer had a sufficient residual load capacity after testing and therefore failed the test. The failed frame was a lightweight (1156 g) MTB carbon hardtail. Two of the thirteen frames withstood a test force of 4400 N, which shows that only few frames have large additional safety reserves here.

With a (desired) permanent deformation of 2.9 to 4.7 mm, the carbon frames exhibited only small amounts of deformation before failing,

while metal frames reached figures of 13.8 to 53.6 mm.

In addition, two Hai End 07 frames – this model was recalled due to a failure in action – were tested under identical conditions. They failed at 2400 and 2500 N respectively without residual load capacity and did not, therefore, pass the test. (The upgraded Hai End 08 model has passed however.)

Overall, the trial tests have demonstrated that the two new test standards can be used effectively to identify potentially dangerous constructions without imposing excessive constraints on legitimate lightweight design. Thanks to the following partners for their constructive support: MountainBIKE, Rotwild, Scott, Stevens, THM, Winora.

EFBe offers new services

The new maximum load and overload frame tests are available now as part of EFBe's standard testing service:

Drop load test	EUR 220
One-sided pedal load test	EUR 220

We recommend these tests in addition to the three fatigue tests that together make up the Full Test, especially for frames whose load-bearing parts are entirely or partly carbon fibre. The complete Full Carbon Frame Test therefore consists of five individual tests and is available at the special price of EUR 1220.

New rules for carbon frame certificates

Until now, EFBe certificates and test seals were issued based on fatigue testing and contributed to reducing the risk of fatigue failure. This is especially relevant for metal components.

Bicycle Test Newsletter 2008-01

2008-01-11

In response to our partners' wishes, we have decided to extend EFBe certification to include brittle fracture testing of carbon frames as of 2008/2009.

As of 1 January 2008, carbon frames must pass the two new maximum load and overload tests in addition to the three existing fatigue tests to be awarded an EFBe certificate (i.e. the "Full Test Carbon"). These changes do not affect frames without load-bearing carbon fibre parts.

Up-to-date statistics for frame tests

For an objective assessment of EFBe test results, it is helpful to know EFBe's complete test results. The table below gives an overview of fatigue tests grouped by frame type and performance level. It shows the percentage of passed tests for the total number of tests in each category (based on 147 Full Tests).

Data for categories in which fewer than ten tests were carried out are not included. Note that these figures, while providing guidance, are not representative.

	MTB	Race	Trekk./City
TP	61	56	-
HP	64	58	86
SP	-	55	-

Statistics: passed Full Tests - % of all Full Tests
(Reading 2008-01-01)

For the rigidity tests, all bicycle types were summarized in the analysis. The following tables show the percentage distribution of all measured frame rigidity values, with grades given from 1 to 5 as introduced in the Newsletter of 16 February 2006. They are based on 156 Track rigidity tests and 153 Out-of-saddle rigidity tests. Here, too, the figures are not representative.

Grade	1	2	3	4	5	Σ
Track stiffness ≥ (N/mm)	10	8	6,5	5	0	
%	7	24	29	29	11	100

Statistics: Frame track stiffness test
(Reading 2008-01-01)

Grade	1	2	3	4	5	Σ
Out-of-sad- dle stiffn. ≥ (N/mm)	150	120	100	80	0	
%	15	9	31	35	10	100

Statistics: Frame out-of-saddle stiffness test
(Reading 2008-01-01)