Operating and installation instructions for the VL3- radiator flap

Discription:

In order to ensure sufficient cooling capacity at high temperatures and performance requirements, both the oil cooler and the water cooler of the Rotax engine are quite large.

With cooler temperatures in winter or with flights at higher altitudes, however, there are disadvantages, especially if you are, like most of the time, in an economical cruise.

Often the oil temperature is then below 70 degrees and the cooling water temperature also drops below the optimal values. It becomes particularly problematic on steep descents from great heights when the engine has to be throttled down completely in order not to become too fast.

The engine can cool down to such an extent that the temperature falls below the minimum operating temperature. Measures such as partially masking the water cooler are very unsatisfactory, as nothing can be changed in flight. It does not work at all with the oil cooler, as you need full cooling capacity for long climbs in any case.

For this reason I made a swiveling flap that is adapted to the oval air inlet of the VL3-Cowling. The flap can be pivoted 90 degrees from a horizontal position using a Bowden cable so that the incoming cooling air can be throttled.

This means that in flight you have the option of influencing the operating temperature individually according to the circumstances. By closing the flap when starting and warming up the engine, the warm-up phase can also be shortened. You will find more detailed operating instructions and recommendations for using the flap at the end of the manual (please read carefully)!

Installation procedure:

Installation does not require any special skills. A little manual skill and technical understanding is sufficient and should actually be automatically given by all pilots.

The installation time should take between 2 and 3 hours if you do it conscientious and for the first time.

For a better understanding, I recommend reading through the complete instructions first and then going through each step again during the actual installation work.

The following tools are required:

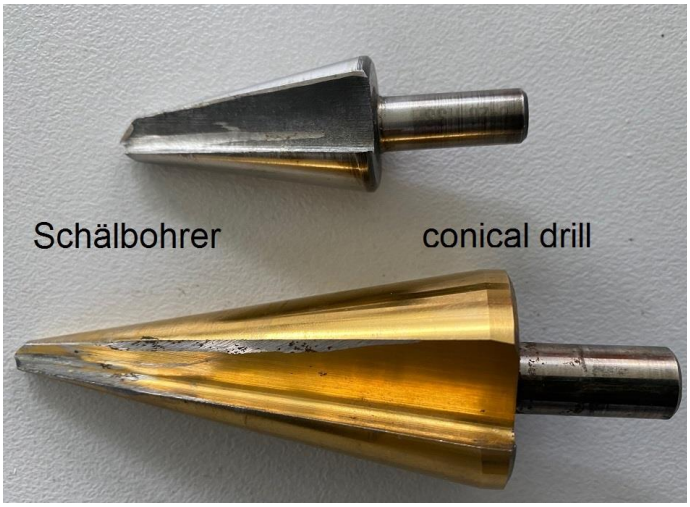
Allen screwdriver 1.5 / 2.5 (without ball head tip)

Rechargeable drilling machine

Drill 2mm / 2.5mm / 3mm / 4mm / 6mm

A Dremel or a Proxxon with a small grinding or burr would be good (a small round file will also do it if necessary)

It would be perfect if you still have a conical drill that covers an area up to at least 16mm in diameter (see picture on the right).



Sanding block with 60 or 80 paper

Screw lock we e.g. Loctite medium strength

Phillips screwdriver

2 Socket wrenche tubes 17 and 19mm


socket wrench tube

Black felt pen

flashlight

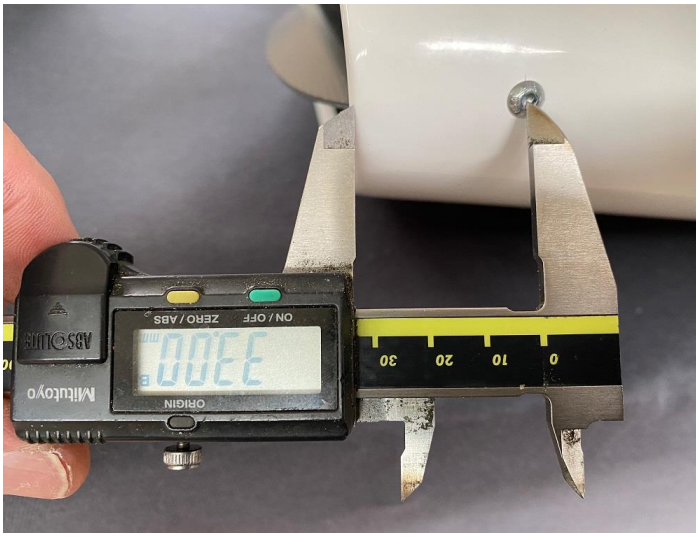
It makes sense to work through the sequence described below, otherwise it could be difficult ☺

First the cowling (upper and lower part) of the VL3 must be removed. Before unscrewing the lower part, loosen the hose clamp that attaches the hose for the fresh air supply to the NACA inlet. In addition, the 4 cable ties that attach the carbon support that hold the oil and water cooler must be cut below. A flashlight is attached here, as you can see next to nothing in the black cowling below.

To remove the lower cowling, it is advisable to get someone to help, because it is a bit difficult to hold it alone on both sides at the same time. It also requires a bit of skill to get this down in the front of the propeller area, as it collides with the slip ring of the variable-pitch propeller on one side and the mechanical fuel pump on the other. But it works if you spread them a little apart and first turn them down on the side of the fuel pump.

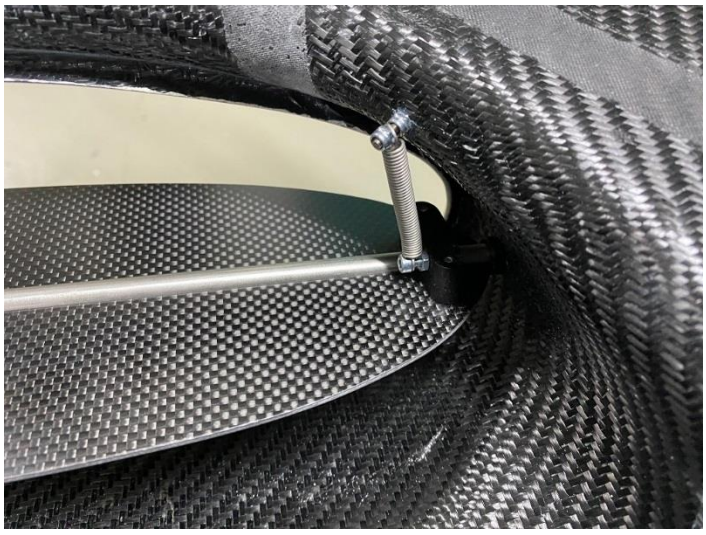
Installation of the swivel flap in the lower cowling:

The first thing to do is to mount the flap with the flap axis in the oval inlet area of the lower cowling. To do this, drill a 4mm hole in the side of the wall in the middle of the oval rounding at a distance of 33mm (see picture).



It makes sense to mark the hole exactly beforehand and, if necessary, to punch something in with a pointed object. You can also pre-drill the hole with a small 2mm drill, so that you have the opportunity to rework the position with a needle file. It should be absolutely avoided that the drill drift away and the holes are not in the same position on both sides. If there is an offset in height, it is better if it tends to be a little higher than lower. You can also temporarily slide the flap into the cowling from behind and swivel it vertically so that a small gap remains between the lower edge of the flap and the cowling. If you now look closely at the oval inlet opening from the front, you can better determine the height position of the screw holes.

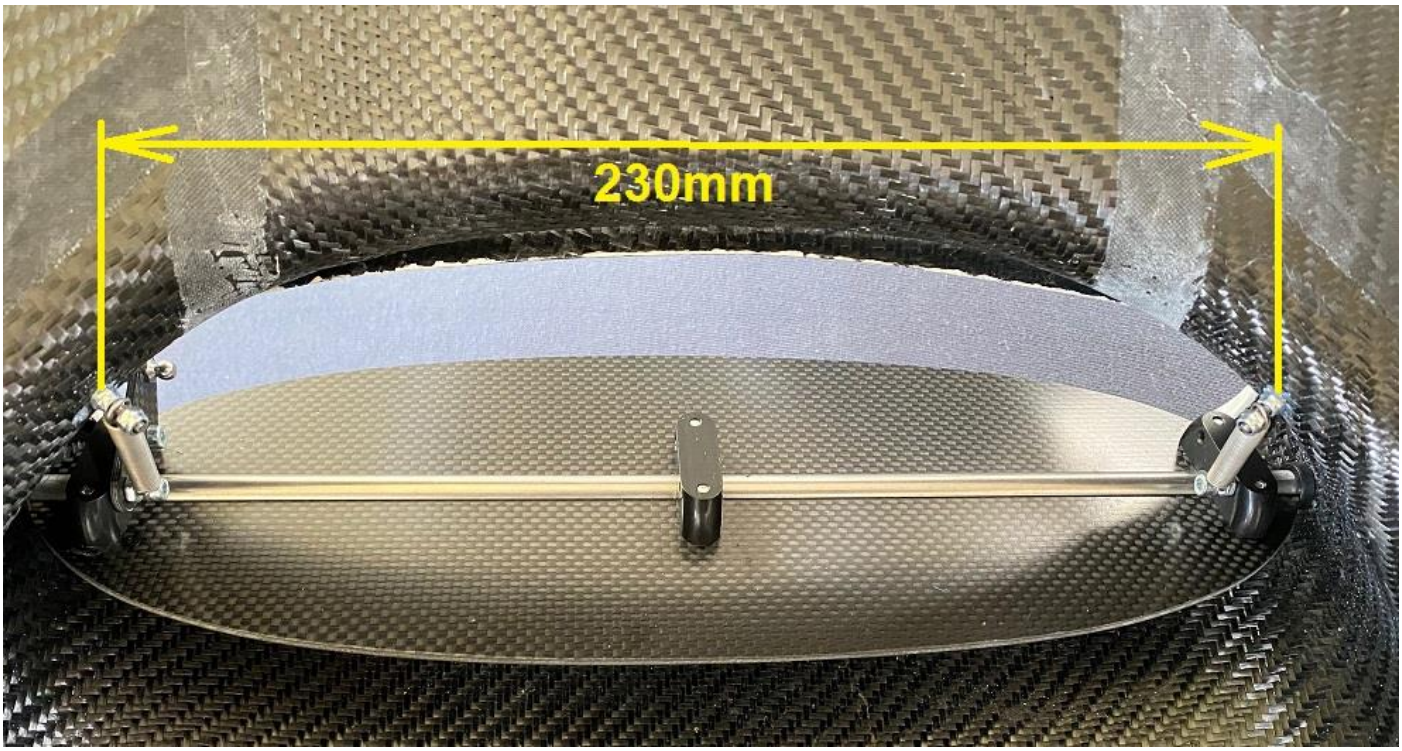
After drilling the holes slide the flap with the axle from behind into the cowling so that the pivot lever for the Bowden cable is on the left side when viewed in the direction of flight (first remove the two M4 lense head screws from the loosely inserted axle holders). If the axle cannot be pushed all the way to the front so that the bores coincide with the M4 threads, the aluminum axle can be filed down a little on one of the two end faces. To do this, pull out the loosely inserted axle holder beforehand (file off a maximum of 1mm).



If the axis still has some lateral play when it is pushed in, it does not matter, as the axis holders pull apart when the screws are tightened. The screws are not tightened at first, just screwed in a little loosely to test whether the lower flap side collides with the bottom of the cowling inlet when it is swiveled 90 degrees from the horizontal position so that the Bowden cable lever points backwards. In this case, the edge of the lower half of the flap is sanded down until it no longer jams.

If everything fits, the axis is fastened with the two M4 lense head screws. Secure the screws with a little Loctite and tighten them well. If the axle holder rotates when you tighten it, you can hold it with a 3mm thick pin (or drill) in the hole provided on the side. To do this, turn the hole backwards so that the pin can be positioned properly.

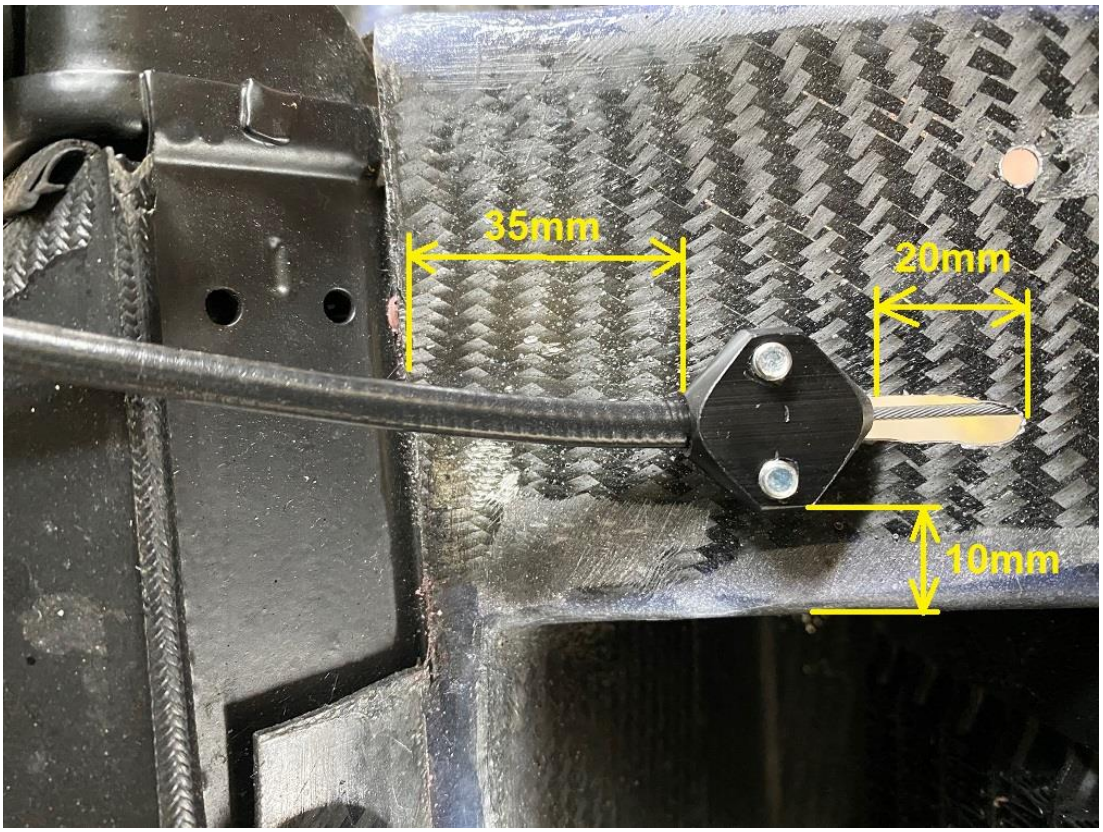
Now the two 2,5mm holes for the screws for hanging in the springs has to be drilled in the middle of the constriction of the cowling (see picture below and also the picture from the outside on the previous page top left).



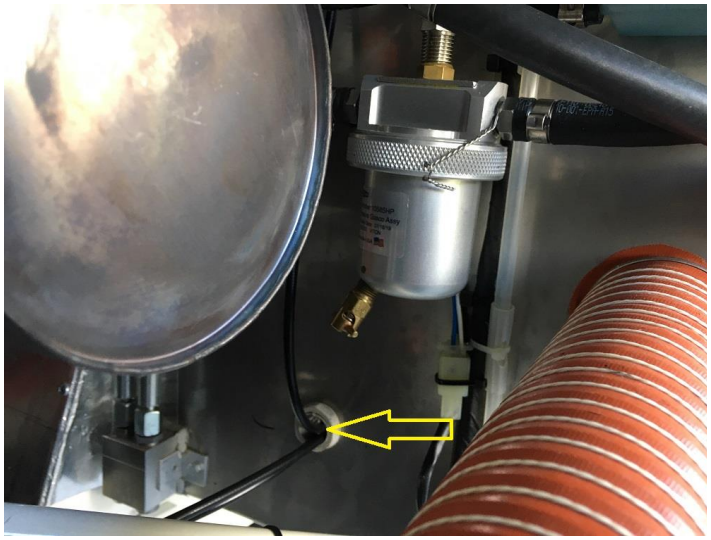
The distance between the screw holes should be 230mm, making sure that they are symmetrical to the center line on the left and right of the inlet opening. The M2.5x12 phillips-head screws are inserted through the hole from the outside and locked from the inside with an M2.5 lock nut so that they are firmly in place. Then the upper eye of the spring is pushed onto the screw and secured against slipping down with the second M2.5 lock nut. The nut is screwed on until the face of the screw is flush with the nut, so that the blue locking insert of the nut engages.

In the next step, the small plastic block is attached to the carbon support part that contains the cooler (see picture).

The plastic block serves as a counter holder for the Bowden cable sleeve. The distance to the rear edge and the right side edge are showed on the picture below. Here it is not down to the millimeter that counts. It is only important that the block is attached so that the side which is labelled with the white cross looks down and that the flatter side with the small hole looks forward.



For fastening, two 4mm holes are drilled at a distance of 12mm so that the block can be fastened from below with the two M4 pan head screws. Then an elongated hole must be made in the thin carbon plate immediately in front of the block where the small hole is. You can either pre-drill a few holes in a row with a 3mm drill and then make an approx. 20mm long slot out of them with a round file, or you can use a Dremel grinder. This basically completes the work on the front of the cowling.



Now insert the black Bowden cable sleeve from the front through the hole in the fire bulkhead (yellow arrow - picture on the right), where the cable for the heating valve also comes out. The silicone may have to be pricked or drilled a little with a 6mm drill.

The front end of the cover is now guided directly over the upper edge of the water cooler to the previously installed block and pushed into the rear hole as far as it will go (picture on the left).

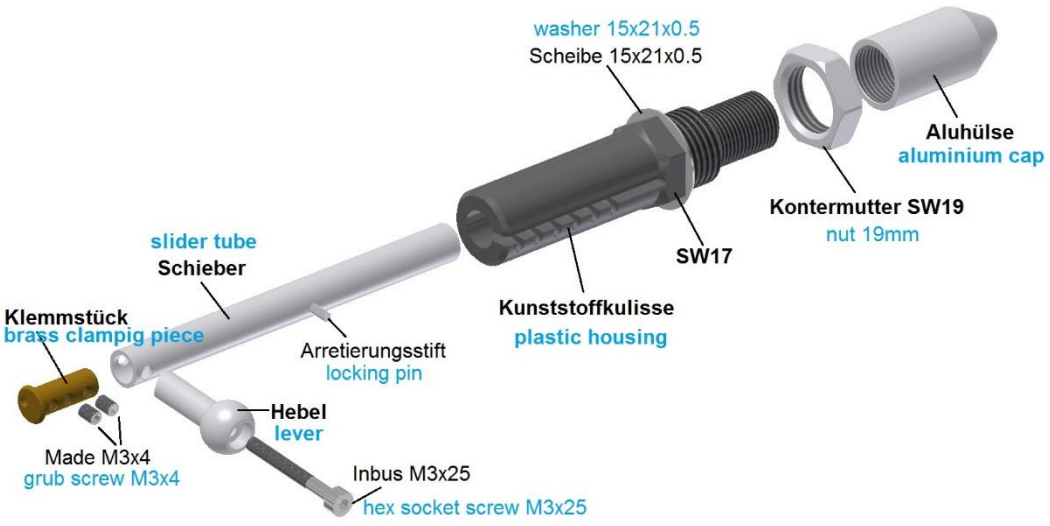
Then the prepared steel core is inserted from below through the slot into the small front hole and pushed into the Bowden cable sleeve. The brass connector with the plastic ball joint should still look out half a meter from the front.

Now mount the lower cowling back on the fuselage. Make sure that the end of the steel wire with the ball-and-socket joint is passed in the right way to the front through the oval inlet opening above the flap between the spring and the lever of the flap when the cowling is put on.

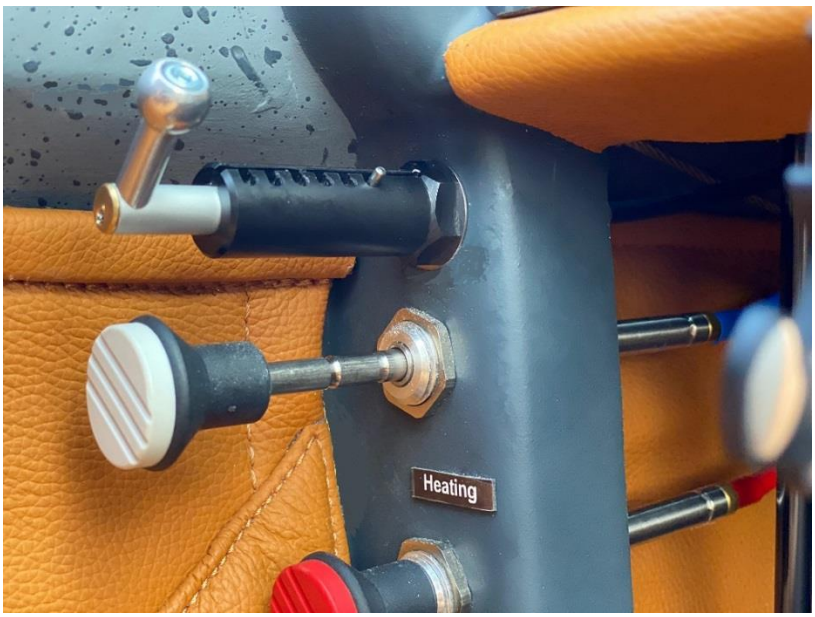
Attention! the ball joint is not yet clipped onto the ball pin. When putting on the cowling, make sure that the cooler holder is positioned between the mounting brackets and not on top.

First attach the cowling to the fuselage with all 8 screws on both sides and then align the radiator support so that 4 new cable ties fit through the eyelets. Most of the time, it has to be pushed a little forward. Make sure that the Bowden cable sleeve is pulled forward accordingly.

Attachment of the pull control lever in the cockpit:

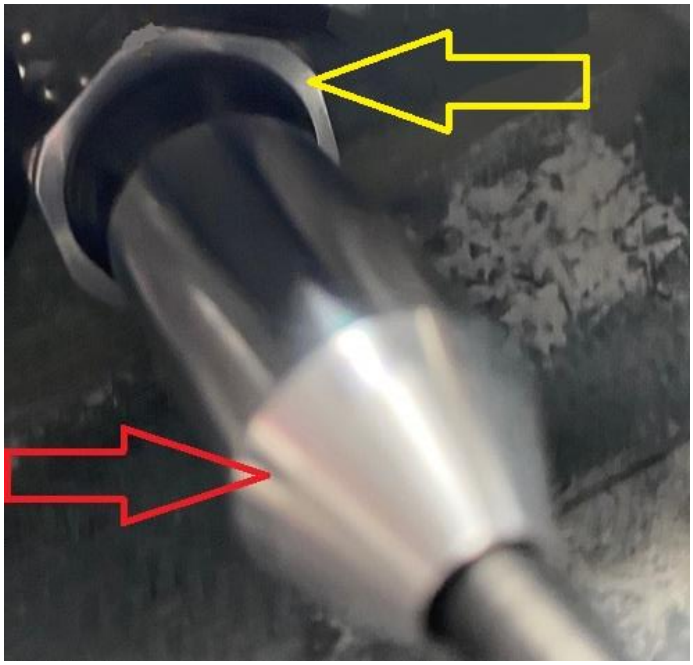


An ideal place is where the two control cables for heating and fresh air supply are already attached. The space there is very limited, but at least with my VL3 it was enough if you make sure that the lock nut on the backside does not collide with the side wall of the mounting console (see pictures below). The picture shows the lever in the locked position (first of six possible levels).



One problem could be the limited space for the 19mm nut on the back of the console (see picture below - yellow arrow). Therefore, drill a smaller hole first and hold the nut centrally against the hole from behind to see whether the hole needs to be corrected laterally or vertically.

Attention! A socket wrench tube should also fit on the nut.



If, for whatever reason, the distribution or the spacing of the existing pulling controls is so unfavorable that there is no additional space, you can easily build a small mounting plate, which you fix under the actual mounting bracket so that the operating lever is just below it.

The red arrow shows the aluminum cap for later fine adjustment of the Bowden cable. It is first unscrewed completely.

Drill a 15mm hole at the corresponding point on the small Bowden cable console.

Attention! Do not use a 15mm drill, as this will suddenly pull itself into the thin material when drilling through and may tear it. So-called conical drills, which are conical and allow any diameter to be made without the risk of being drawn into the material, are ideally suited for such holes in thin materials.

If something like this is not available or can be obtained quickly, the hole can also be pre-drilled in a circle with smaller holes and the further elaboration done with a round file or a Dremel.

First, the slider tube is pulled out of the plastic housing and the aluminum cap for fine adjustment of the Bowden cable tension is unscrewed.

The plastic housing is inserted into the prepared hole from the front, with the thin washer also coming into the front. The aluminum nut (wrench size 19) is screwed on from behind and carefully tightened. A socket wrench tube is suitable for this.

The plastic housing has a hexagon with a wrench size of 17mm to hold on. Alignment should be so that the slot with the grid gaps points upwards (it tends to be swiveled approx. 10 degrees to the right). The lever of the slider tube must not hit the canopy frame when moving in the slot. Then the aluminum cap is screwed back on from behind.

First screw the cap on as far as it will go and then screw it off again approx. 6 turns (attach a felt-tip marker to count). In any case, the slide must be able to be pushed in until the locking pin can rest against the end of the guide slot at the very back.

Now the Bowden cable sleeve protruding into the footwell is laid so that it does not interfere with the feet or the rudder pedals anywhere. It must not be kinked sharply behind the passage in the bulkhead either. I put it in a slight curve behind the left ventilation hose so that you don't touch it with your feet if you put your feet under the pedals. This is a job for small, flexible people who somehow manage to get into the narrow space down there ☺

Then it is laid on the side of the wall together with the other cables for fresh air and heating. The length of the Bowden cable sleeve should roughly fit. By enlarging the arch, you can lay the flooring so that the end extends to the hole in the aluminum cap.

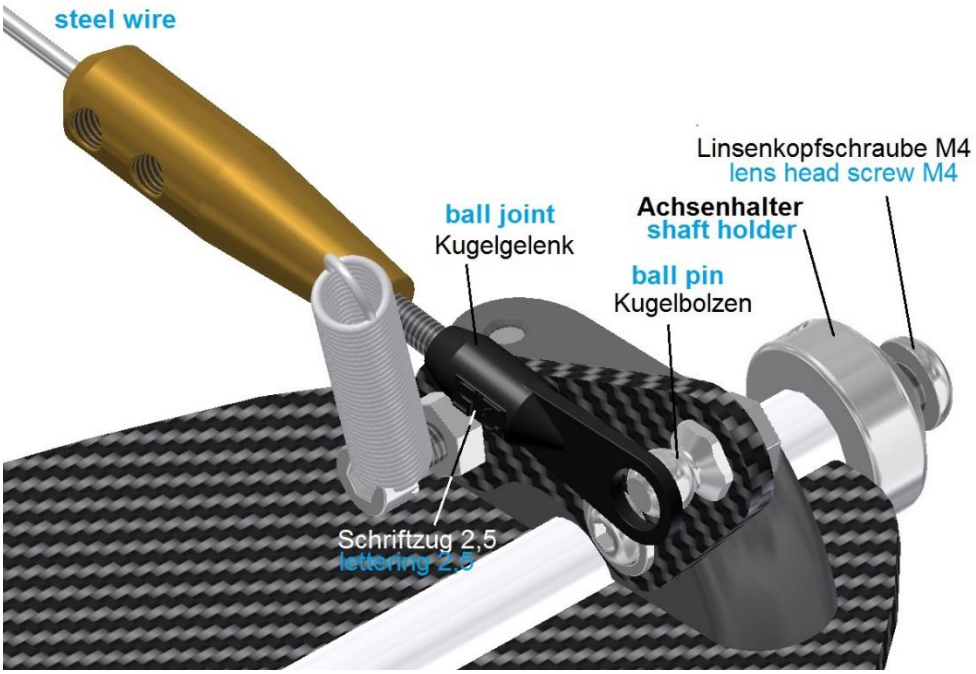
If the Bowden is considerably too long, it can be shortened with a wire cutter.

Attention! In any case, the steel wire must first be pulled out towards the front of the flap so that it is not accidentally cut off. However, it should not be pulled out so far that it slips out of the plastic block at the front, as it is difficult to thread it back in with the lower cowling installed.

If the Bowden cable is cut off, the end must be reworked so that the steel wire does not get stuck.

The steel wire is now pushed through so that it looks out of the Bowden cable top end. Then the Bowden cable is pushed into the hole in the aluminum cap until it stops. The steel wire should then look out of the plastic housing at the front. Then secure the Bowden cable with 2 to 3 cable ties on the other cables or suitable fastening points.

Now the lever of the slider tube is unscrewed and the small brass clamping piece is removed from the slide tube.



Now is the time to get someone to help. This person should hold the front radiator flap in a horizontal position and position the plastic ball joint loosely on the ball stud, but not clip it on yet (see picture on the left).

For this procedure, you can press the ball joint against the ball with your thumb and support yourself with your index finger on the lever, while you hold the flap horizontally with the other hand.

The end of the steel wire should now look a long way out of the plastic housing so that it can be easily pushed through the sliding tube. The locking pin does not interfere with this, as there is enough space on the side. Then the sliding tube has to be pushed into the plastic housing again until the pin stops at the end of the guide slot.

Now the small brass clamping piece is pushed onto the steel wire and pushed into the tube until the shoulder stops.

The steel wire is pulled slightly out with one hand and a felt pen mark is made with the other hand at the point where the core emerges from the brass piece.

Attention! It is important that the helper at the front ensures that the flap is as horizontal as possible and that the ball joint is in the position of the ball pin. The steel wire must be at the front between the flap spring and the operating lever (see picture on the last page).

After the marking has been made, the assistant can let go of the flap and the ball joint so that the steel wire can be pulled out a little further at the top.

The steel wire is cut off approx. 1 to 2mm in front of the marking with a side cutter, so that no sharp wires protrude from the brass part later.

Then the brass part is pulled out of the sliding tube again and shifted on the steel wire so that the end of the steel wire is immediately behind the trailing edge and does not look out at the front. The two M3x4 grub screws are tightened with a little screw locking (Loctite), so that the steel core is firmly clamped. The grub screws must be screwed deep enough into their holes, otherwise they will stick out at the top so that the brass part can no longer be pushed into the aluminum tube.

If the grub screws are fastened too tight, it can happen that the thin wall of the eccentric hole is pushed outwards a little. In this case, rework a little later with a small file until the brass part can be easily pushed back in.

When finally inserting the brass part, make sure that the M3 hole for the lever is aligned with the hole in the tube. Then the lever is screwed onto the tube.

Attention! The lever has a semi-circular cutout at the bottom that is adapted to the sliding tube, so that it must be aligned accordingly before you screw in the M3x25 Allen screw with a little Loctite.

Finally, the plastic ball joint is pressed onto the front of the ball pin with flat-nose pliers. This takes a little force.

Make sure that the joint is pressed on in such a way that the lettering "2.5" on one side of the ball joint points outwards and not towards the ball pin. It will work the other way around also, but requires a lot more force.

If the lower cowling is to be dismantled at a later date, please always remember that the ball joint must be unhooked before.

After hanging the ball joint and with the slide fully pushed in, the flap should now be roughly horizontal.

You can now make slight corrections by turning the adjusting aluminum cap at the top of the Bowden cable control. Turning it out tightens the steel core, turning it in relaxes it.

Operation of the flap during flight:

The flap control has 6 different locking options. The neutral position with the flap in a horizontal position is given when the slider tube is fully pushed in.

The first 12mm of the plastic housing slot do not have a grid, as the flap has no remarkable influence on the flow volume in this slightly inclined position. This is followed by 6 grid slots, each 5mm apart.

With my **VL3**, the first effect is noticeable from the second slot. When cruising with 65% engine power, I usually fly on the third grid. In the summer, an oil temperature of around 85 degrees sets in after a short time and the water or cylinder head temperature also level off in this range.

Attention! These values can be very different from engine to engine and must be test flown individually.

It is important to know that the water temperature must first be monitored. Depending on the flap position, this usually rises faster than the oil temperature and is therefore primarily to be observed. If it rises above 95 degrees, the flap should be opened wider again immediately.

With an optimal setting, the values will equalize after a while. If you are in a stationary cruise flight without any change in performance, you can test the flap effect very nicely by closing the flap one step at a time. At the latest by the third stage you should see how the oil and water temperature slowly begin to climb.

After a short time you will find the optimal values for different flight conditions.

Attention! If you close the flap completely for a cold start in order to shorten the warm-up phase, you must pay attention to the water temperature. It can rise quite quickly while the oil takes a long time to warm up.

When the water temperature reaches 95 degrees at the latest, the flap should be fully opened again and left open for the entire take-off process until the cruising altitude is reached.

During the high workload phase, you quickly forget this and then receive a temperature alarm on the Garmin G3X. Please include this point on the checklist immediately before the start!

When descending quickly from great heights with the engine throttled to idle, the flap can be completely closed without hesitation. When leveling up later and accelerating, don't forget to open it again!

Flight tests have shown that under certain circumstances it makes sense not to position the flap completely horizontally when climbing, but rather to set the slider tube to the first grid position. Due to the slight deflection of the air flow, a little more air is directed to the water cooler, which makes sense here because the water or cylinder head temperature tends to come into the critical range.

However, this can be very different from engine to engine and should simply be tried out.

In the unusual event of a steel wire break, the flap is held in a slightly inclined open position by the springs so that the motor does not overheat. Pay attention to the temperatures and, if necessary, do not operate the engine at full load until the steel wire has been replaced.

Now I wish you a lot of fun and great flights with optimal operating temperatures ☺

Jan Henseleit D-MVLX

Henseleit Helicopters

Germany / 24855 Jübek / Ellhöft 9

www.henseleit-helicopters.de

If you have any questions about the installation or the function, please contact me at any time.

jan.henseleit@henseleit-helicopters.de

TEL.: +49 151 67820900