

Cherry BX-2 / Increasing the MTOW to 600 kg

Origin:

Following a request from the British PFA (Popular Flying Association), the calculations for the plane were reviewed. The originally estimated lift distribution had been very conservative, not considering any lift of the fuselage. However, practice has shown a lower stall-speed which is a consequence of the lift provided by the fuselage because the max. C_a -value is given. Hence, the wing has to carry fewer loads. With this understanding the lift-structure was re-calculated in 1999.

Documentation:

The re-calculation dated 1999 is shown in the following sheets:
(not attached)

- 5.1 A Lift distribution
- 5.2 A Shear and bending
- 5.5 A Outer wing stub
- 5.5 B, C Center front spar half

Comparison old / new:

For position B (main wing-bolt):	old	new	Factor
Spar – torsion-momentum mkg	837	700	1,20
Spar – cross-force kg	809	652	1.24
Wing bolt-load F2 kg	3200	2652	1,21

Following the new calculations a wing of a defect Cherry was load-tested up to destruction. The wing was tested with the new load plan (for the load test) dated Nov 1999 up to 6 g. Then an additional hydraulic load was applied, when - at 9g - the end of the wing suddenly yielded for 10 cm still carrying the 6g load.

Result:

The load of the structure is actually 20 % less than originally expected.

**Increasing the MTOW to 600 kg = 9 % can be permitted for the wing.
The original load-plan D 131 dated 1985 is still valid.**

Additionally affected elements:

Landing gear:

Load tests for the landing gear were required in Austria. These tests need to be repeated with 9 % more load. The landing gear should be inspected carefully prior to testing. A note in the AFM should remind that extended and fast taxiing could cause the tires to overheat.

CG (center of gravity):

The increased MTOW may be used for a heavier engine or more useful load (luggage...). For the MTOW of 600 kg the CG-area remains at $X = 0,26$ to $0,42$ m. An exact check of the situation – with full and empty tank – is essential.

Speed:

Permitted-speeds are depending on the load of the wing-area. The wing-area load increases from 65 to 70 kg/m². In theory the values increase only by the square-root, which means 4 %. Nevertheless, the AFM and the instrument markings are to be changed according to the table „Envelope 1999“ (supplement # 9). The v-n diagram remains valid, which is a deviation adding safety. Maneuver-speed (V_a) is set to 170 km/h = 92 kts.

Flight characteristics:

At flight with higher loads no changes in terms of stability and stall-characteristics could be felt. Special test-flights are not necessary for this reason.

30 Aug. 06

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Note:

Using the improved landing gear-, lever-arm- and bracket-variants (latest drawing-index) seems to be appropriate for the increased MTOW.

21 March 2010 Wolfgang Spang