



Hints on Flying the Pilatus B4

This is an English summary of Jochen Reuter's paper, published on the SAGA-website www.sagach.ch

I could not resist adding a few hints of my own, where I saw it appropriate. But overall, it is still Jochen's text.

And I was too lazy to convert any units of measurement from metric to English. If you prefer to go by knots and pounds etc. you will have to juggle the units yourself.

General Remarks

Any pilot, who is new to the B4 will notice that it is a "noisy" glider. The "blonk-blonk" of the skin panels can upset a novice, but after a few flights you get used to it and before long you'll ignore it.

Jochen's B4 came from the UK and a previous owner had apparently tried to turn it into a high-performance machine. All the skin joints and rivet heads had been covered and smoothed. But if you intend to do aerobatics, this is not a good idea at all. Apart from the additional weight and lots of useless work, the putty becomes brittle with time and when the structure is flexing, will crack and eventually peel off.

Talking about C of G: Jochen is very tall and weighs around 100 kg. So he flies at the load limit and also the forward CG limit. Earlier, he used to fly with the small tail ballast weight (2.3 kg), mainly to facilitate spinning, but now he recommends even for heavy pilots not to. In his opinion, the B4 handles better with a forward CG.

I am somewhat lighter, ca. 80 kg with parachute, and SAGA's B4 which has an authorised load range of 55 to 104 kg handles ideally at my weight.

The trim should be set nose-down for aerobatics. Hands-off speed should be around 150 km/h. This way you do not need so much down elevator in most manoeuvres.

It may be a good idea, before you start with aerobatics, to check and adjust the control deflections. Find someone who is capable and authorised to do it. Particularly the ailerons should be adjusted to the very limits. You can use every single degree of aileron deflection for better rollrate.

If you want to do aerobatics seriously, aiming-sticks on the wingtips are a MUST. Without, you are unable to judge your attitude accurately. The sticks should be aligned parallel to the longitudinal axis, not to the zero-lift axis. If you fly the B4 with the zero-lift axis vertical, the nose points nearly 10° forward on the way up and back on the way down. In principle, aerobatic judges must take this into account, but in practise THEY DON'T!
Also put strings on your aiming sticks. In a tailslide, they are the best indicators when to pull back or push forward.

If you want to try flicks, please be gentle! The version PC11 AF has a strengthened rear fuselage and is certified to do flicks. Nevertheless, keep in mind that all our B4s are at least 36 years old (as long as they were not produced in Japan). The structure does not get any stronger with time and the torsional loads on the rear fuselage are considerable in flicks.

Entry Speeds and Operating Limits

In general, you can fly practically all the manoeuvres with the speeds you are used to from the ASK 21. But in a normal Advanced sequence, you will not have any height problems with the B4, so Jochen recommends to fly a bit faster. 190 km/h should do.

The main weaknesses of the B4 are its low V_{NE} of 240 km/h and V_A of 163 km/h. This becomes most critical in vertical down-lines. It is impossible to stabilise the down-line for any length of time without coming out at or near the redline. Be extra careful never to go into a vertical down-line from too high an airspeed.

The low V_A in my opinion is not so much of a problem. As long as you remember to be easy on the elevator in pullouts from high speed, you are not likely to overstress the airframe.

True, torsional loads on the wings from aileron deflection increase by the square of the speed. On the other hand, you can't avoid exceeding the V_A with full aileron deflection, if you want to fly figures, which are required in today's Advanced competitions.

But under any circumstances avoid to apply large aileron inputs while pulling g at the same time. The resulting torsional loads add to the bending loads and may well overstress the wings.

Individual Figures

All entry speeds are 190 km/h, unless stated otherwise.

Loops

Pullup no more than 4 g. Over the top release back pressure not before the nose touches the horizon. Then let it go "ballistic" till the nose points down 30-40°. Seat pressure should remain positive at a fraction of one g over the top.

On the way down, avoid pulling too early or too hard. Otherwise, you end up with a "9" instead of a nice, round loop.

Aileron Rolls

Main problem is the B4's relatively sluggish roll rate; but if you are used to the ASK 21, it may still appear quick to you.

Never roll with lots of top rudder! Particularly in the second knife-edge, if you apply too much top rudder, the airflow over the vertical tail may stall and the B4 falls out of the figure doing a funny kind of wobble. It's not dangerous, but it looks awful.

We found that rolls look best with neutral rudder all the way.

It is not necessary to lift the nose over the horizon for the start of the roll, but beginning in the first knife-edge, the direction must be maintained with down elevator and the nose must be pushed a few degrees above the horizon in the inverted position. Maintain the down elevator into the second knife-edge. Otherwise, you will turn away from the direction of roll in the final

quarter. The correct dosage of elevator control is the secret to good-looking rolls in the B4 and can only be learned with lots of practise.

Two-Point-Rolls

Fly it like the full aileron roll; just stop it in the inverted. Don't forget to push the nose above the horizon in the inverted stop. The greatest difficulty is again the correct application of down elevator, to avoid a "corkscrew" in the second half of the roll. Practise, practise, practise...

Four-Point Rolls

Due to the slow rollrate, the stops must be long enough to be clearly recognisable. Contrary to the full aileron roll, the nose should be raised a little before the start of the four-point, but don't overdo it.

Do not use top rudder in the knife-edge stops! Correct for the nose-drop by deliberately raising the nose in the inverted stop.

When you plan your Free sequence, don't do a full four-point! It'll take forever and you'll need the entire length of the box.

Superslow Roll

Quite difficult!

Practise counting the seconds, this helps keeping the rollrate constant.

I use much the same technique as for a roll with the ASK 21 (which takes at least 12 sec.). Start with the nose above the horizon. Keep the nose up with elevator till you approach the knife-edge. In the first knife-edge, start pushing the nose "out" and up. In the inverted it must be markedly above the horizon. Maintain down elevator into the second knife-edge to control the direction. In the last quarter (past the second knife-edge), I apply some top rudder (gently!) to keep it from turning away as I come out of the roll. Again, proper elevator control is the secret!

Stall Turns

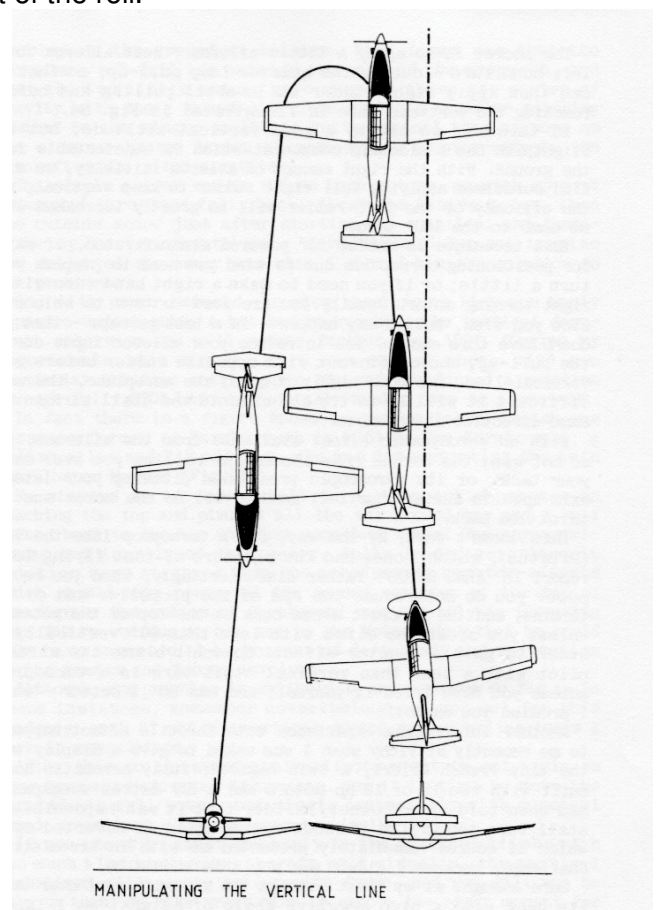
Nice to fly; looking very good, but only with the right technique...

In German we call it "Vorspannen" = tensioning. I am not quite sure that you are familiar with it.

The trick is to establish a slight sideslip on the vertical up-line in the direction you want to turn. Look at the inside wingtip before you start the pullup. Then, you can either dip the inside wing a FEW degrees before pulling or apply some aileron in the direction of turn during the pullup. Going up vertically, you must then use opposite rudder to keep the inside wingtip on the horizon. As speed decreases, opposite rudder deflection is increased up to the point where you apply full rudder in the direction of turn.

This drawing of another Pilatus aircraft illustrates it. I took it from the book "Flight Unlimited" by famous Swiss aerobatic pilot Eric Mueller.

Due to it's high-lift airfoil, the B4 wants to raise the nose during the turnaround. You must counteract with some down elevator.



On the way down it may be necessary to push again in order to stay vertical, but again, don't overdo it.

Tailslices

Canopy-up tailslices are more tricky in the B4 than canopy-down. The obvious reason is the difference of nearly ten degrees between longitudinal axis and zero-lift axis. From an exactly vertical attitude, the B4 MUST tip over backwards, because the zero-lift axis is inclined about ten degrees back.

Therefore, for a canopy-up tailslice, use no more than about 80° nose-up. Jochen writes, his limit is exactly 84°; 85° is already too much. But as a beginner, you'll never be able to control your vertical attitude as exactly...

This is how it's done (canopy-up):

First, establish a wings-level glide at 200km/h, yaw-string centered. If you take your feet off the pedals for a moment, the rudder streamlines and there is no more yaw.

Both hands on the stick, looking at the horizon start a pullup with not more than 4 g. Maintain wings level by reference to the horizon. When the horizon disappears, look at a wingtip and stop the pullup short of the vertical (the ominous 80°). Stabilise this attitude and hold the wings horizontal, till the glider stops. In this attitude, your zero-lift-axis is nearly vertical and when the glider starts to slide, you can control the slide to tip over forward. Watch the string on your aiming stick and pull all the way back when the string goes forward; not before! With its short fuselage, the B4 tips over very quickly and the slide is hard to see. But for the judges it should still be easier than judging a tailslice by a Pitts...

With the nose pointing down again, neutralise the elevator. There will be some pendulum before the glider goes into the dive. Allow it to stop by itself. Then establish the vertical down-line and stabilise it for a moment before you pull out.

Canopy-down tailslices are much easier. All the preliminaries are the same, except that you stabilise the up-line at exactly 90°. When the string at the wingtip goes forward, push all the way. But it should work just as well, if you hold the stick neutral.

And all this said, when it comes to composing your Free, by all means use a canopy-down tailslice.

Humpties

Recommended entry speed 220 km/h. Pull up with around 5 g and stabilise the vertical. It takes some experimenting to find the correct IAS when to pull or push. Airspeed indicators always have some lag and it differs from one instrument to the other. Obviously, you need more speed to push than to pull over at the top. Fortunately, the B4 has no tendency to stall, neither upright nor inverted, as long as there is no significant yaw involved. Go over the top as slowly as possible. All it takes is the right amount of pull or push, then you can leave the elevator neutral and rely on ballistics. This way the half loop over the top has the minimum radius. As soon as the nose starts to point down again, increase elevator pressure, in order to maintain a constant radius.

Half Roll 45° up with 5/8th Loop down (reverse half Cuban)

With the slow rollrate of the B4 this is really difficult and takes lots of practise. Start with 30° up-lines and as you gain confidence you can increase the angle.

Entry speed at least 220 km/h. Starting with higher speeds is possible, but keep in mind that you have to be gentle on the elevator. Again, it's a matter of practise.

Pull up briskly, stabilise the line and immediately start the roll; you have no time to lose! In the knife-edge, use some, but not too much top rudder to keep the nose up and avoid turning out of direction. In the latter part of the roll you will need some forward stick to keep the nose from dropping and the top rudder helps you to maintain direction. Stop wings level inverted,

rudder neutral and let the nose drop by itself. You'll be very slow, so be very gentle on the elevator. Pulling down produces an ugly "kink" in your flightpath. When the nose points 30-40° down inverted, start to pull progressively to round out the loop.

Half Rolls 45° down (Cubans and half Cubans)

Again, the slow rollrate of the B4 and the low V_{NE} are the problem. For the beginner, I recommend to do 30° down to start with.

Start the down-line from as low an airspeed as possible. Stabilise the down-line and immediately start the roll. In the knife-edge use a bit top rudder and down elevator to maintain direction. Do not start to pull in the latter part of the roll, or you will turn away opposite to the direction of roll. Start the pullout immediately when you reach wings level. If it's a half Cuban, stay level for the next figure; if you do a full Cuban, pull up into the 3/4 loop. In the full Cuban, be careful to go over the top of the second loop at minimum speed, otherwise you'll end up too fast for the next half roll 45 down.

Half Loop with half Roll off the Top (Immelmann)

Entry speed at least 220 km/h, a little more doesn't hurt.

Pull up with about 5 g till the nose is a few degrees above the horizon inverted. Stop the loop by pushing the stick deliberately forward. Immediately start the roll and use SOME top rudder, in order to maintain direction and keep the nose from dropping too much.

The most common error is to hold back stick when starting the roll. This makes the nose drop and the roll goes badly out of direction.

Inverted Flight

The B4 behaves very well inverted. There is no tendency to stall down to an airspeed of 100 km/h. The optimum speed for straight flight is around 130 km/h. Depending on CG, considerable forward stick is needed to maintain pitch attitude and airspeed.

Inverted turns are best flown with at least 140-150 km/h. First establish the desired bank with aileron only. At these speeds, there is no adverse yaw and you need no rudder. To start the turn, you must push the nose along the horizon. Without a lot of forward stick, the B4 just continues straight ahead.

Whenever things do not look right whilst inverted, don't experiment! Simply move the stick towards the sky! This returns you most quickly to upright flight.

Spins

Except with extreme rearward CG the B4 has no tendency to spin on its own. With normal or forward CG it must be forced into the spin.

There are different techniques to enter the spin. In competition aerobatics, it is important that the nose does not rise during spin entry. Ideally, nose and wingtip should drop simultaneously. Jochen recommends to go straight ahead slowing gradually to stall speed and as soon as the nose drops, to go full rudder into the spin and stick all the way back simultaneously. Then, immediately apply full pro-spin aileron.

With a forward CG, the B4 will immediately stop spinning when back stick or aileron are reduced by the slightest amount.

My own technique (medium weight) is a little different: I found that our B4 is reluctant to enter the spin from a full stall. Just above the stall speed (ca. 65 km/h IAS), I kick full rudder and when the nose swings to the side, I gently pull back and apply full aileron.

The disadvantage of this method: If you are still a bit too fast, the entry looks like a flick, and the judges will zero the figure!

Very light pilots may not need the full aileron to stay in the spin.

Recovery is very simple: Opposite rudder and stick neutral. As soon as the rotation stops, rudder neutral.

In competition, you must show a vertical downline after the spin before pulling out. So the stick must be pushed forward of neutral to go into vertical.

At pilots' weights of less than ca. 65 kg, the B4 may not stop spinning accurately by this procedure. I recommend to release the back stick a little half a turn before the intended stop and to apply opposite rudder and full forward stick simultaneously about 30° before the desired direction.

And one more trick: In an aerobatic sequence, when you have to enter a spin and you are still going too fast, do not hesitate to open the airbrakes. Bring them back in just before reaching stall speed.

Quarter Rolls on vertical Down-Lines

A real problem, but if you want to compete in Advanced, you must face it.

Again, it is imperative to start the downline from as low an airspeed as possible. Coming out of a stall turn, tailslide or humpty, with a little experience, this should not be too difficult. If the preceding manoeuvre, however, was a P-loop, you're in trouble!

Some pilots, mainly those who do not know the B4 well, recommend to do rolls vertically down with the airbrakes out.

I know some top pilots who do it. But it is difficult to do correctly and it takes lots of practise. Unlike the ASK 21, the B4 has, to the best of my knowledge, no restriction on positive g with the airbrakes out. But nevertheless, I would never pull more than 4 g with airbrakes out. The airbrakes produce a "dip" in the spanwise lift distribution and excessive local bending loads may result, when high-g are applied in this condition.

This means that whenever airbrakes are used to keep the speed within limits, they must be in and locked before pulling out.

Fortunately, the B4 can be rolled with full aileron without any unwanted effects, except naturally, that the V_A may be exceeded in these manoeuvres.

Also, with some practise, it is possible to use the rudder to speed the rollrate a little. But it takes some experience to do it right. If it's overdone, a "corkscrew" will be the result.

Closing Remarks

For today's pilots, used to modern high-performance gliders, the B4 may look outdated and it takes some effort to become familiar with its handling. But once you have mastered it, you will have lots of fun with this gentle oldtimer.

For competition aerobatics today there are certainly better gliders. But with some experience and training it is still possible to compete successfully, simply because you are the better pilot!

Translation: Manfred Echter, Jan. 2014