Three-Dee-Fun

M A N U A L

Version 18.12.2017

Jan Henseleit

C A U T I O N! **I M P O R T A N T!**

Please read this manual before opening any bags!

Index

Safety Precautions:

A remote controlled model helicopter is not a toy. Keep strictly out of reach for children. A model helicopter will only perform reliably if assembled properly and regularly maintained after each flight.

Keep sufficient safety distance from the model. Always assume technical failure could happen at any given moment, which may cause the model to become out of control.

Only apply original spare parts in case of repair. Such may be acquired directly through me. Sloppy assembly or repair work, as well as lack of experience in mastering a remote control, may cause the model to become out of control and become a lethal hazard. The enormous rotating energy of the main blades impose a permanent threat to anyone in the vicinity of the model.

Careless handling may cause any given sort of lethal injuries or property damage. Therefore, refrain from overflying pedestrians and vehicles by all means.

Safety is the highest commandment within the scope of your sole responsibility.

The particular hazards involved are explicitly mentioned here, due to the fact that neither the manufacturer nor the seller of these kit products has any influence on their use and operation.

Henseleit Helicopter corporation is not in the position to monitor an orderly use or operation of the kit products. Therefore, Henseleit Helicopter corporation disclaims any sort of liability for damages, injuries or consequential damages and injuries caused by the use of their product portfolio.

Diagrams, instructions, specifications and any other parts of my documentation are subject to change at any given time. I disclaim any liability for printing errors. My documentations are subjected to copy right regulations. Republishing any sort of text, diagrams or figures, require my permission signed in hand written ink.

Jan Henseleit.

T h r e e - D e e F un

After delivered the TDR-II, pilots came often to me, asking for another helicopter close to the TDR, but technically up to date. The TDR impresses by simpleness and was one of the most powerful and variable helicopters for years. It was important for me, to have a machine in range , which can be flown with less powerful and cheaper drive components, but with lots of fun.

Not only the weight is a big difference also the cost of a monster ESC and motor and huge flight packs are exceeding the cost of the TDR-II may times over. For the new machine the components should be possible to use much cheeper and lighter components.

This results in a light but stiff mechanic. Even the original TDR build in 2009 full filled this demands. But it was the time of using stronger and stronger drives and the weight went up and up. This result in 700 Helicopters which have a weight clear over 5kg. The playful flying was lost over the time. So I decide , that after developed TDR-II / TDS for extreme powerful flying, its time to go - back to the roots - and develop a new helicopter for everyone.

My goal was a helicopter for fun flying, possible to use with simple components, but able to fly all figures the pilot want to. It should als be possible to build powerful motor equipment for more extreme flying. It should not be a face lifted TDR only but a totally new designed machine, with a lot of technical solution in, which I developed over the years and complete new solutions as well. Weight should be lighter than the old TDR - which makes it necessary to construct with cleverness, not to loose stableness or quality. With this new helicopter I followed my principles to implement trends, different from usual constructions and follow new paths. The result is the TDFun.

TDF is the new 700 size helicopter for all pilots, which like a light weight agil 3D helicopter, build up clear and simple - but having all necessary features which are recommend in a high-end helicopter. A fun machine which impresses by its flying simplicity - even without monster motor systems.

During development the weight was always in focus - but also the technical refinement of a Henseleit helicopter was newer lost. So the 700 size TDF presents itself with canopy by an empty weight of approx. 1800g. Finished in the lightest version - with Midi size servos, JIVE ESC, PYRO 650 motor, as well as 6 or 7S flight pack (about 800g) - his total weight is about 3650g - which is lower than most 600 size helicopters. Equipped with the most powerful components - standard HV servos, KOSMIK ESC and PYRO 750motor, as well as 12S flight pack - the total weight is approx. 4700g, safely under the 5kg border.

His gear in one step and the construction with the one way drive and tail gear drive inline with the motor shaft result in a extrem easy and clear construction of the drivetrain. Different motors and flight packs allows to fly the TDF smooth but also as a hot 3D machine. The gear ration is not changing.

My design of the LDS (Linear-Drive-System) is also realized in the TDF. Due to more space than in the TDR-II, it could be kept very simple. This system has so many advantages that I do not want to miss it any more. TDF allows to use the linear drive system with normal servos. Also the smaller, half price midi size servos are able to handle the necessary force. There force of 8kg is plenty enough for this helicopter - precise controlling makes precise flying - thats 3D-Fun.

Due to the helical gearing of the one step main gear and the toothbelt drive tail gear the TDF is very quiet und clear in construction. So easy to maintain.

Some parts of the TDF loyal Henseleit customers will know from the TDR and the TDR-II. So the canopy is the same as it is for TDR, as this design is still nice and aero dynamic - with good visibility - nothing to improve. A new decal design changes the view, but also the old design can be used if wished. TDR-II design has to be modified a bit, but can than also be used. TDR customers can also use there existing canopies - it fits without changes.

The approved main rotor of TDR II has been modified for 12mm main rotor shaft and 8 mm feathering spindle, to save weight. The adjustable damping was implemented - so adjustments can be done on the field in seconds.

Technical Data:

Name	TDF (Tree Dee Fun)
Manufacturing and sales	Henseleit Helicopters
Main rotor diameter	up to 1600 mm
Rotor blades	680 - 720 mm
Recommended rotor blades	710 mm / 175 - 210 g
Tail rotor blades	up to 110 mm carbon blades
Empty weight of the mechanic	approx 1800 g
Total weight - depending on used components	3.6 - 4.8 kg
Total length - tip of canopy to end of tail	1390 mm
Total height	390 mm
Maximum width of skits	190 mm
Maximum width of canopy	140 mm
Recommended motor	PYRO 650 – 78 (6S setup) PYRO 650 – 65 (7S / 8S setup) PYRO 700 – 52 (for 10S) PYRO 700 – 45 (for 12S) Maximum motor PYRO 750 – 45 Competition (for 12S)
Recommended ESC	JIVE PRO 120+ HV KOSMIK 160+HV depending on motor and flight syle (recommended only for PYRO 750 motors)
Gear ratio main rotor to tail rotor	1 : 5,56 (tail rotor is running during auto rotation)
Gear ratio motor to main rotor	9,27 : 1
Maximum flight pack size (L x W x H)	340 mm x 60 mm x 62 mm When using 6S or 7S, the flight pack should be a weight of minimum 800 g.
Recomended servos and some general things	In gereral al standard servos can be used, but the TDF can also be flown with mid size servos due to his weight and Linear Drive System, as 80 Ncm torque is more than enough. Normally these servos are only half in weight of standard ones - so a total saving of about 160 g is possible. Important is, tha there is no play in the servo and that the are precise in finding and holding their position. The enormous torque of up to 300 Ncm, the manufacturers are beating each other, I believe in substantial exaggerating. Servos with more than 150 Ncm using in this helicopters are not useful. Even with 3 midi size servos the swash plate is pushed with nearly 25 kg (2 ½ baskets of water). Considered that the rotor blade with cyclical input and 1800 RPM on the main rotor change from one side to the other about 30 times a second - you can imagine that the forces cannot be as high, as the stud bolts would not stay in the plastic ball link if the force would be as high.

General information for the assembly (very important!)

Before you start, you should try to get an overview of the assembly by scrolling through the manual. It is recommended to assemble the helicopter next to your computer. You can also print the manual.

Please start at the beginning of the manual and keep with the sequence of the assembly instructions. It makes no sense to start in the middle of the manual. You can become easily stuck and lose track. Before starting a new assembly group, first read the whole chapter description and then start mounting. **It is not sufficient to view only the images because the text contains important instructions that have to be considered in any case.**

At the beginning of each assembly group you will find a part list with pictures, order number and name as well as the number of pieces you need. Normal screws and connecting parts have different (grey) part numbers. These numbers are also found under connection parts in our web shop. The part numbers of these parts are not shown in the pictures - only the dimensions - e.g. M3x10. The picture shows, which type of screw has to be used. Caution! The length of screws is the length of the shaft until the screw head. Only with countersunk head screws the length is the total length including the head.

The assembly groups are packaged in separate plastic bags. Each plastic bag is labeled with the name of the assembly group. Bulky or long parts are packaged separately. Complex assembly groups with a great number of small parts are separated into several smaller bags.

Please open only the needed bag when required, as it is easily possible to loose the overview. You can identify the needed bag by looking on the part list of the actual chapter. By means of the part number it's easy to identify the corresponding assembly group for later spare part orders. The first number after zero is figure the assembly group.

All parts of the tail gear starts by 09 for instance. Sometimes parts have letters behind the 4 digit order number like a/b/c/d/R/L/HS/RS. This letters show that the parts correspond and belong to one group or only have little differences.

The biggest mistake would be to open all bags at once. In the parts list of each chapter, you can find all parts of the according assembly group. Sometimes there are screws inside, which have to be used later to fix different assembly groups together. This is always described.

Attention! The drawings and 3D animations in the manual show a right-hand rotation. Left-hand rotation on this helicopter is theoretically possible, but would need some modified parts. Right-rotation helicopters are mainly used worldwide. The differences to left rotation are minimized due to the excellent flybarless systems.

Some parts of the helicopter are already pre-assembled. Nevertheless, this manual contains detailed instructions for these parts. These instructions may be helpful in case you have to disassemble or to change parts. There is **no** need for you to check the pre-assembled parts or to disassemble or tighten them! Also, the screws are secured with Loctite already if necessary.

Attention! Screws, which need to be tightened with **L**octite, are marked with a red "**L**". Use the blue **L**octite (medium strength) or a similar product. Especially with the small grub screws, do not use too much **L**octite. Otherwise, you may have problems unscrewing the grub screws.

It is not necessary to tighten all screws of the electric helicopter with **L**octite because they do not get loose depending on the kind of stress. The lens-head screws can especially be hard to unscrew if using **L**octite because of their small hexagon.

In general, all grub screws and threaded link balls, as well as the 0911 screws of the tail centre hub, have to be degreased and tightened with Loctite.

Attention! Parts that you need to pay extra attention to are marked with a red "**!**". You will also find notes for these parts in the text. Important screw tightening is marked with the recommended force. If a torque wrench is used you can be sure about the correct tightening.

In case some items do not fit, do not use excessive force. Re-think why it may not fit together and see if a little reworking might solve the problem. If you cannot solve the problem on your own, please contact me. Have a look at the carbon-fiber reinforced parts. Use a strip of flexible sandpaper to chamfer the sharp edges if necessary.

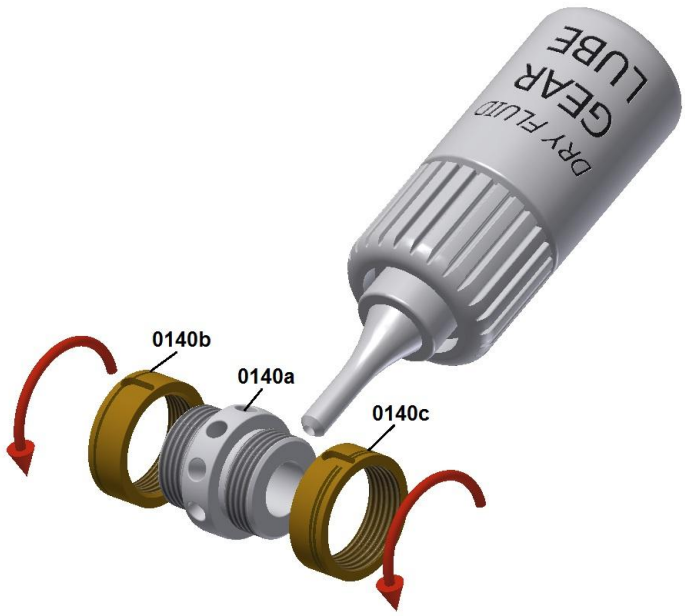
Attention! When sanding Carbon fiber, use a fitted dust protection mask!

The helicopter consists of numerous screws and small parts. It may therefore occur that a part is missing or that the screws are not shaped correctly or that they are rejects. Unfortunately, we are not able to check every single screw. In these cases, please send us a short e-mail and we will immediately deliver the spare part. You will find a bag with some special tools and special grease for the gears. A small extra bag (Reserve Parts) containing some established replacement screws is also included there. Some replacement parts are available if a screw is missing or a part is defective.

All in all, the assembly is not very demanding and does not require, besides some basic technical understanding, any special skills. Please take your time and work diligently to avoid problems that later on might be more expensive and time-consuming. Now I wish you a lot of fun assembling the helicopter!

Adjustable feathering spindle damping

	0140a	Straining screw R-L-thread	1
	0140b	Thrust nut R- thread	1
	0140c	Thrust nut L- thread	1

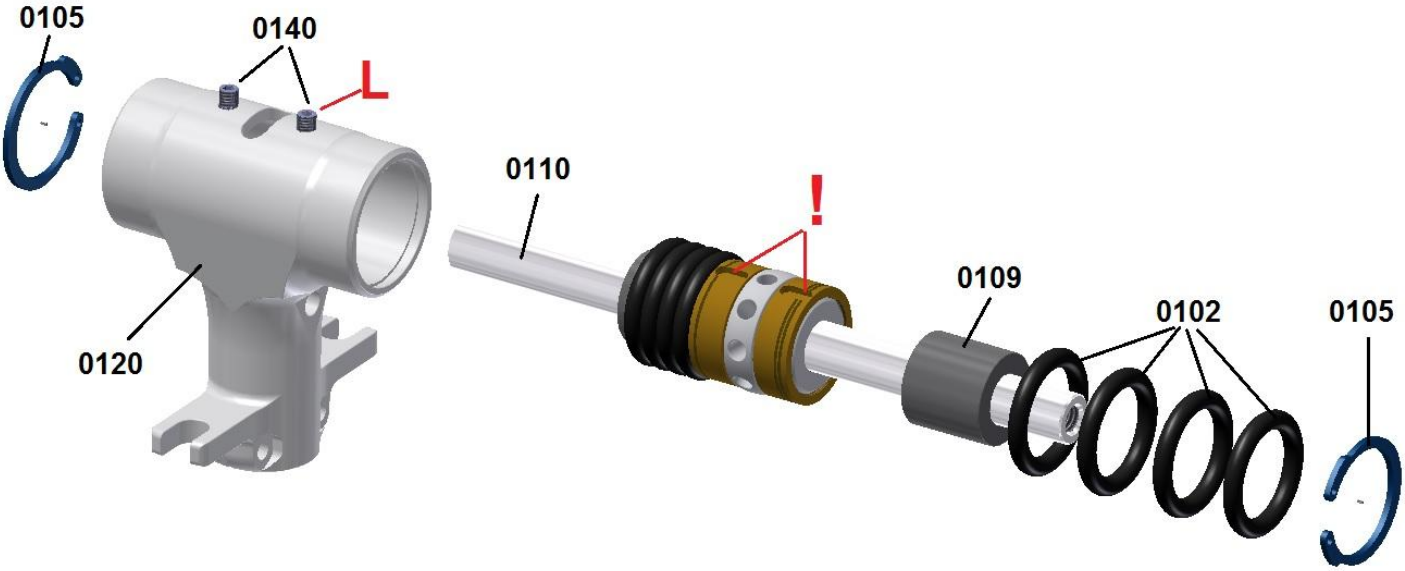


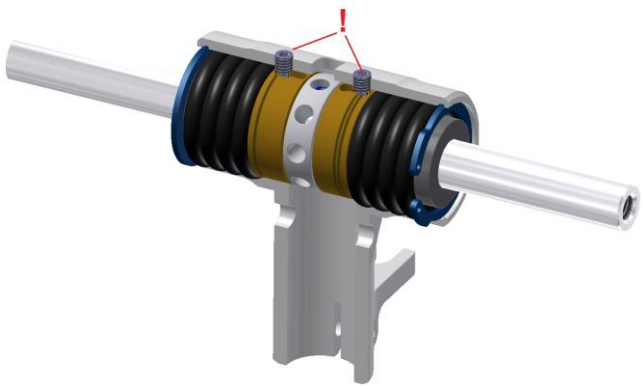
Fasten both thrust nuts 0140b and 0140c to the collar of the straining screw 0140a. Beforehand, apply some of the lubricant “DRY FLUID HELI” onto the threads. (has already been done before delivered). The lubrication is indispensable (shake well before use). Otherwise the threads will damage upon clamping under pressure.

Attention! The nut 0140b with a single mark has a right-hand thread. The nut with two marks has a left-hand thread. There are no markings on the straining screw. Find the matching threads by careful insertion. Preferably start with nut 0140b (right-hand thread). This will conclude the left-hand turns on the opposite side. (note the direction arrows). The milled grooves of both nuts need to be perfectly aligned by slightly unscrewing one of the nuts. A slight difference between both gaps to the collar is irrelevant.

Feathering spindle mount

	0102	O ring 14x3 - NBR80	8
	0105	C-clip Seeger - JV-20	2
	0109	O-ring inner bushing	2
	0110	Feathering spindle 8x110	1
	0120	Center hub	1
	0140d	Grub crew M3x4	2





General function description:

The image to your left shows the assembly structure of the adjustable rotor head damper. The center part is displayed in a sliced manner for better understanding. Both of the thrust nuts are resting at their inner position close to the collar. In this position, all O-rings are relaxed.

The straining screw can be rotated with the 3mm pin (in the tool bag) through the slot on the top of the center hub 0120. The straining screw 0140a will push both thrust nuts outwards. The O-rings are squeezed axial and supported by the C-clips 0105 of the center hub. This will increase the tension onto the O-ring inner busher 0109 and the damping gets harder.

Both of the grub screws plunge into the slots of the thrust nuts and thereby prevent the rotation of the thrust nuts together with the straining screw.

Attention! Both of the grub screws may not insert to the bottom of the slots (also refer to the following assembly instruction).

First, apply some lubricant onto the O-rings 0102 and the O-ring inner bushing 0109. You may use a viscose bearing grease or the enclosed “DRY FLUID GEAR” (Shake well before use). The inside of the center hub 0120 should also be greased at the O-ring seat.

Only assemble one C-clip 0105 with C-clip pliers or a set of nose pliers tooled to fit into the clamping holes of the C-clip. C-clips are punched out of sheet metal. They always have one sharp-edged side and one rounded-off side. Assemble the sharp side facing outward so that the O-rings will have their seat onto the rounded side. Check if the C-clip has correctly snapped into its groove. Now turn the open side of the C-clip into the rotational direction of the main rotor shaft / center hub as displayed in the drawing. (If you look at the center hub from the top, it turns clockwise to the right)

Now, push four O-rings from the open side of the center part all the way to the averted opposite C-clip. Then insert the pre-assembled straining screw unit into the center part. Both milled grooves of the two trust nuts should now be aligned with the two M3 thread bores in the top side of the center hub. Then the next four O-rings are inserted and the second C-clip is assembled as displayed in the drawing.

Both of the O-ring inner bushing 0109 are now inserted from left and right all the way through the O-rings until the stop. Finally, the feathering spindle 0110 is inserted and aligned roughly to the middle.

The shaft usually has a tight fit in the jacks. Retain the averted opposite jack so that it will not be pushed out again while inserting the feathering spindle.

Now align the two grooves for the grub screws 0140d with their threads in the top of the center hub. Perhaps you might need a thin sharp tool to accomplish alignment. Carefully insert the grub screws 0140d into their M3 threads with a slight touch of **L**octite.

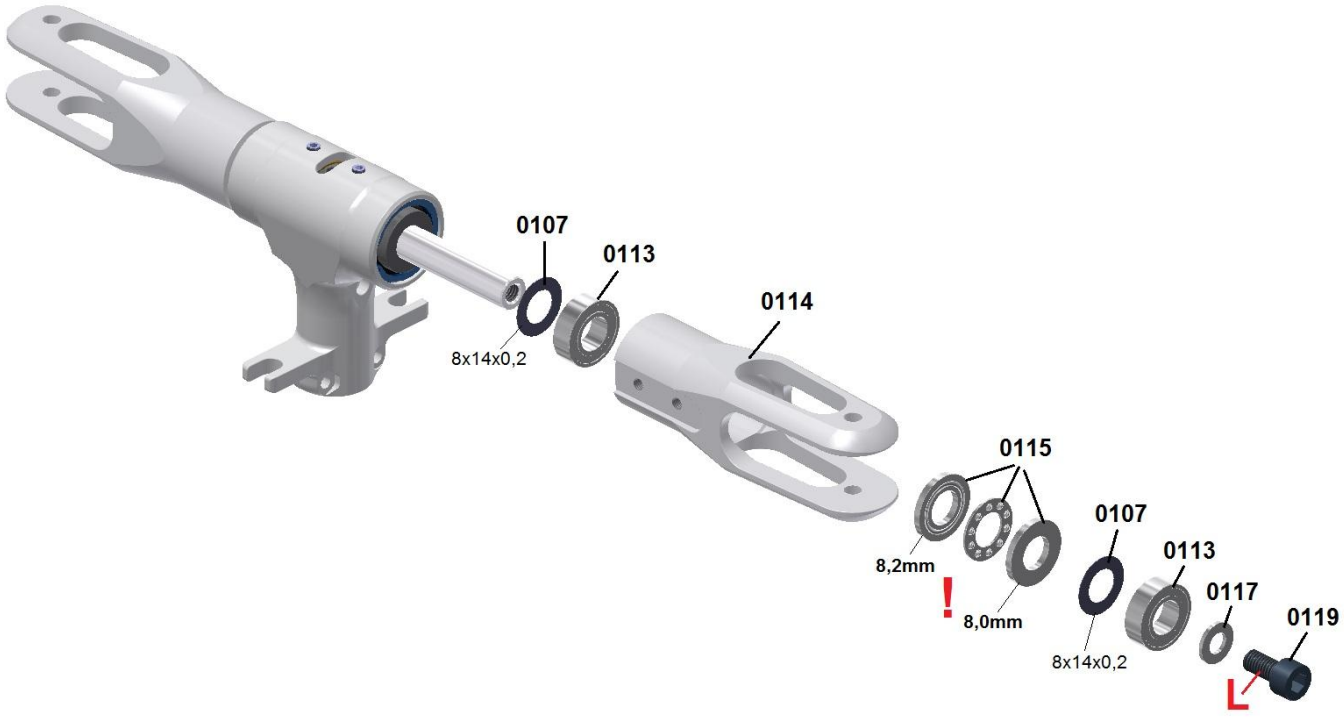
Attention! The grub screws should not be inserted aslant to avoid damage of their short thread. Now carefully screw the grub screws to the bottom stop of the grooves. At the bottom, the grub screw will be nearly level with the top of the center part.

Attention! Now the grub screws needs to be reversed exactly by one turn, equivalent to 0.5mm lash between the tip of the grub screws and the bottom of the grooves! This is very important. The blade shaft including damper unit must have enough clearance to avoid clamping nuts from hitting the grub screws during flight. Should this tend to happen, the grub screws will be forced out and damage the threads of the center hub.

The assembly section bag contains a little bag inscribed with “rotation lock.” It contains a 4cm long silicon string with 3mm in diameter. Later on, you will need 8mm of this silicon as rotation lock for clamping screw 0140a. Details will be referred to in the chapter “adjustments.”

Blade holder

	0107	Spacer washer 8x14x0,2	4
	0113	Radial bearing 8x16x5	4
	0114	Blade holder	2
	0115	Axial bearing 8x16x5	2
	0117	Spacer washer 5x10x1	2
	0119	Hex socket screw M5x10 – 12.9	2



First assemble the blade holder with all bearings. Attention! To avoid any mistake it is important to follow a specific sequence. Both of the radial bearings 0113, which are pointing toward the center hub, are pressed into each blade holder. If necessary, expand the blade holder with hot air. Make sure not to insert the bearing aslant. Now insert the axial bearing 0115 through the fork of the blade holder. Apply enough lubricant onto all parts of the axial bearing in advance (viscose grease into hollow side of ball cage). Pay attention to the correct sequence as displayed in the drawing. Each ring has to be inserted laterally through the fork. At the beginning of the fork where the bore of the blade holder begins, the rings are swiveled into rectangular position and pushed into the bore. Make sure the rings do not swivel by 180° and carefully reassure that the grooves of the rings always point to the bearing balls. This procedure can be simplified with the aid of a pin inserted from the other side, onto which you may align the rings. The first ring to be inserted has a 8.2mm inner diameter. Then the ball cage follows with its hollow side pointing toward the center hub. Then you insert the ring with an inner diameter of 8.0mm, followed by a spacer washer 0107 (8x14x0.2) and finally the radial bearing 0113.

Attention! To avoid aslant insertion, the final radial bearing should be assembled as follows.

After the axial bearing 0115 and the spacer washer 0107 are inserted, shove the bearing laterally between the fork and swivel it into a right position.

If the radial bearing does not enter the blade grip without force, expand the blade holder with hot air. You can also use a 8mm pin to get the bearing aligned to the other bearings.

Finally slide both blade holders onto the feathering spindle. However, the spacer washers 0107 (8x14x0.2) need to be inserted before, between the O-ring inner bushing 0109 and the pre-assembled blade holder.

In case the pre-assembled blade holders do not properly slide onto the feathering spindle, the predominant cause would be a displacement of spacer washer 0107. In such case, use a pin to align the spacer washer with the rest of the bearings and rings seated within the blade holder.

Now, secure the blade holder with washers 0117 and hex socket screw 0119. Tighten both screws 0119 with Allen keys. The screws have their seat at the stop of the washers.

Attention! Only tighten the screws very slightly to begin with. The axial lash of both blade holders needs to be checked first. Pull both blade holders apart forcefully. Measure the distance between both edges of the blade holders with the inner beaks of a caliper. Subsequently, push both blade holders together forcefully and repeat the measurement with the inner beaks of your caliper. The difference between both readings should not exceed 0.3mm. Should this be the case, add washers (8x14x0.1 or rather 0.2) equally on both sides. The washers are found in an extra bag. Finally tighten both screws 0119 forcefully with two Allen keys.

Attention! After tightening, the blade holders must still turn freely. If that is not the case, remove one set of washers. Upon release of both screws, one screw will release first. Carefully remove the blade holder unit of the first release screw. To obtain a tight grip onto the feathering spindle without damaging it, you would need a special shaft wrench. If you do not have such a tool, I recommend to remove the other blade holder with the attached feathering spindle from the center hub, in order to access the second washer. Avoid clamping nuts to slip away from the grub screws 0140d. Do so by carefully pushing the feathering spindle out of the center hub with another 8mm shaft. It will serve as replacement for the feathering spindle and keep all parts in position until the spindle, including blade holders, is reinstalled.

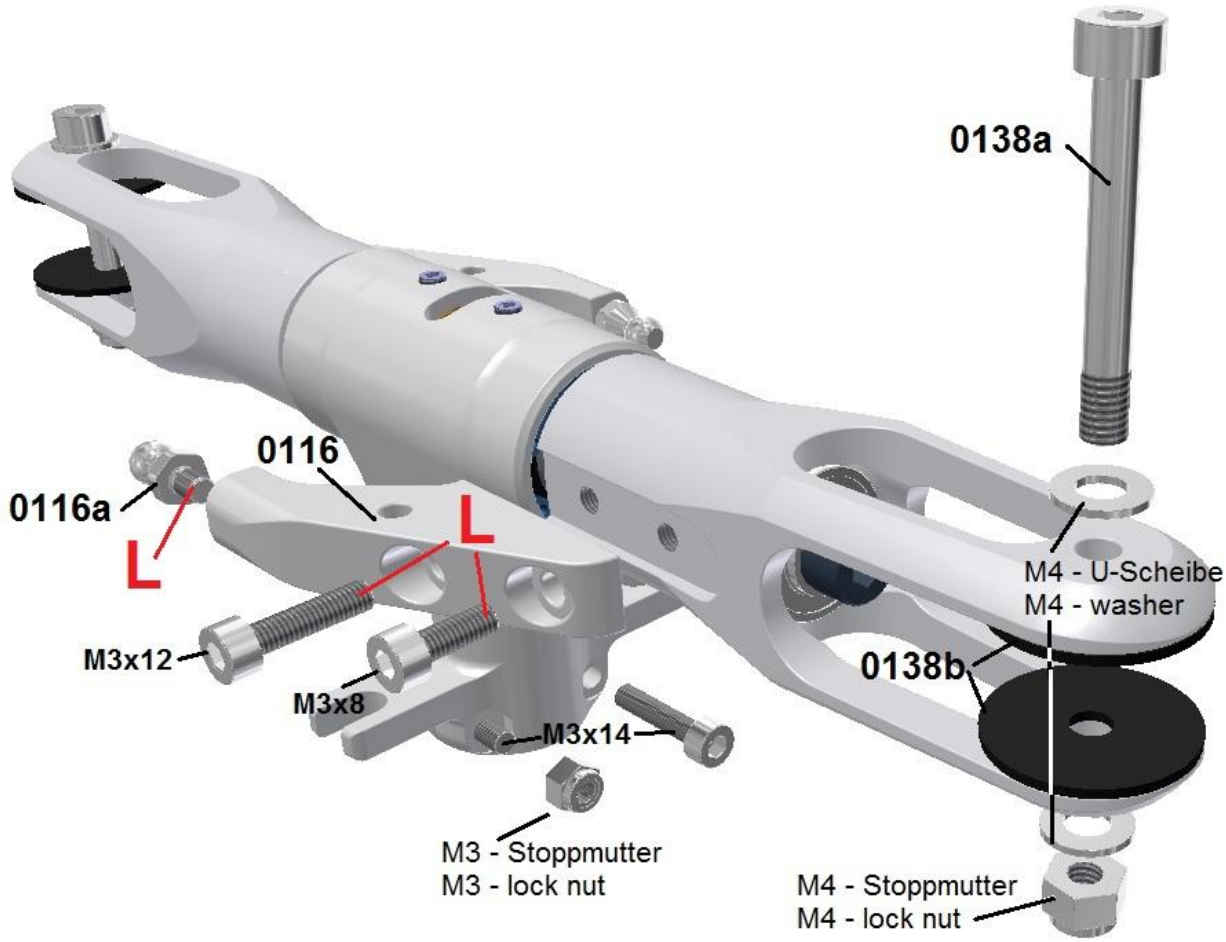
Attention! The screws 0119 are of high-grade steel and may only be replaced by original spare parts. The use of conventional screw types bears the danger of tearing.

Please note! The basic adjustment of the rotor head damping will be outlined later on.

Do not try to pull the feathering spindle out of the bearings from the bent side after crashing. Always try to use the side that remained fairly straight. Check on the first visible bearings 0113. The other bearings usually never take any damage. Turn the inner ring of the bearings with a finger and check for smooth movement. These two bearings may be extracted without removing all other parts of the blade grip unit. Push the old feathering spindle back into the damaged bearing until the bottom of its inner ring. Then pull the bearing out by swiveling the shaft sideways to get some grip on it from the inside (if needed expand blade holder with hot air). You may also use an 6mm spindle to push the bearing out by seating the spindle onto the inner ring of the bearing through the fork side. Do not slide the blade holder units with violent force onto the new feathering spindle. Sand down the new spindle if needed, with some fine-grade emery linen, while it is rotating in a manual drill tool.

Pitch arms

	0116	Pitch arm	2
	0116a	Threaded ball stud M3x4 – 6mm	2
	0138a	Blade bolt M4x30 – 10.9	2
	0138b	Spacer for rotor blade 4x20x1	4
	0138c	Adapter sleeve 5mm to 4mm	2
	W04	Washer M4	4
	NS04	Nyloc nut – M4	2
	NS03	Nyloc nut – M3	2
	M0308	Hex socket screw – M3x8	2
	M0312	Hex socket screw – M3x12	2
	M0314	Hex socket screw – M3x14	2



Attention! Do not use an open-end wrench to tighten the ball stud. Use a socket wrench in order to not damage the external hex.

The pitch arms 0116 has to be mounted in the grooves of the blade holder as shown in the picture. Look for the different screw length M3x8 or rather M3x12 (use **L**octite). Pull the arms into the fully outer position before tighten the screws.

Attention! By using the wrong screw length it is possible that the pitch arm is not fully fixed or the rotation of the blade holder on the feathering spindle may be jammed.

Mount the blade bolts 0138a and the washer 0138b loose at the blade holder by the M4 nyloc nut not to loose them. Don't forget the M4 washers as the M4 nyloc nut could not be fixed correctly without.

Also tighten the M3x14 screws loose with the M3 nyloc nut in the lower holes of the center hub 0120. They are for clamping of the center hub at main shaft later.

Attention! At one side there is a hex socket to fit the nut, as on the other side is only a round hole for the screw head. If the nut does not fit directly into the hex socket, move it step by step into a different position until it fits.

Main rotor head is ready and can be lay beside.

Attention! The bolts 0138 are of high-grade steel fabric and may only be replaced by original spare parts. Standard bolts bear the great danger of tearing.

The two plastic spacer 0138b are needed to fill the gap when using 12 mm blades in the 14 mm blade holder. Do not use the usual Aluminum washers - they will damage the blade holder or the blades.

When using blades with 14mm blade grips - the washers are not needed.

Reference: Sadly today most of the blade manufacturer do not deliver any reduction sleeves from the 5mm blade hole to the 4 mm bolt used. Therefore one set of adapter sleeves 0138c is included in the kit.

This sleeves are for 12mm blade grip. For 14mm blades they can also be used if they are glued into middle position with a small gap of 1mm on each side. 14mm adapter sleeves are available as well.

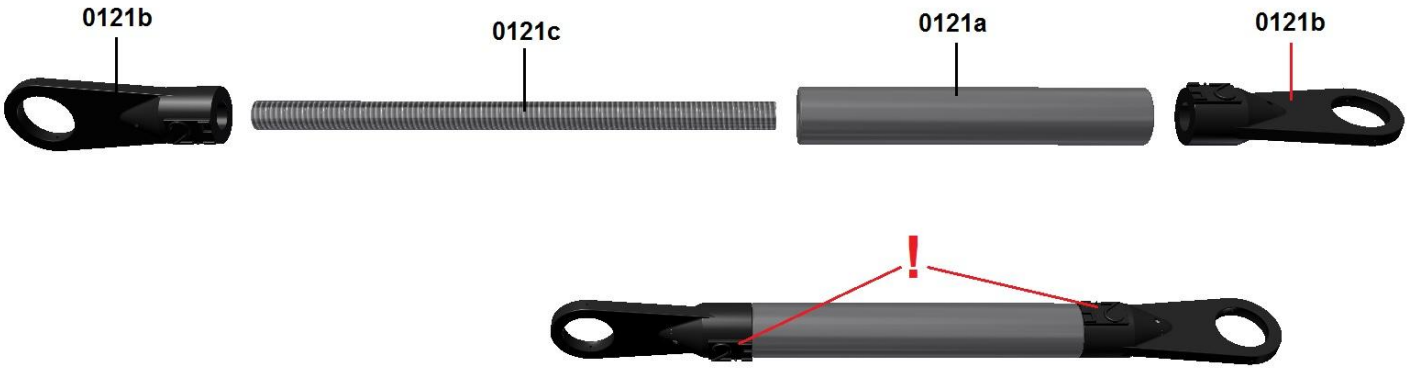
The adapter sleeves 0138c are also available as spare parts - for 12 and 14mm blades.

Do not drill out the blade holder hole to 5 mm, to use a 5mm bolt because a precise alignment is not guaranteed any more.

The 4mm screw is absolute strong enough and takes more load than the usual M5 screw at the end of a 8mm feathering spindle. So it makes no sense to use a M5 screw for the blades when not using M6 for the feathering spindle.

Push rod for blade control

	0121a	Spacer 30mm	2
	0121b	Ball link 15mm	4
	0121c	Stud bolt M2,5x 45	2



Mount the rod as shown in the picture above. Position the ball link in line to prevent damage.

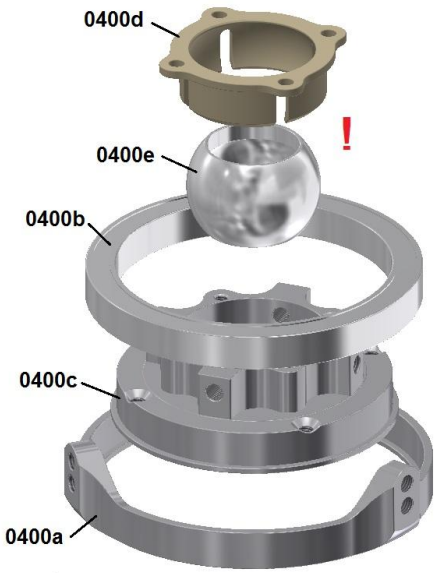
Attention! Screw both ball links 0121b as far as it touches the spacer bush 0121a. Then rotate backward until the lettering „2,5“ is in 90° position to each other as shown on the picture.

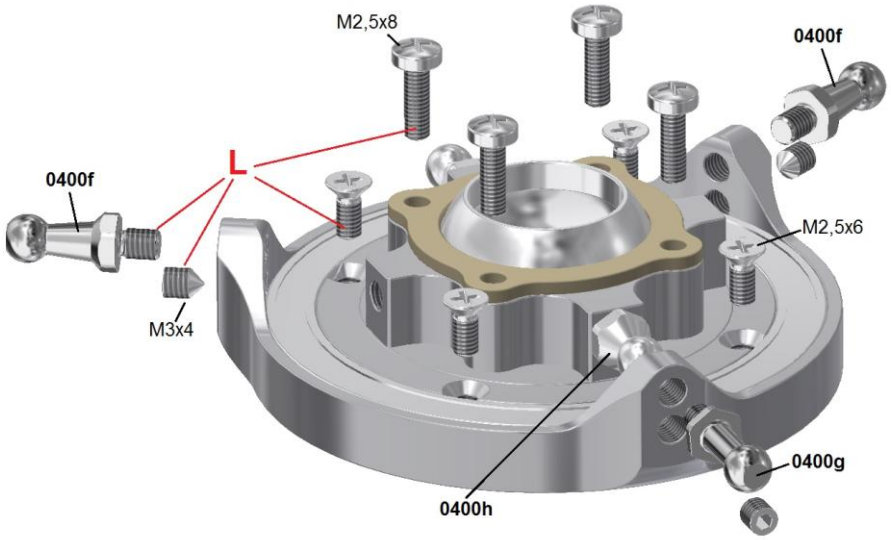
Do not try to screw the ball links further if they are touching to the bush, as the thread may be damaged and fixation is not longer guaranteed.

Chapter – 2 **M a i n s h a f t u n i t** (Assembly group 4)

S w a s h p l a t e

	0400a	Swash plate outer ring	1
	0400b	Radial bearing 45x55x6	1
	0400c	Swash plate inner ring	1
	0400d	Ball shell	1
	0400e	Ball	1
	0400f	Threaded ball stud M3x4 / 9mm	2
	0400g	Threaded ball stud M3x4 - 9mm (Special Elevator)	1
	0400h	Threaded ball stud M3x4 / 6mm	2
	G0304S	Grub screw M3x4 with tip	3
	P2508	Phillips screw M2,5x8	4
	C2506	Countersunk head screw M2,5x6	4





The base body of the swash plate will generally be delivered finally assembled. In case of a damage of the bearing the swashplate can be disassembled to all single parts.
The proceeding of the assembly will be described in the following chapter. So in case of an exchange of the bearing you understand the proceeding and what to take care about.

The bearing 0400b will be placed into the outer ring of the swashplate from above, without tilting. Slightly heating the ring will ease the insertion significantly.

Secure the bearing with the three tapered grub screws M3x4 (see detail drawing below), placed in the lower radial hole of the outer ring (use **L**octite at the thread of the hole).

Attention! Tighten the grub screws carefully with feeling. Tighten them so that the tips just touch with light pressure the upper radius of the ball bearing, securing it from slipping to the top.

Slide the inner ring of the swashplate 0400c from below into the ball bearing up to the shoulder.The ring should slide with low force into the bearing. Grease the shoulder if necessary.

Now the inner ring will be secured by four M2,5x6 countersunk screws from sliding downwards. Also these screws have to be tightened carefully until the cone sits on the radius of the ball bearing inner ring (use **L**octite). Now there should be now axial play between the swashplate inner ring and the ball bearing inner ring.

If the ball bearing itself has too much play between inner and outer ring (visible tilting) you can decrease this play by stepwise tightening the three tapered grub screws. Tighten all three screws at the same level. This presses the outer bearing ring some hundredths mm to the inside putting a little bit pressure on the balls.

Attention! Just tighten the grub screws so far that the bearing is still running smoothly.

With this method you can also correct an older worn bearing when it got too much play.

Grease the pivot bearing at the outside of the ball 0400e and the inside of the shell 0400d with Dry Fluid Gear (shake before use). Then press the ball into the shell from the lower side. Insert the pivot bearing in the hole of the inner ring of the swashplate and fix it with four Phillips screws M2,5x8.

Attention! Tighten the screws carefully and use **L**octite.

In no case the ball is allowed to stick. A small axial play has no influence on the precision of the control.

The ball pins 0400f **and** 0400g at the outer ring and the ball pins 0400h at the inner ring have to be secured with **L**octite.

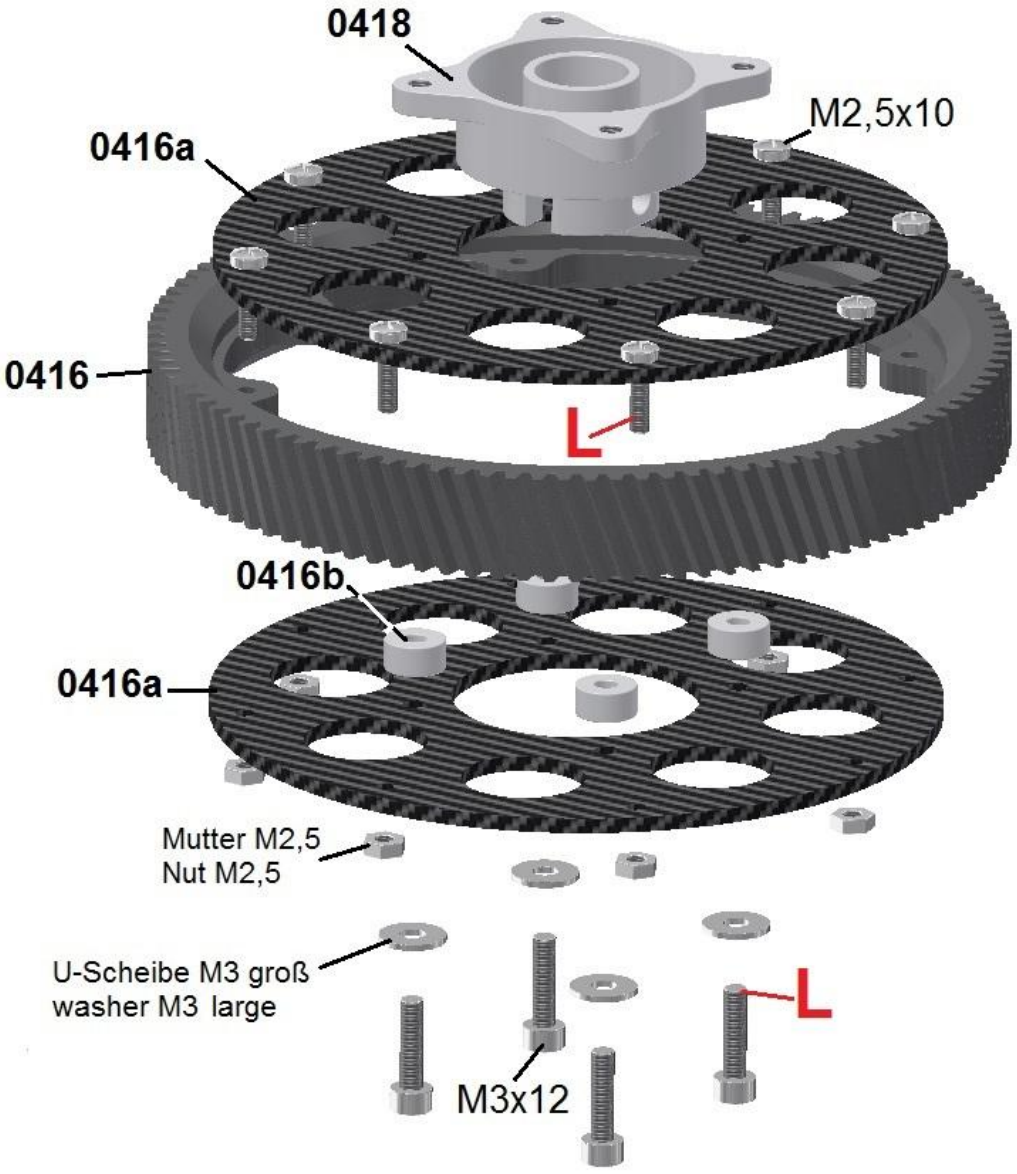
Attention! Do not use an open-end wrench but a 5,5mm socket wrench to prevent the hexagon of the ball pins from damage.

Attention! The ball pin 0400g has a slimmer shape and will be used for the connection of the elevator control rod later on.

Main shaft gear

(Assembly group 4)

	0416	Main shaft gear	1
	0416a	Carbon spoke	2
	0416b	Spacer 3x8x4	4
	0418	Main gear flange	1
	P2510	Phillips screw M2,5x10	8
	N25	Nut M2,5 flat	8
	M0312	Hex socket screw M3x12	4
	WL03	Washer M3 large	4



To prevent the increase of the diameter of the main gear by heating even in case of hardest flying style, a special design measure was taken. The delrin gear ring 0416 is manufactured with a 0,5mm smaller diameter as it should be. The inner carbon spoke 0416a will not fit inside the gear in cold condition. For mounting the gear ring has to be heated in an oven up to 60-70°C (140°-158°F). The gear ring will expand so the carbon rips can be inserted and positioned easily.
Put in two M2,5x10 Phillips screws at opposite sides through the holes of the carbon rip and the gear ring. The holes will stay aligned also after cooling down.
Press the carbon rips down to the ground of the 2mm step of the gear ring. During cooling down the gear ring is shrinking on the carbon rip and will be fixed with screws. All screws will be put from above to the holes and fixed with the M2,5 nuts from below (use Loctite).
Now the nominal diameter of the gear is reached. Even under highest loading during flight the diameter will not increase. It just could increase when the temperature of the gear will exceed 60°C (140°F) in operation.
Slide the complete gear on the gear flange 0418. In case of a too tight diameter you can grind the hole in the carbon rips carefully until fitting without play.
Before fitting the gear with the M3x12 screws and the 3mm washers the four spacers 0416b (3x8x4) have to be placed between the two carbon rips. You can place them easily through the holes of the rips and position them at the holes for the screws.

Chapter – 3 **S e r v o p r e p a r a t i o n**

(Assembly group 6)

	0630NS	Elevator servo mount	2
	0630RS	Aileron servo mount	4
	0630HS	Tail servo mount	2
	0634	Servo pad	8
	0638	Threaded ball link M2x5 – 3mm	1
	0640	Servo gear - 28 teeth	3
	N02	Nut M2	1
	P2516	Phillips screw M2,5x16	16
	NS25	Nyloc nut M2,5	16
	L0306	Lense head screw M3x6	8
	WL03	Washer M3 large	6

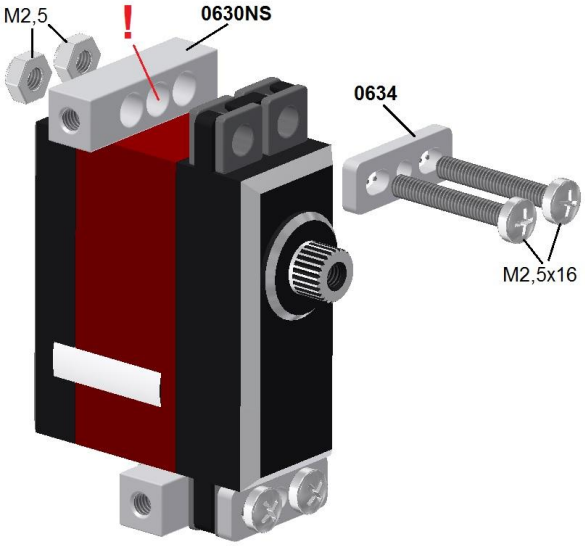
Generally the servos can also be installed when the helicopter is completely assembled. But I advise to prepare the servos in this stadium to be able to install them in the next assembly step at the inner side of the chassis plates in advance of the chassis mounting. This eases the work.

Attention! There are three different servo mountings: 0630NS (elevator servo), 0630RS (aileron servo) und 0630HS (tail servo). Take care to use the right blocks for the respective servo and take care of the orientation of the M3 hole in the blocks towards the right side according to the drawings.
The servos are positioned on the drawings (next page) in a way as looking from the right front side on the mechanics when installed.
The blocks for the two aileron servos are identical and will be mounted with the thread orientated respectively to the right and the left side.
The blocks for the elevator servo are a little bit longer. They can be distinguished from the other ones by the third hole between the holes for mounting the servos.
The blocks for the tail servo are much longer and therefore easily to identify.

Note: All blocks are equipped with a larger hole so standard size servos (hole spacing=10mm) and midi servos (hole spacing=7,5mm) can be fitted. The screws touch either the outside or the inside of the holes.

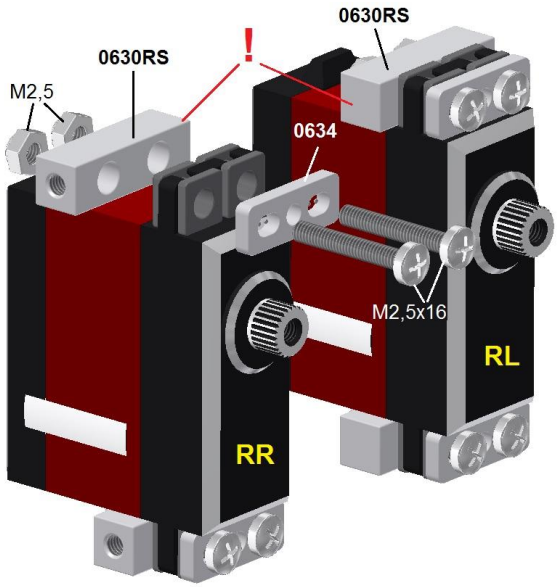
Unfortunately there are no standardized rubber fittings or spacers available by the servo suppliers. The fittings are from a period were the servos were mounted on wood with wood screws and are inappropriate for today's helicopters. Often the mounting is too soft depending on the length of the spacers or the design of the rubber blocks. Therefore I recommend either to shorten the spacers supplied with the servos to be able to compress the rubbers more or not to use them.
To get the necessary extensive pressure on the rubber blocks of the servos the servo pads 0634 will be used (see drawing next page).
By equal torqueing of the M2,5x16 screws the rubber blocks can be pressed until the servos are fitted tight on their blocks.

The following drawings show midi size servos with a housing width of 15mm. When using standard servos with a width of 20mm the blocks for the aileron servos are just 0,2mm wider on the side with the M3 thread.



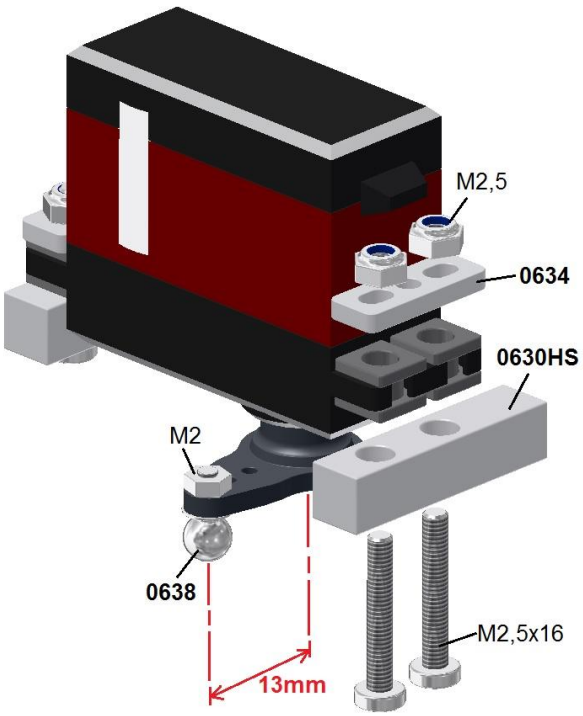
Elevator servo–preparation

The elevator servo will be screwed to the blocks 0630NS (three holes) according to the drawing.
The servo pads are used to get the necessary extensive pressure on the rubber blocks until the servos are fixed tightly without play.
Torque the M2,5x16 screws and the 2,5 nuts stepwise and equally. Take care that the blocks are correctly aligned.
This servo will be mounted at the next assembly step on the inner side of the right chassis plate.



Aileron servo–preparation

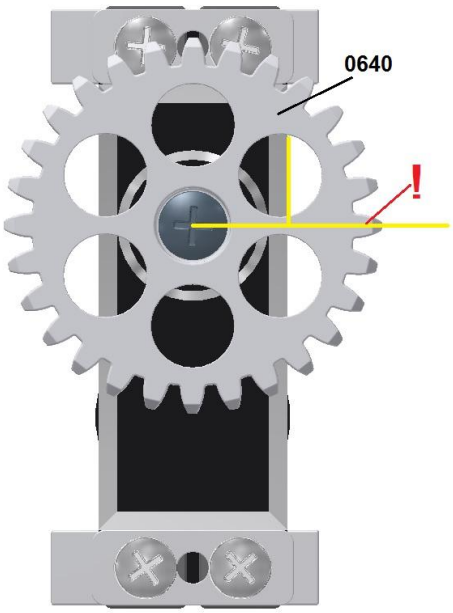
Both aileron servos will be fixed similar to the elevator servo on the blocks 0630RS.
Take care of the positioning of the M3 thread holes at the front side which shall be facing to the left and the right outside.
These servos will be mounted later on in the inner side of the left and right chassis plate.



Tail servo–preparation

In difference to the swash plate servos the tail servo will be mounted with the upper side of the servo flanges to the servo blocks 0630HS.

The servo lever will be mounted according to the drawing and equipped with one ball pin 0638. The length of the lever should be about 13mm.
The remaining M3x6 and M3 washers will be used to mount the servos to the chassis plates (see chapter 4).



Now mount a servo gear 0640 on each swash plate servo.
To reach an optimum adjustment from mechanical point of view, you should follow the described procedure exactly. So much the better you work here the less corrections you have to do by electronics. In the ideal case you can keep all values in you FBL system without adjustment of the trims and can use your system perfectly. This can be realized especially with the **L**inear-**D**rive-**S**ystem (**LDS**)

Only servos with a Futaba compatible 25 tooth involute gearing can be used, which is standard at nearly all servos nowadays.

On one side the toothing is manufactured in a way to ensure a very tight fit on the shaft of the servo. You need a high force to press it on. Therefore I recommend to press and to remove the servo gear on an old servo. Then the final mounting on the servos will be a little bit easier.

Attention! The servo gears 0640 should be mounted with one tooth exactly oriented perpendicular to the side wall of the servo.

As with 28 the number of teeth is even the teeth on the opposite side is also oriented perpendicular to the side wall of the servo. Also in the servo longitudinal axis a tooth is exactly aligned. The position of the hole-circle doesn't matter.

As the shaft of the servo have 25 teeth and the servo gear have 28 teeth a very fine adjustment is possible to get the optimum position. This is much easier as in case of a normal servo lever, where often an exact alignment is not possible.

Proceed as following:

Connect the respective swash plate servo directly to the receiver without a FBL system. Take the channel for aileron or elevator (not ESC or collective)

All trims on the transmitter of the used channel have to stand on center position. Switch on the receiver. The servo will move to neutral position. Keep the system switched on, so the servo shaft cannot be tilted during mounting of the servo gear.

You can also use a servo tester to bring the servo to neutral position.

Place the servo gear onto the servo shaft tentatively and check the position exactly from above. Press the servo gear just slightly on the servo shaft so it just fixed a little bit to check the alignment.

By repositioning the servo gear by one tooth you can find the optimal position in which one tooth is exactly perpendicular to the housing. You can choose the right direction for the repositioning by checking the tendency if it getting better or worse.

To support the adjusting you can also compare the distances of the two teeth which are closed to the servo side wall. This is easier to check with your eyes.

Prerequisite is a straight fitting servo gear and that you look exactly from above. After finding the optimum position, the servo gear will be pressed completely onto the servo shaft and fixed with the servo lever screw. (use **L**octite).

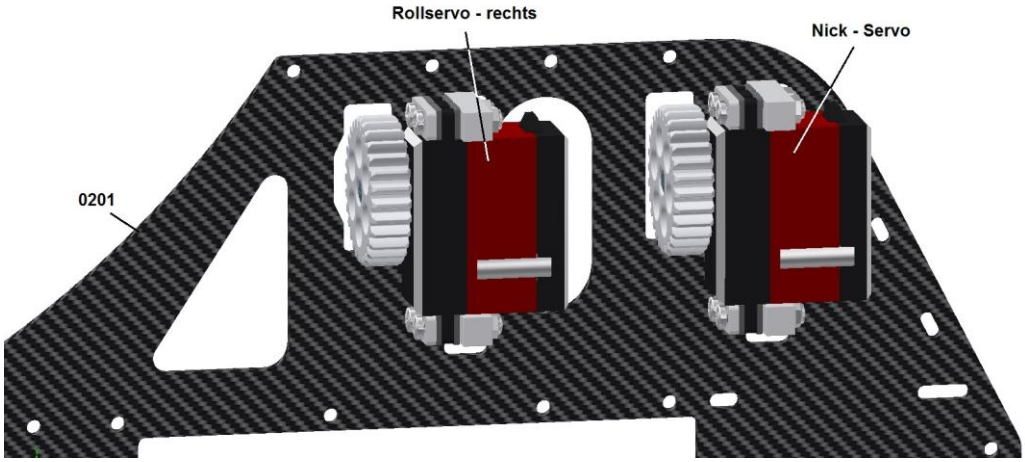
Mark the respective tooth which lying mostly to the outside with a water resistant marker to see the position during installing the servo. You have to align this tooth with the middle tooth of the gear rack later.

Proceed like this with all of the three swash plate servos.

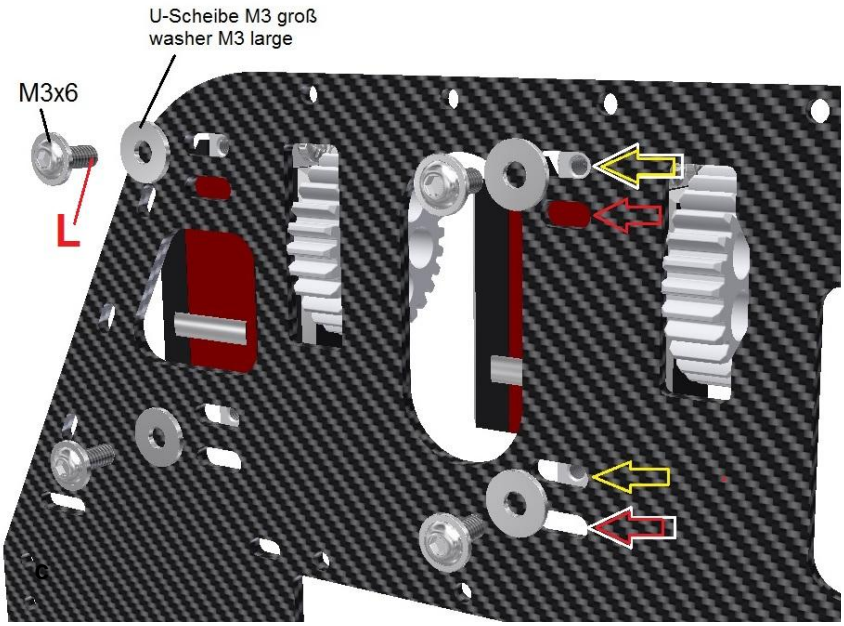
Chapter – 4 **C h a s s i s** (Assembly group 2)

S e r v o m o u n t r i g h t c h a s s i s p l a t e

The following three pictures show the installation of the right aileron servo and the elevator servo to the right upper chassis plate 0201 (bag CFK-parts)



View from inner side of the chassis

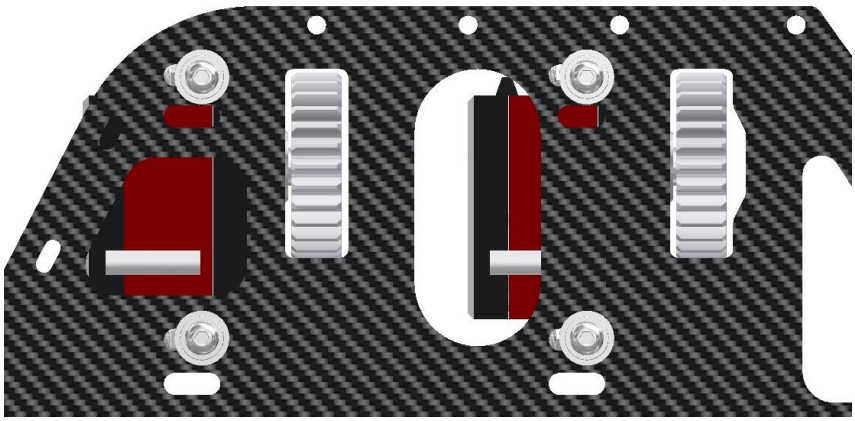


View from outside oft the chassis

Choose the according long holes according to the used servos for fixation.
For standard servos it will be in any case the most upper long hole and the lower long hole (white arrows).

When using midi-servos, with a distance from the housing edge to the shaft of about 10mm (similar to standard servos), use the long holes marked with yellow arrows. A slight vertical offset doesn't matter.

Some of the midi-servos (e.g. MKS-servos) have the shaft located very close to the housing edge. In this case the servo gear would be located too far upwards in the gear slot.
In this case use the long holes marked with the red arrows even when the servo gear is positioned 3mm below the center of the slot.
A lower positioned servo gear is uncritical as soon it will not scratch the chassis, due to the larger downward space of the gear rack inside the guide. To compensate this difference the control rods between gear rack and swashplate can be elongated by turning out the rod ends.

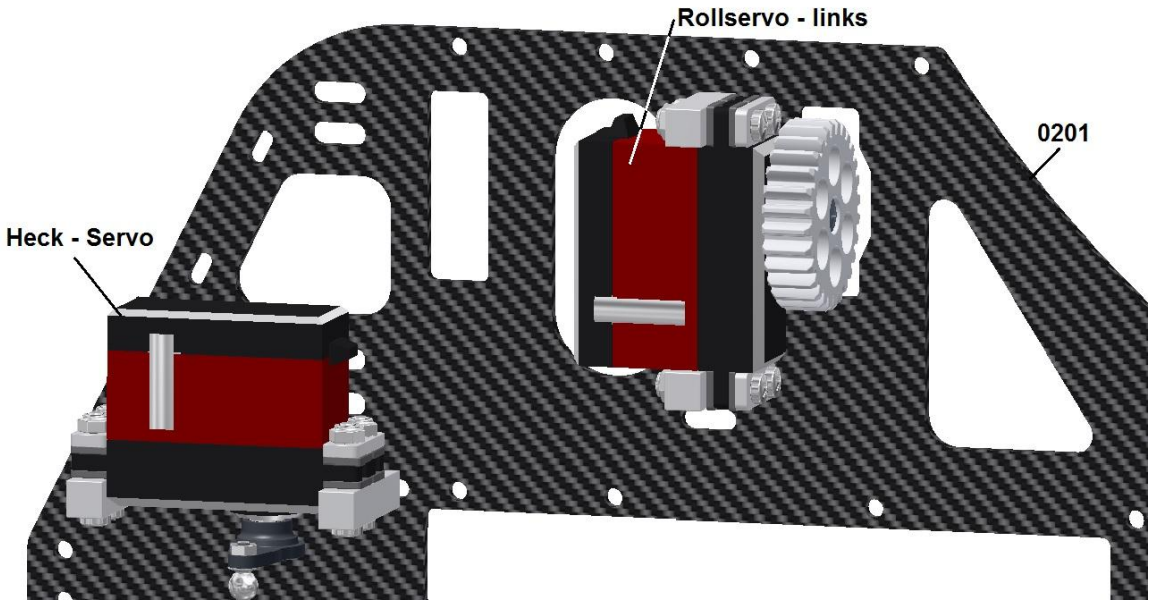


Servos have to be centered so that the 8mm wide servo gears should be in the middle of the 10mm slot and should not be tilted.

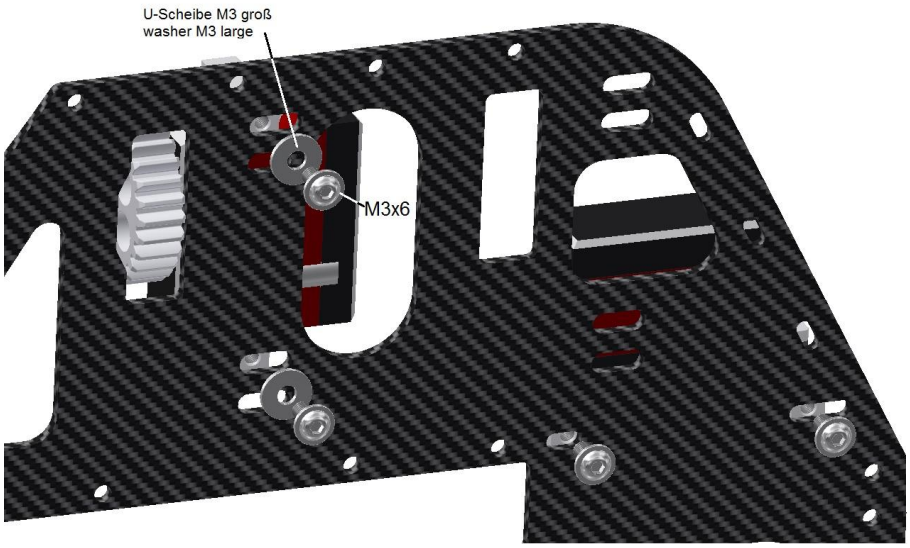
Use Loctite for the screws.

Servo mount left chassis plate

The following three pictures show the installation of the left aileron servo and the tail servo at the inner side of the left upper chassis plate 0201.

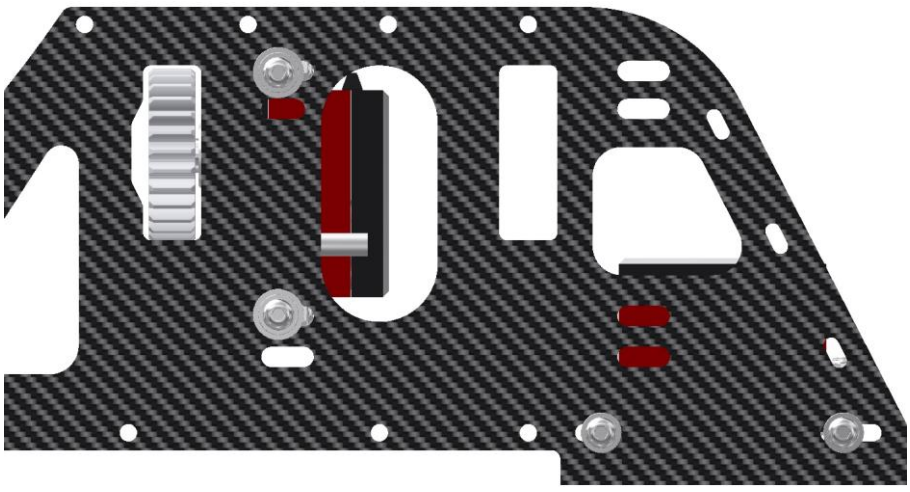


View from the inner side of the chassis



The left aileron servos will be mounted mirror inverted to the right aileron servo to the left chassis plate.
The tail servo will be installed according to the drawing using the horizontal aligned long holes. It will be slided backwards as far as possible. The M3x6 screws for the tail servos will be mounted without washers.

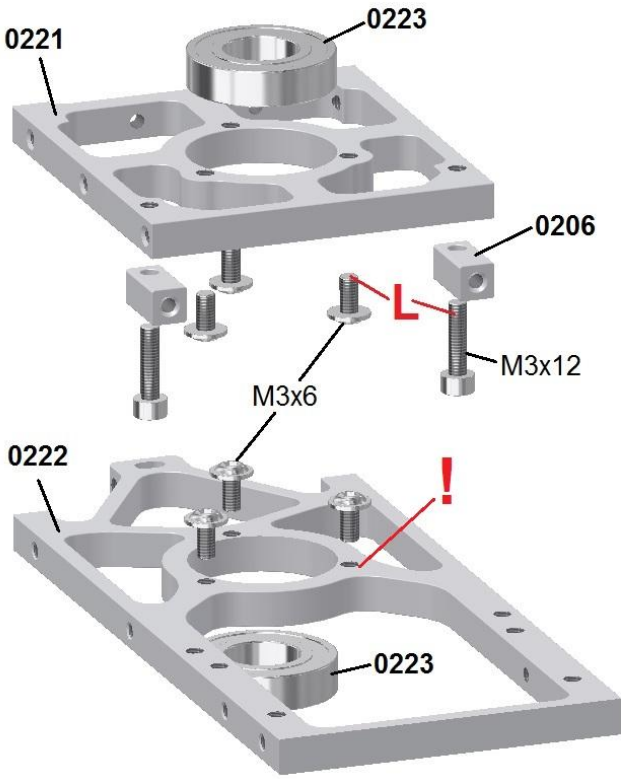
View from the outside of the chassis



Bearing plate preparation

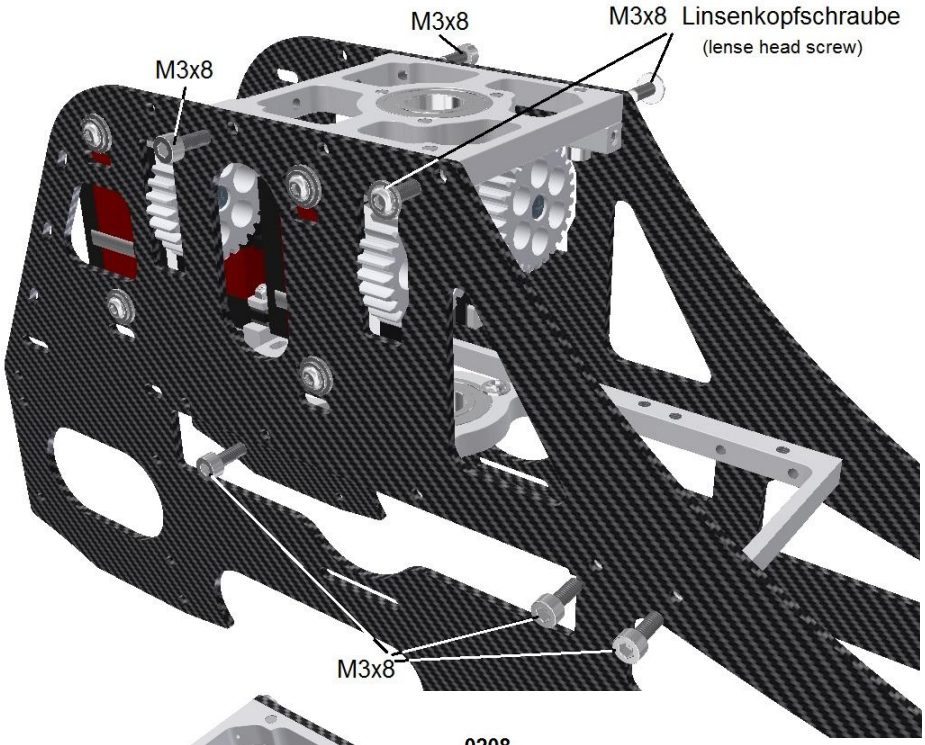
(Assembly group 2)

	0221	Upper bearing plate	1
	0222	Lower bearing plate	1
	0223	Radial bearing 12x24x6	2
	0206	Mounting block	4
	0207	Carbon X stiffening front	1
	0208	Carbon X stiffening back	1
	L0306	Lense head screw M3x6	6
	L0308	Lense head screw M3x8	2
	M0306	Hex socket screw M3x6	4
	M0308	Hex socket screw M3x8	12
	M0312	Hex socket screw M3x12	4

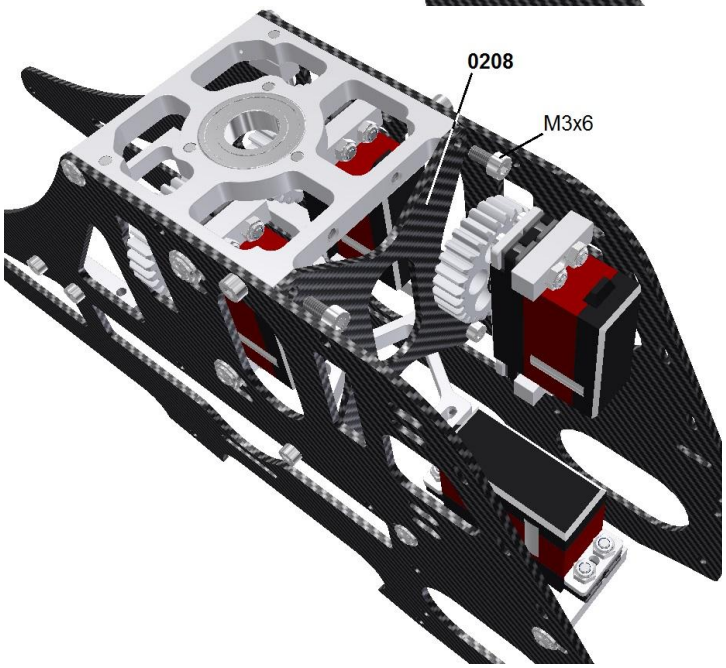


The bearings 12x24x6 for the rotor shaft will be pressed into the bearing plate until they are aligned with the upper surface. By heating up the plate the work will become easier.
Three M3x6 lens head screws secure the bearings from sliding either upwards (lower plate) or downwards (upper plate).
Attention! The three M3 holes in the plates have a sunk on one side to allow the head of the screws resting on the plate in any case. Take care to use the plates in the right direction and insert the security screws from this side.
The two fixation blocks 0206 used later on for the front X-stiffener will be screwed from below to the upper bearing plate.
Take care to align the outer edges of the blocks with the outer edges of the bearing plate while tightening the M3x12 screws.
This can easily be ensured if you place the bearing plate on an even plate with the outer edge and press it down together with the block during tightening.

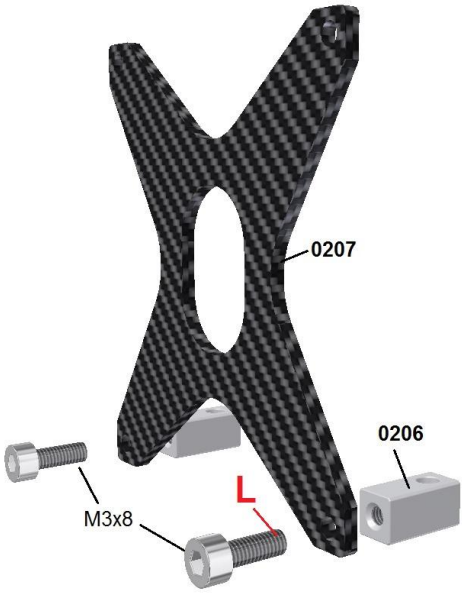
Chassis mount

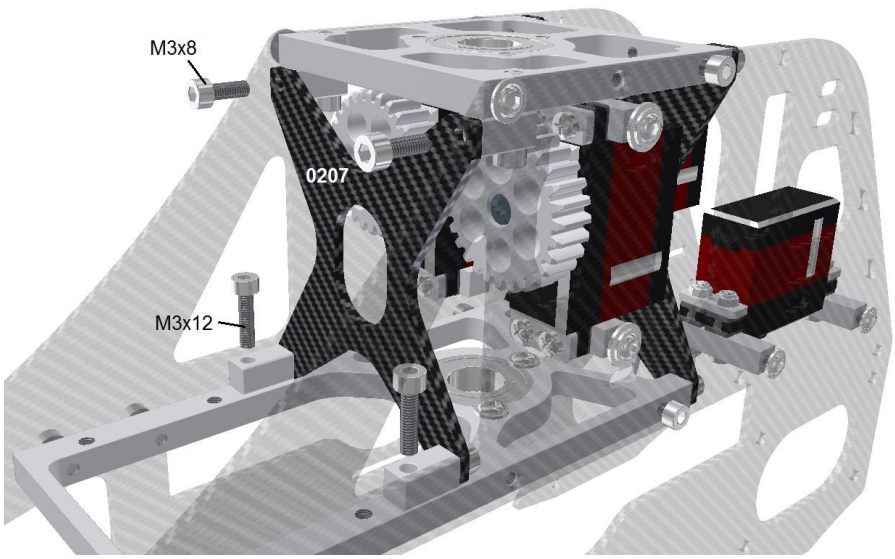


The two chassis plates will now be connected with the two bearing plates.
Check with the drawing which screws will be placed in which holes.
Use a M3x8 lens head screw at the front and a M3x8 Allen screw at the rear of the upper bearing plate. The center hole remains unused.
Use three M3x8 Allen screws for the lower plate on each side. The third hole counted from front remains unused.
Torque the screws carefully and alternating to prevent tensioning of the chassis.
There is no need to use **L**octite for these screws as the screws are under tension during operation and will not get loose.



The rear (higher) X-stiffener 0208 will be screwed at all four corners with M3x6 Allen screws directly to the upper and lower bearing plates (picture left).
(use some **L**octite at this position).
The front (shorter) X-stiffener 0207 will be screwed with two fitting blocks 0206 (picture left below).
Take care to align the blocks parallel to each other. Position the X-stiffener on an even plate and press down the two blocks with two fingers while tightening the two M3x8 Allen screws.
Slide the X-stiffener with the two blocks facing downwards and forward between the two chassis plates. Screw them with M3x8 screws to the already mounted blocks at the upper bearing plate and with M3x12 screws to the upper side of the lower bearing plate (use **L**octite).

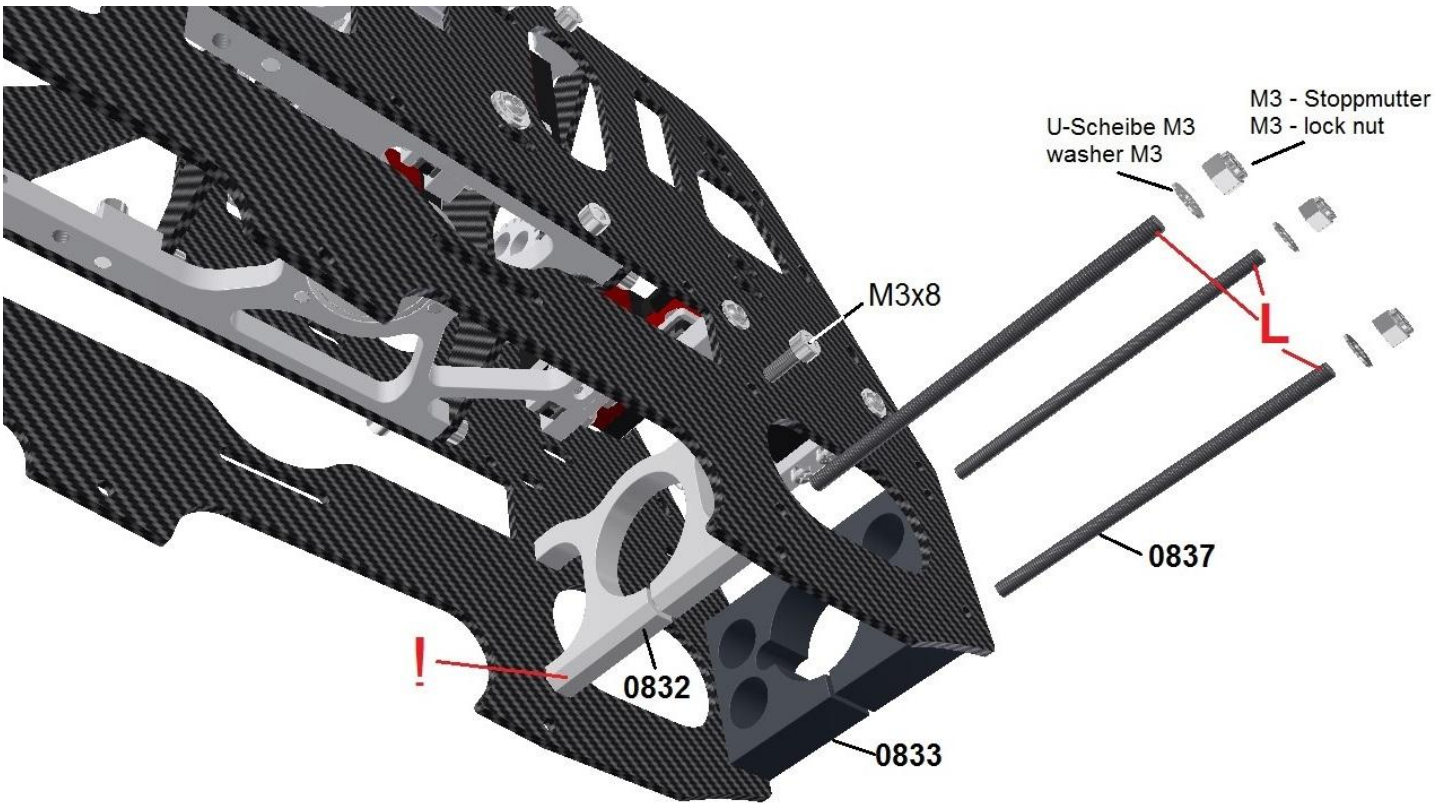




Tail boom mounting flange

(Assembly group 8)

	0832	Boom clamping flange front	1
	0833	Boom clamping flange rear	1
	0837	Thread rod M3x72	3
	M0308	Hex socket screw M3x8	2
	NS03	Nyloc nut M3	6
	W03	Washer M3	6



Mount the two tail boom clamping flanges with the slots facing downwards between the two chassis plates.

Attention! The large chamfer of the front clamping flange 0832 has to face forward.

Screw a lock nut just on one side of each M3x72 thread rod. The end of the thread rod should protrude about 0,5mm above the nut. Secure the nut additionally with Loctite. Keep in mind on which chassis side you positioned the additionally secured nuts.

Use a washer M3 for each nut. The rear clamping flange 0833 will be positioned with two thread rods. Just one thread rod will be used at the front clamping flange in the lower hole.

Screw a M3x8 Allen screw in the upper hole which has a M3 thread.

Place a washer and a lock nut at the opposite side of the thread rod without additional Loctite.

Do not tighten the nuts so the flanges are still fitted loosely. The nuts will be tightened later on when mounting the tail boom.

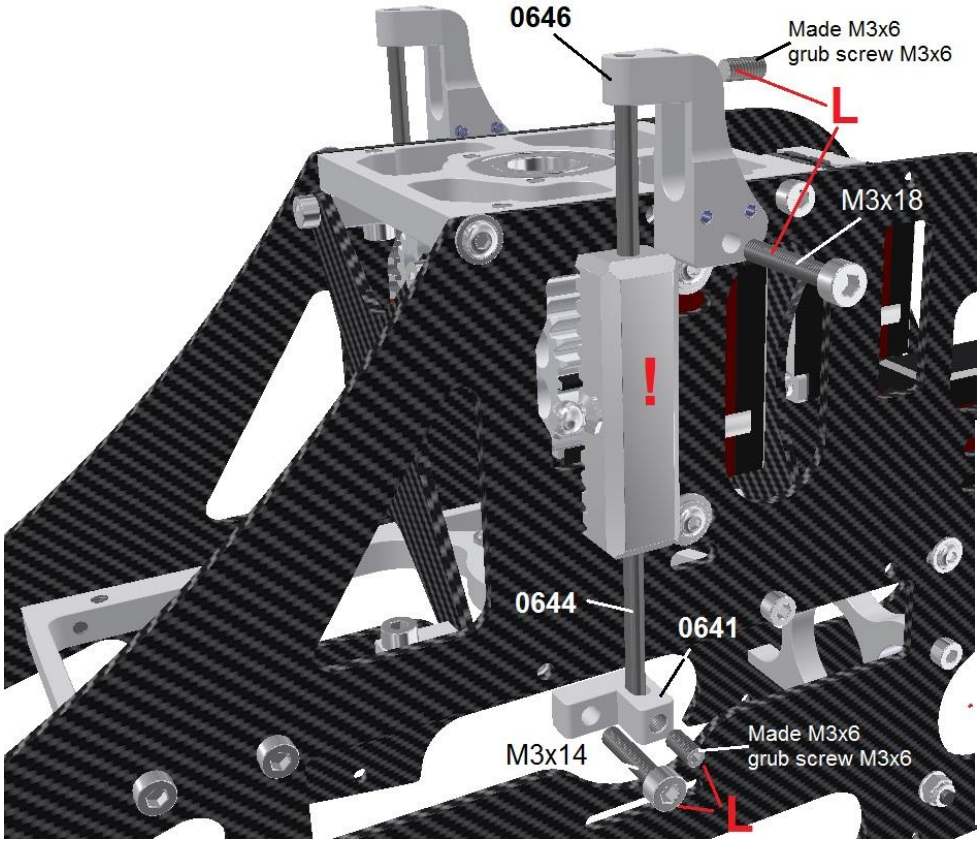
Chapter – 5 **Swash plate linkage**

Aileron servo tooth rack

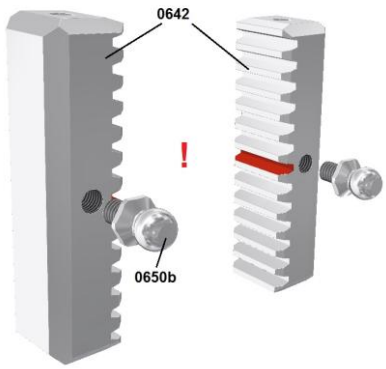
(Assembly group 6)

	0641	Support for roll toothed rack guide rod	2
	0642	Toothed rack	2
	0644	Toothed rack guiding rod 3x98	2
	0646	Support for elevator toothed rack guide rod	2
	0646a	Pin 2x12	4
	0650b	Threaded ball link M3x4 – 4 mm long	2
	M0318	Hex socket screw M3x18	2
	M0314	Hex socket screw M3x14	2
	M0306	Grub screw M3x6	4

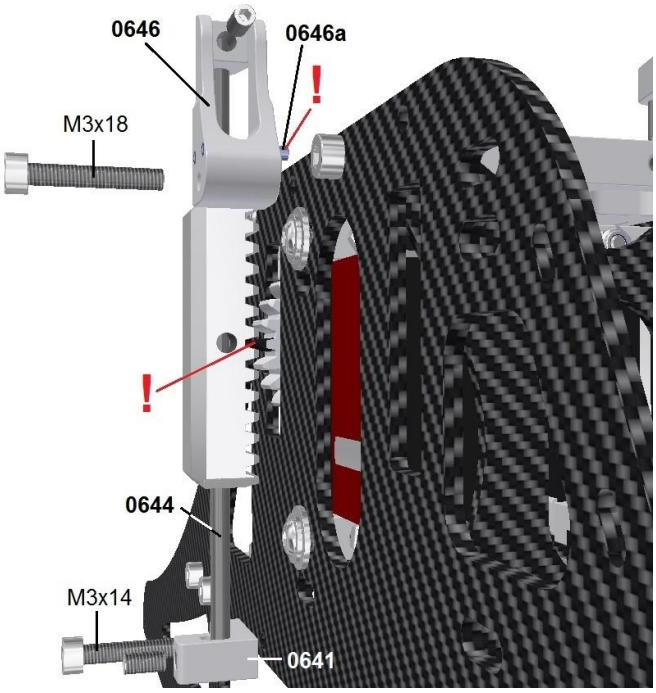
Following the tooth racks of the two aileron servos will be mounted mirror inverted at the outer sides of the chassis (see also additional views at the next page)



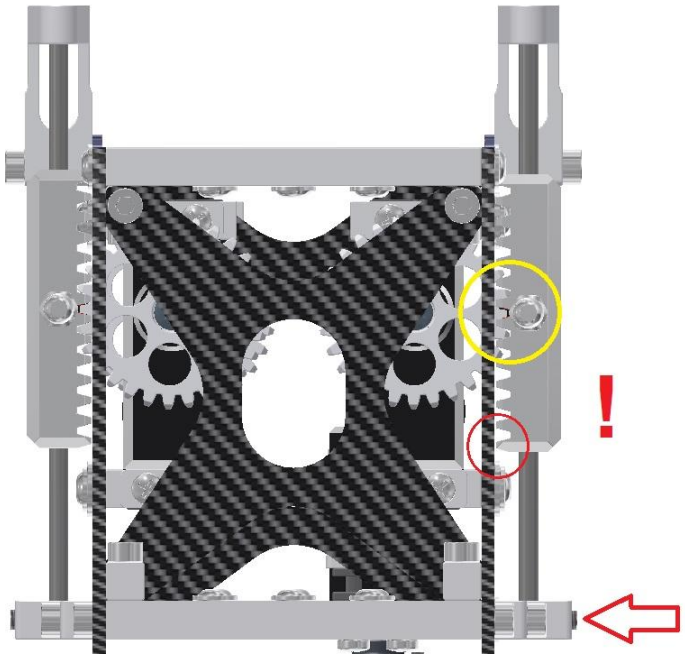
View to the left chassis side



Attention! Screw in the threaded ball link 0650b carefully into the tooth racks 0642 for not over torqueing the threads in the plastic material.
Therefore the tooth racks will be delivered with installed ball link. Additionally they are secured with special superglue for plastic material.
Please do not loosen or tighten them again.



View from the rear to the left chassis side



View from the front to the mechanics

First the two guide rods 0644 of the tooth racks will be fixed to the brackets 0646 of the guide rods for the aileron tooth racks. The end is of the rod has to be positioned flushed with the upper side of the bracket.

Secure the grub screw M3x6 with some **L**octite. But do not use too much of it!

Before sliding on the tooth racks 0642 with the pall pins 0650b facing towards the front of the mechanics grease the rods with Dry Fluid Gear.

Both brackets are furnished with a pin 2x12mm respectively. They stick out on one side by 2mm. These pins have to face towards the mechanics. They secure the bracket from tilting by supporting on the edge of the chassis plate.

Attention! The brackets 0646 will now screwed be with a M3x18 Allen screw respectively (use **L**octite). Align the center tooth gap of the tooth rack with the marked tooth of the servo gear of the aileron servo (see also the yellow circle in the right picture).

Slide the bracket 0641 on the guide rod 0644 from below and align the hole for the M3x14 screw with the hole in the chassis. Before tightening the M3x18 screw align the upper bracket so that the guide rail is not bended.

Tilt the bracket 0641 in a horizontal position to allow the spring steel spindle moving in the long hole without jamming. Tighten now the M3x14 screw (use **L**octite). Hold the bracket with an even parallel collet to prevent the bracket from tilting if necessary.

The M3x6 grub screw will be screwed in the hole until touching the spring steel spindle slightly (see red arrow in the right picture).

Tighten the grub screw until the tooth rack is touching the servo gear without play. You can check this easily by tilting the tooth rack around the spindle. There should be no play. Starting from this point you can tilt the grub screw a half turn to give the spring spindle a little initial tension.

Attention! Slide the tooth rack down to the lower stop and check if the lowest tooth (red circle in the right picture) is not clamping at the chassis plate. It doesn't matter if the tooth is touching the plate but in no case it should be clamped. In this case turn back the grub screw until the tooth rack is no more clamping.

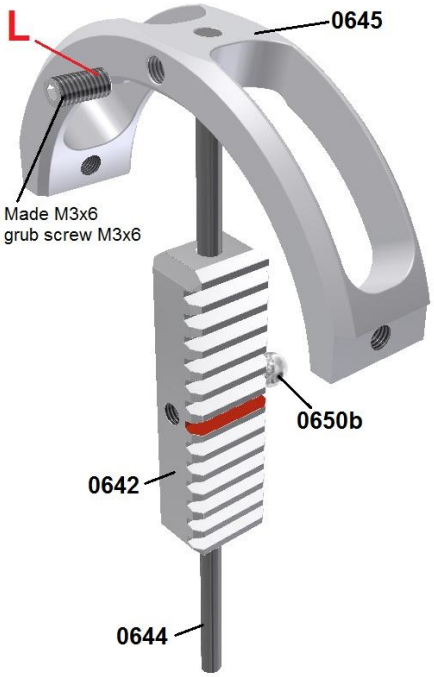
Note: In case of too much play of the tooth rack even with a maximum tightened grub screw, the servo is positioned too much to the center of the mechanics. In this case move the servo on the servo mounting brackets to the outside so the servo gear is looking more outside the chassis.

The width of standard servos should not be more than 20,5mm. Otherwise the servo will touch the chassis plate and cannot be moved more to the outside.

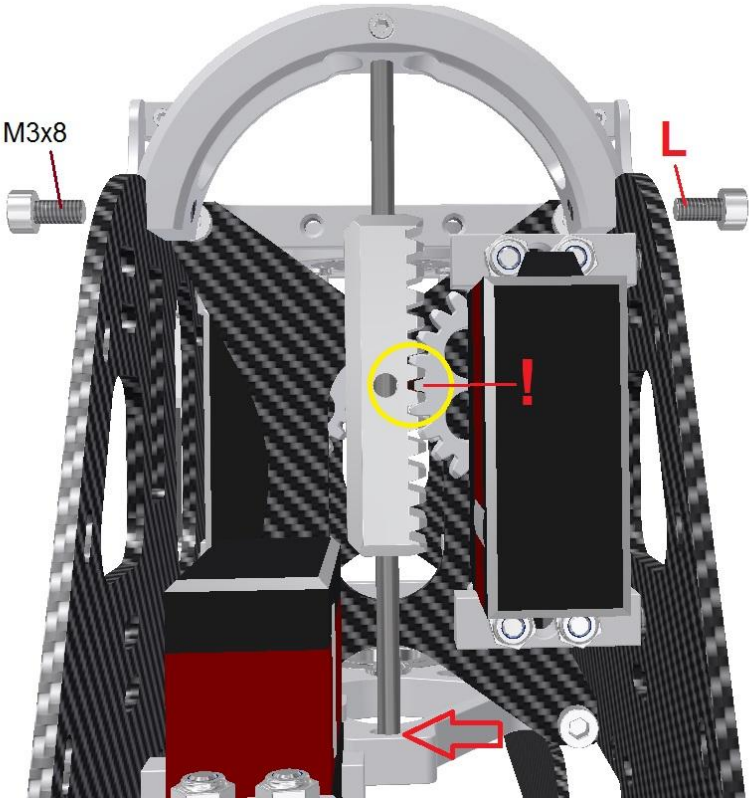
Elevator toothed rack

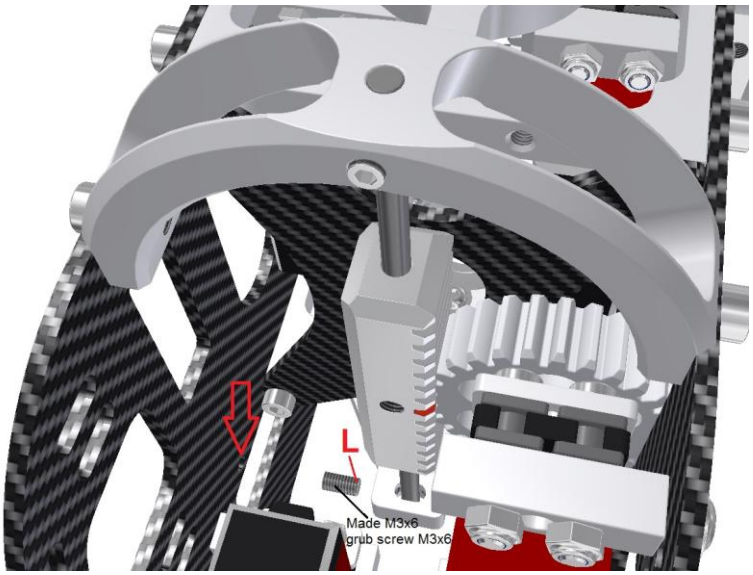
(Assembly group 6)

	0642	Toothed rack	1
	0644	Guiding rod 3x98	1
	0645	Support for elevator toothed rack guid rod	1
	0650b	Threaded ball link M3x4 – 4mm long	1
	G0306	Grub screw M3x6	2
	M0308	Hex socket screw M3x8	2



The unit of the elevator tooth rack will be prepared similar to the aileron servo ones (picture above).





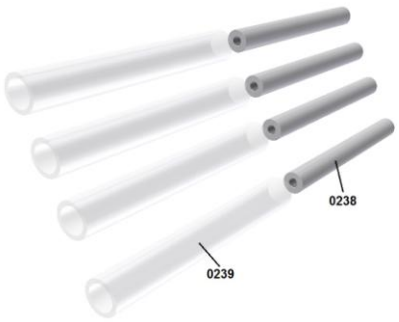
Mount the bracket 0645 between the two chassis plates. Align the center tooth gap of the tooth rack 0642 with the marked tooth of the servo gear of the elevator servo (yellow circle) and the guide rod 0644 is inserted in the long hole of the lower bearing plate (red arrow, right picture).
Insert the grub screw M3x6 with a socket wrench through the hole in the chassis plate (red arrow – picture on the left) and screw it into the lower bearing plate until touching the guide rail slightly.
There should be no play. Starting from this point you can tilt the grub screw a half turn to give the spring spindle a little initial tension.

Chapter – 6 **Chassis lower section**

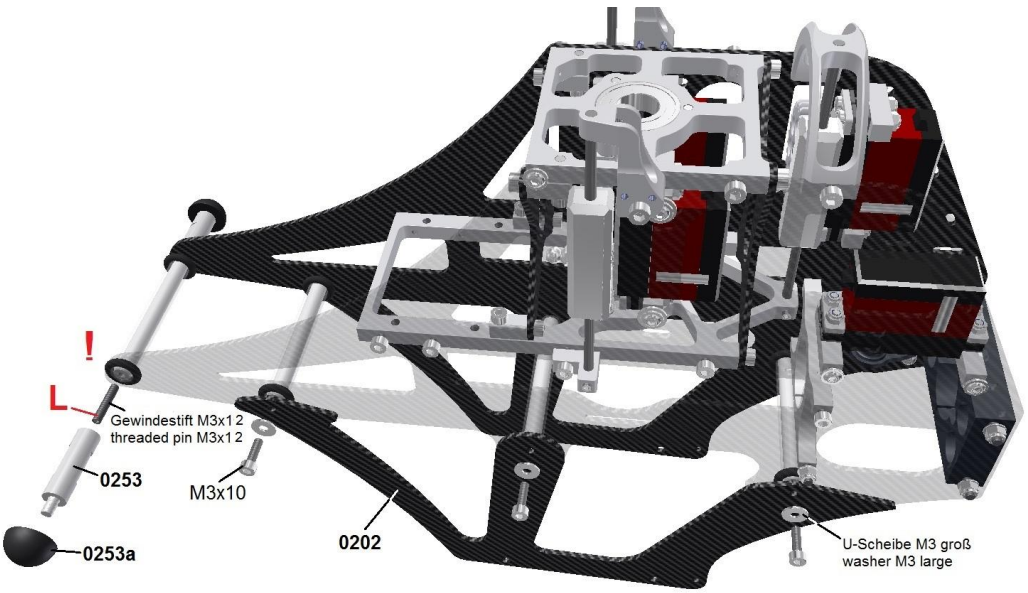
Lower Chassis

(Assembly group 2)

	0202	Lower carbon frame	2
	0203	O ring 7x3	6
	0238	Spacer 6x58	4
	0239	Silicon tube 58mm	4
	0253	Canopy mounting bolt front	2
	0253a	Rubber end cap	2
	G0312	Grub screw M3x12	2
	M0310	Hex socket screw M3x10	6
	WL03	Washer M3 large	6



Slide the silicone tubes 0239 on the bolts 0238. On three of the bolts slide also respectively two O-rings 0203 aligning with the bolt ends.



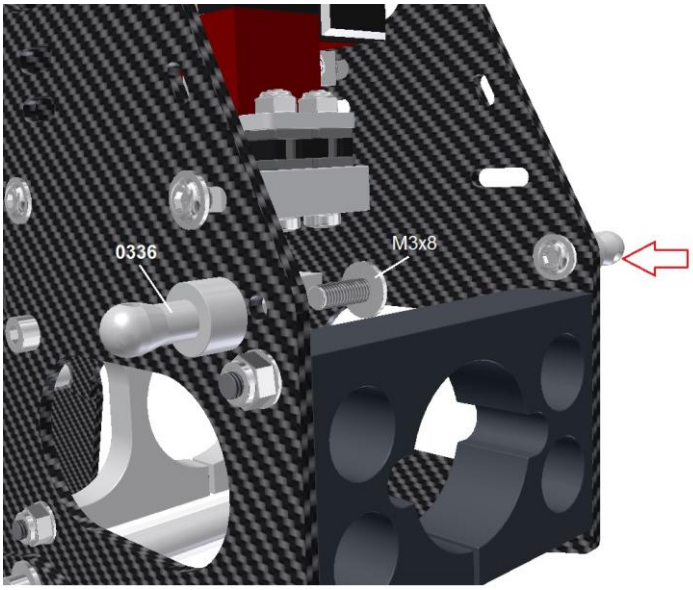
As you can see on the picture the lower chassis plates will be placed on the two upper chassis plates from the outside and will be connected with the bolts 0238 (for better visualization the left upper chassis plate is shown transparent).

Attention! The bolt without O-rings will be mounted at the third position, counted from the front. The front spacer will be fixed with the two canopy holders 0253. Screw the threaded pin M3x12 by using **L**octite about 5mm deep into the two canopy holders. Ensure the Loctite is dried before you screw the spacer with the unit. Do not use **L**octite on this side.

Canopy mount back

(Assembly group 3)

	0305	Rubber grommet for canopy	2
	0336	Canopy mount	2
	0336a	R-Clip	2
	L0308	Lense head screw M3x8	2

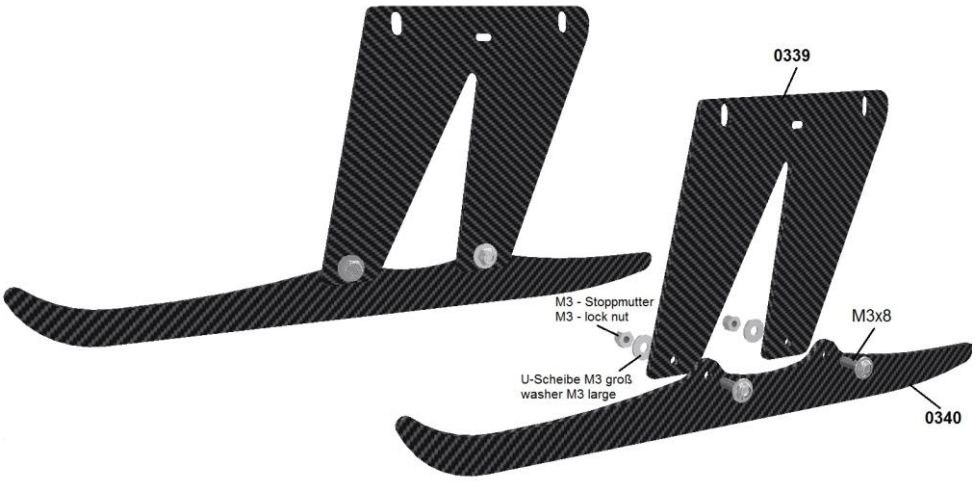


The two rear canopy fittings 0336 will be fixed by a lens head screw M3x8 respectively.
Turn the fitting in a position so the hole for the safety splint is facing forward in longitudinal direction of the mechanics (red arrow).

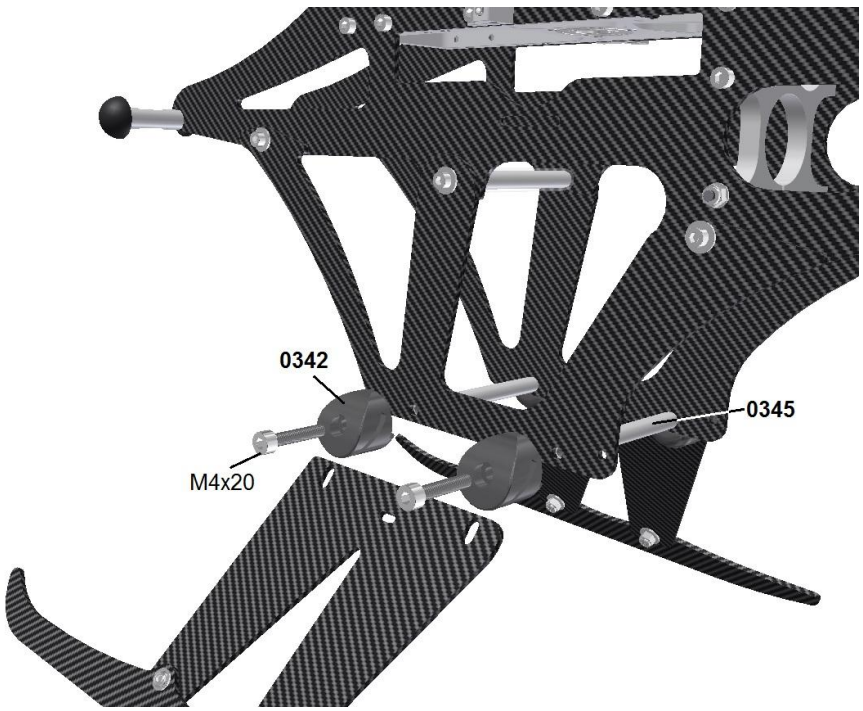
S k i d s

(Assembly group 3)

	0339	Skid plate	2
	0340	Skid	2
	0342	Skid plate holder	4
	0345	Stud 6x62	2
	M0420	Hex socket screwn M4x20	4
	L0308	Lense head screw M3x8	4
	NS03	Nyloc nut M3	4
	WL03	Washer M3 large	4



The skids 0340 will be screwed from outside with the lens head screws M3x8 to the skid plates 0339.

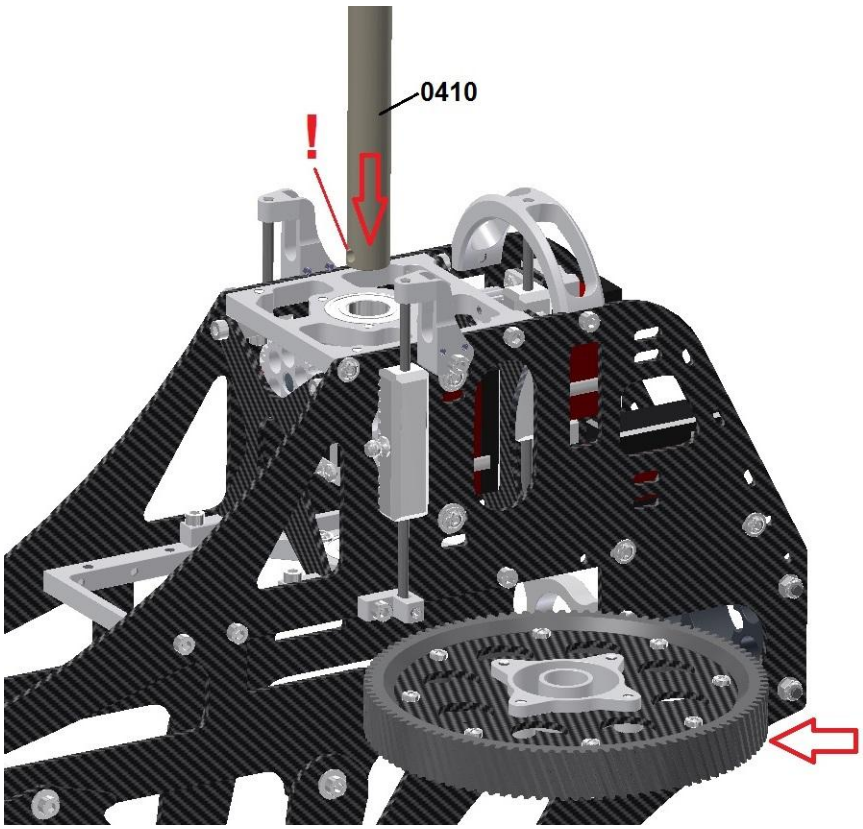


Slide the skid brackets 0342 in the area of the long hole onto the skid plate until the stop. Check if the M4 screws can be put through.
Afterwards the brackets will be screwed to the 6x62 spacers 0345. Possibly the screws have to be torqued again after a while as the plastics can be set.
There is no need to use Loctite for these screws as they will not get loose due to the pre tensioning. Even for dismounting you don´t have to fix the spacers with a collet than.

Chapter – 7 **Installation of rotor shaft unit**

Mount the main shaft unit into the chassis (Assembly group 4)

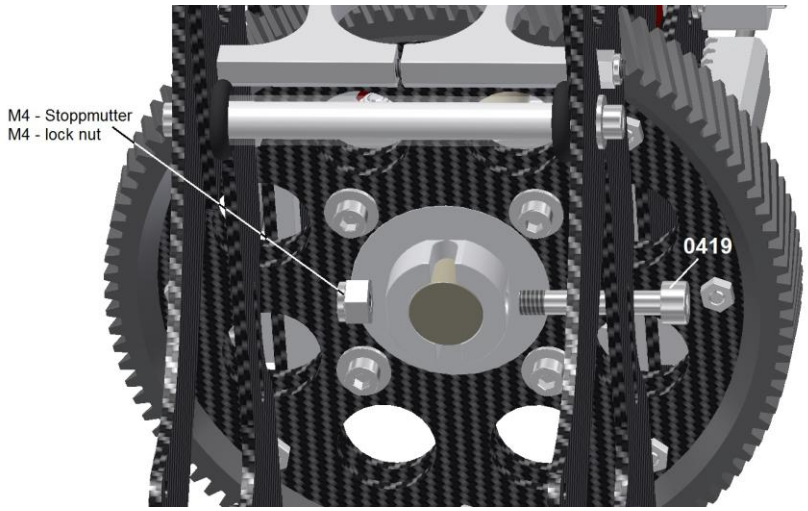
	0410	Main shaft 12x171	1
	0407	Spacer 12x15x42,5 (PEEK)	1
	0419	Hex socket shanked screw M4x23 / 10.9	1
	0136	Hex socket shanked screw M4x23 / 10.9 (Assembly group 1)	1
	NS04	Nyloc nut M4	2
	W04	Washer M4	2



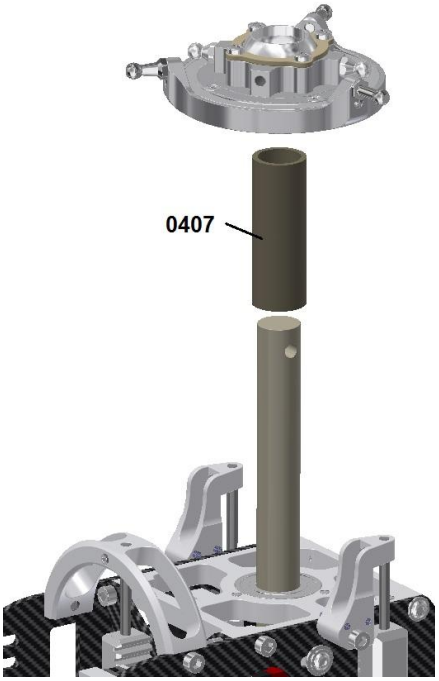
Slide the assembled main gear into the mechanics from the side until the flange is aligned with the bearing of the lower bearing plate (see picture left).
Slide die rotor shaft 0410 through both bearings from above into the flange of the main gear.

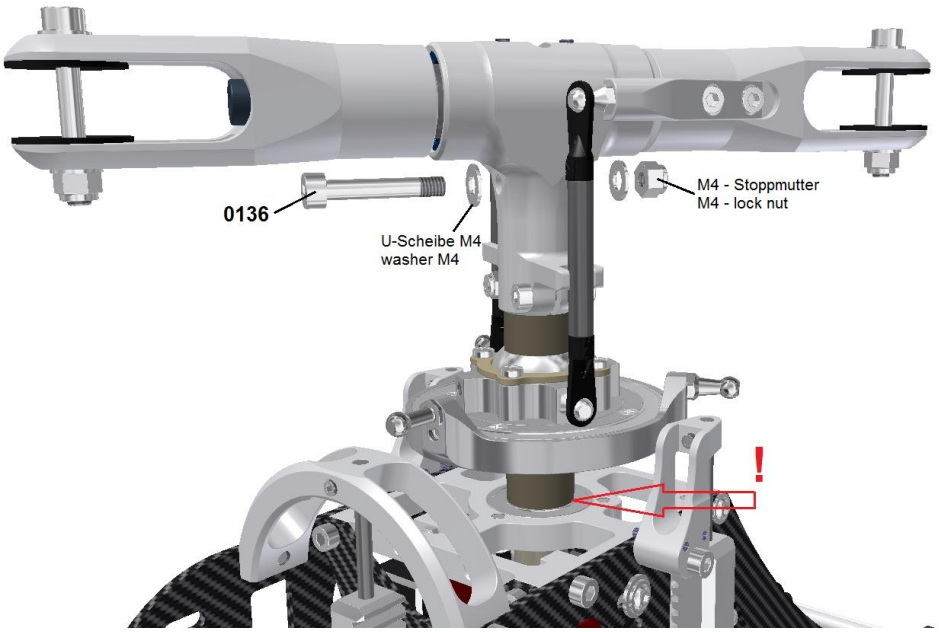
Attention! The holes on each side of the rotor shaft have a different distance to the shafts end. The side with the lower distance has to face downwards

The shaft should go easy into all components.
Never hit the shaft with force through the bearings or into the flange. The shaft is made of high strength aluminum and will fret easier as a steel shaft.
When the shaft is clamped put it in a drilling machine and polish it with sandpaper 600 or an even smoother one.



The flange has to be clamped hardly by using the special high strength M4x24 shaft screw 0419 and a M4 lock nut.
To align the spanner-flat of the nut with the face at the flange the nut has to be turned accordingly.
This prevents the nut from turning when the screw is tightened by an Allen wrench from the side.
A dedicated slot is in the chassis plate.





Slide the spacer 0407 on the rotor shaft down to the upper bearing, but do not install the swashplate.

Slide the rotor head on the rotor shaft temporary down until it stops at the bushing. Press the main gear in the mechanics upwards as far as possible. Align the hole of the center piece of the rotor head with the hole of the rotor shaft by tilting the rotor head. Put in the high strength M4x24 shaft screw 0136 through the hole without tightening.

Move the main gear up and downwards to check the size of the play.

Attention! You will find a bag with additional shim rings 12x18x 0,1 / 0,2 / 0,3 in the bag of the rotor shaft unit.

You can eliminate the axial play with these shims when necessary by putting them between the spacer and the upper rotor shaft bearing (see red arrow, right picture). You can eliminate a play from 0,1 to 0,6 by using different combinations of the three shims.

To prevent from dismounting the rotor head each time you can put the shims between the spacer and the bearing from the side until you investigated the right total shim thickness. After that you can remove the rotor head and the spacer and place the shims finally under the spacer.

Position the swash plate and the rotor head and tilt the shaft screw tight. Use M4 lock nut and two M4 washers respectively.

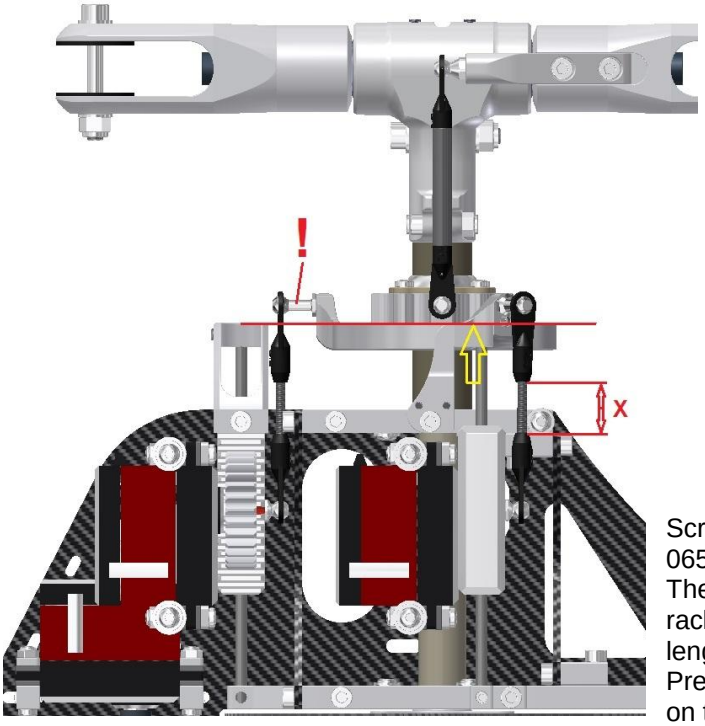
Grease the spacer on the outer surface with Dry Fluid Gear to get a smooth sliding swashplate.

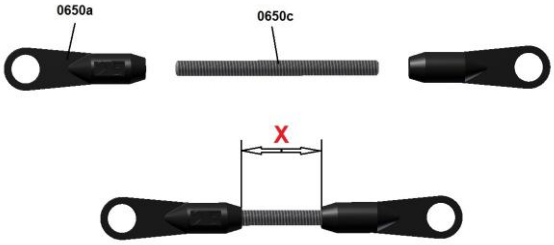
Attention! To clamp the center piece of the rotor head additionally to the rotor shaft tilt the two M3x14 Allen screws alternating step by step.

Finally press the control rods (assembled in the first assembly group) onto the ball pins. The characters (2,5) should be on the outside to reduce the necessary force for pressing.

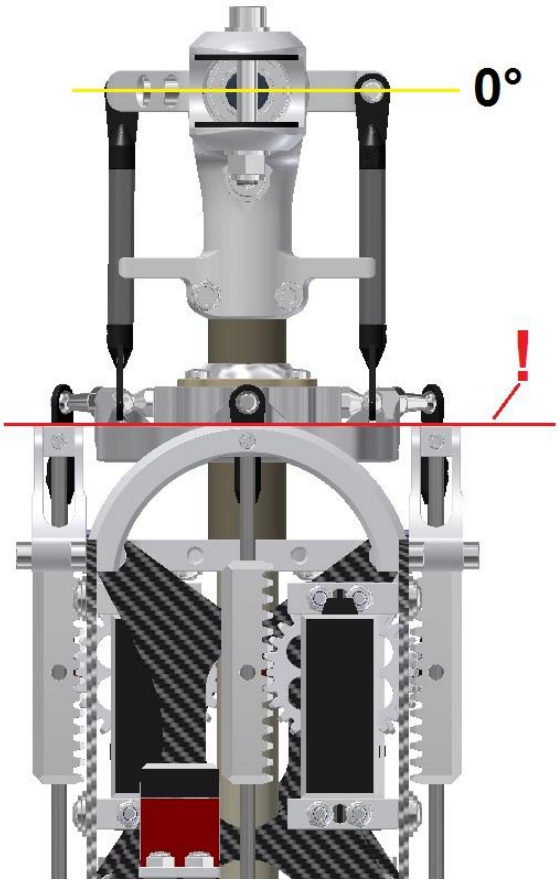
Fix the control rod first at the rotor head and then at the swashplate to allow the sliding of the rod into the crank of the center piece. When removing the control rod proceed vice versa which means first at the swashplate then at the rotor head. When adjusting the rod just loose it at the swashplate.

	0650a	Ball link 19mm	6
	0650c	Stud bolt M2,5x33	3





Screw respectively 2 ball ends 0650a on the three thread rods 0650.
The distances „**X**“ are depending from the position of the tooth rack, which level can vary do to the servo type used. Adjust a length of 13mm on all control rods at first.
Press the control rods with the characters “2,5” facing outside on the ball pins of the tooth rack.
Attention! The outer ring of the swashplate has to be tilted so that the special ball pin with the slim cylindrical shaft is facing backwards towards the elevator servo (left upper picture). Align roughly by visual judgement. The fixation will be done later on by the swashplate guide (see next page).

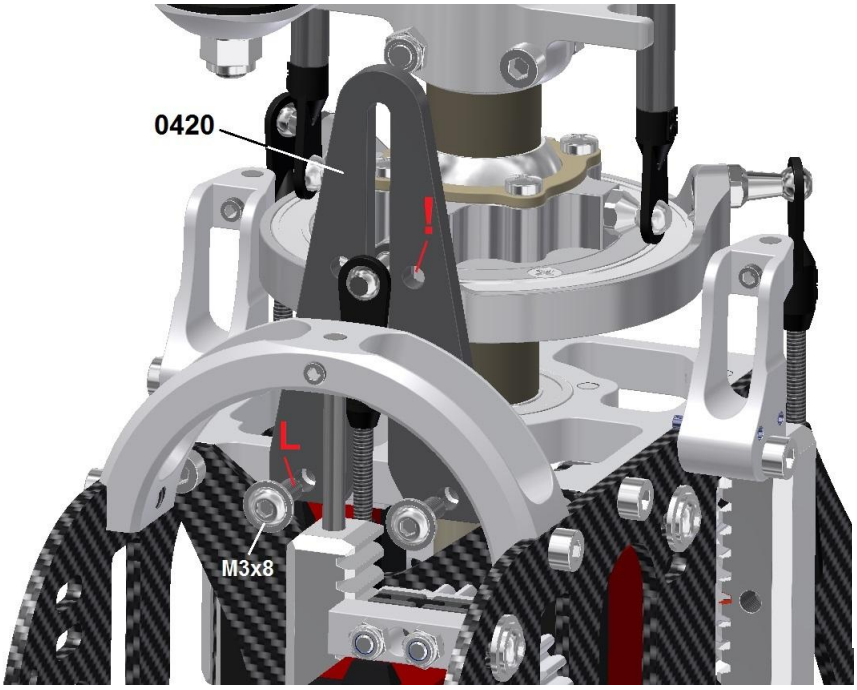


Center the three swashplate servos in neutral position (center of the collective stick). You can do in the same manner as for the mounting of the servo gear or you can connect the servos to your FBL system and adjust the servos to neutral position in e.g. the setup menu.
Adjust the length of the control rods until the swashplate is in a horizontal position and the upper side of the swashplate bearing face is align with the upper edge of the bracket of the guide rail. (see red line in the pictures for the different axis’s).
These three upper edges build the reference level (see also yellow arrow) so there is no need for a gauge for the swashplate adjustment.
When this basis adjustment is done properly the two blade grips stand at a 0° angle (yellow line in picture left). Fine corrections can be done at the control rods between swashplate and blade grips.

Swash plate anti twist guide

(Assembly group 4)

	0420	Swash plate anti-twist guide	1
	L0308	Lense head screw M3x8	2



The swashplate guide 0420 will be positioned from above over the special ball pin and fixed with two M3x8 lens head screws to the upper bearing plate (use **L**octite).

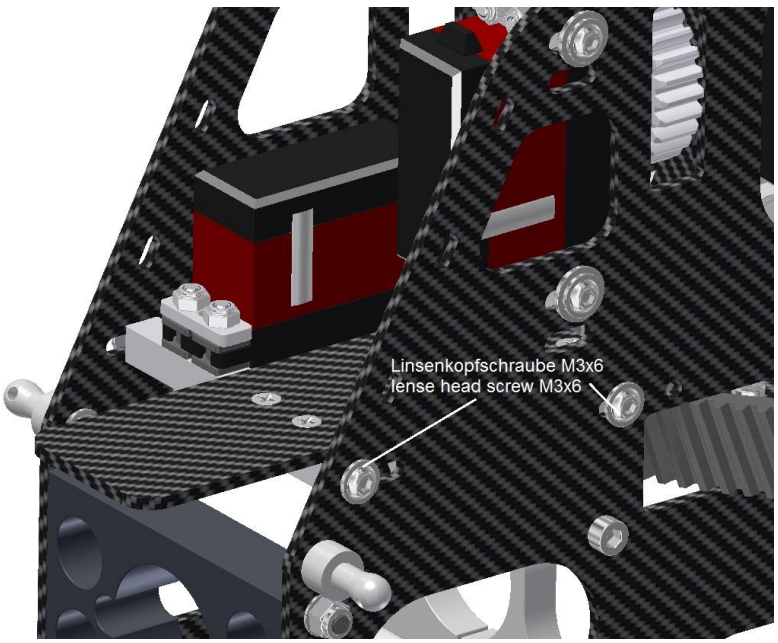
Attention! The two additional holes are used as marking for the neutral position of the special ball pin.

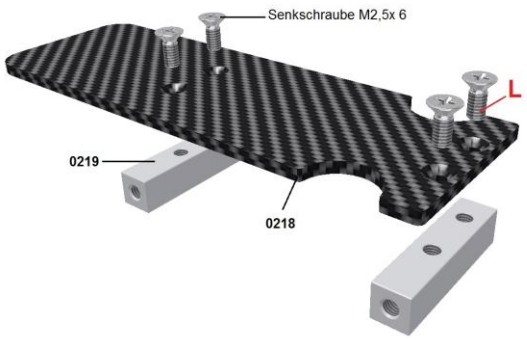
If you look at the mechanics exactly from the rear and the special ball pin is on the same height as the two holes than the swashplate is in neutral position. The references for the front ball pins are as described on the last page the two brackets of the guide rails.

Plate for the FBL–system

(Assembly group 2)

	0218	Plate for FBL- system	1
	0219	FBL- plate fixation	2
	C2506	Countersunk head screw M2,5x 6	4
	L0306	Lense head screw M3x6	2





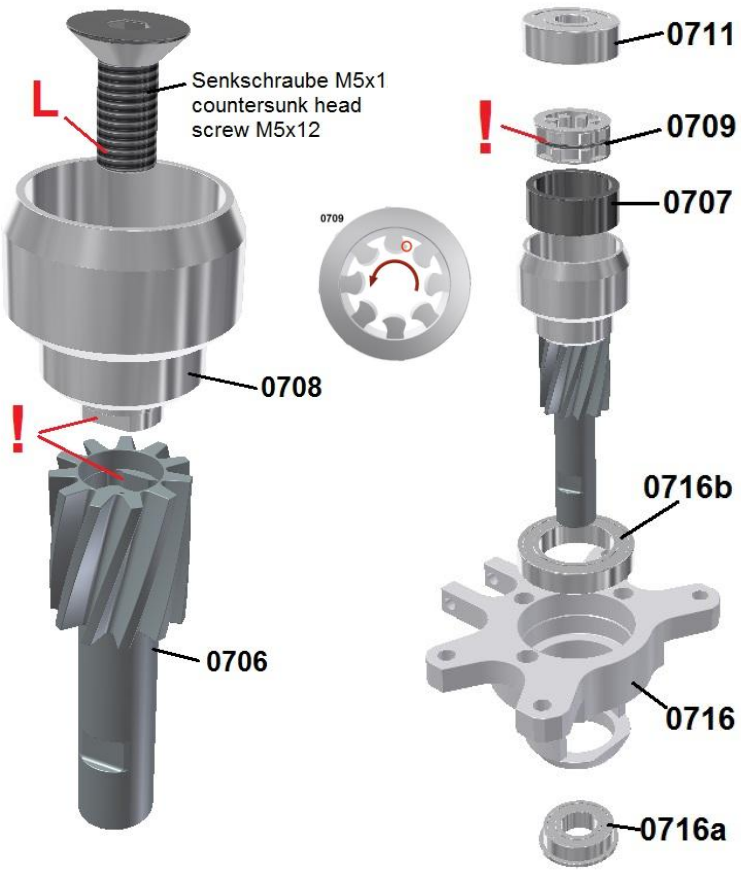
The carbon plate 0218 will be screwed with the M2,5x6 countersunk screws to the two brackets 0219 (use **L**octite).
Take care that the M3-threads at the front end are facing to the right side as shown in the picture above.

Chapter – 8 **Motor pinion unit + motor**

Motor pinion unit

(Assembly group 7)

	0706	Pinion shaft	1
	0707	One way drive bush	1
	0708	One way drive housing	1
	0709	One way drive	1
	0711	Radial bearing 6x17x6	1
	0716	Motor mount	1
	0716a	Flange bearing 8x16x5	1
	0716b	Radial bearing 15x24x5	1
	C0512	Countersunk head screw M5x12	1
	M0430	Hex socket screw M4x30	3



To ease the removing the both bearings 0716a and 0716b from the motor support 0716 heat up the support.

The pinion shaft unit is generally delivered complete mounted and greased.
The drawings show the buildup to be able to exchange parts when needed e.g. a damaged free wheel 0709. It is a clamp body free wheel which has small dimensions but can transmit high loads. Just when during a crash the rotor is suddenly blocked overloads can occur by the inertia of the rotating motor bell.
The hardened free wheel sleeve 0707 is generally pressed into the free wheel housing 0708 by us. It is not possible to remove the sleeve. So when a sleeve is worn the assembly sleeve and housing has to be exchanged.

The free wheel 0709 itself can be exchanged. Therefore the centering bearing 0711, looking 3mm out of the housing, has to be removed first and then you can pull out the free wheel.
This can be done easily by putting a 6mm shaft into the bearing and by moving back and forth the bearing can be pulled out.
Attention! There is a top view of the free wheel 0709 shown between the two drawings. The red arrow shows the turning direction of the motor shaft. The clamp bodies have a small tip on one side (red circle). They have to face according to the drawing against the direction of the arrow.

Attention! The pinion shaft 0706 has an accurately fitting dent with two spanner flats resulting in a form lock connection to the counter piece at the free wheel housing. A slippage is therefore not possible.

Assemble these parts carefully to prevent a damage of the fit.

The counter sunk screw M5x12 (use **L**octite) connects the two parts. Tighten the screw strongly. Therefor fix the pinion gear at the shaft (not at the pinion) with two wooden brackets in a bench vice to prevent the shaft fit from damages.

Grease the shaft of the pinion with graphite grease or similar (already done by us) to prevent the bearing seat from corrosion. The shaft and the free wheel housing are manufactured from stainless steel, but the bearings build up a corrosion layer at the inner ring quickly.

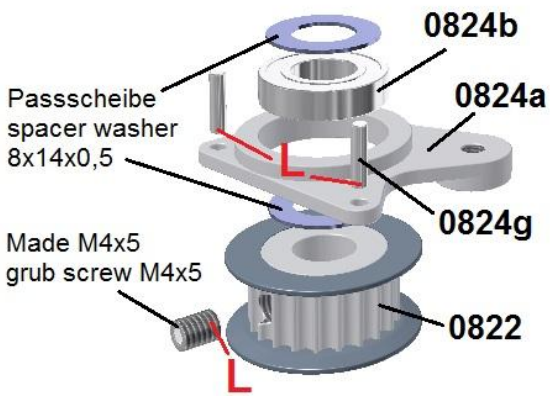
Toothed tail belt disc + belt tensioner

(Assembly group 8)

	0822	Toothed belt disc 21-T	1
	0824a	Upper belt tensioner flange	1
	0824b	Radial bearing 8x16x4	2
	0824g	Pin 2x8	2
	SW081205	Spacer washer 8x14x0,5	2
	G0405	Grub screw M4x5	1

The bearing 0824b will be pressed into the upper flange of the belt tensioner. Press the two 2x8mm pins 0824g into the respective holes (use **L**octite).

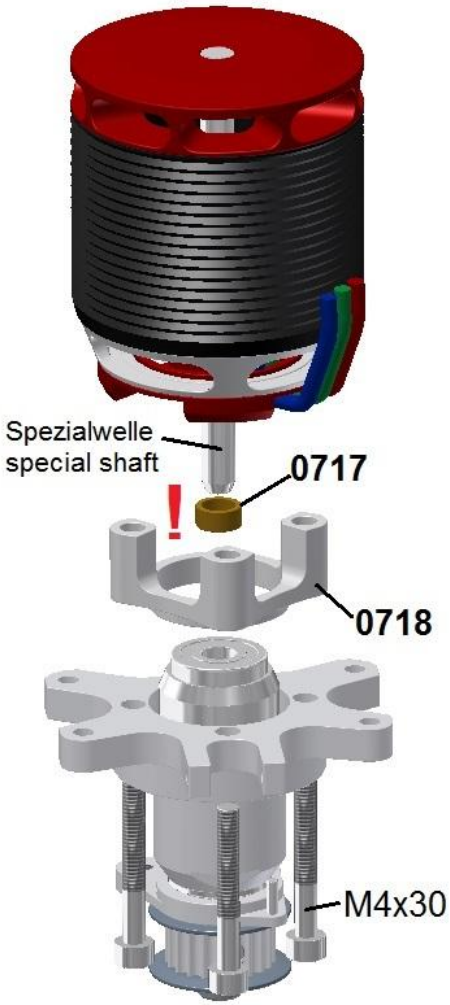
Slide the parts (left lower picture) onto the pinion shaft with a shim ring 8x14x0,5 placed above and below the bearing.
Finally slide the belt disc 0822 onto the shaft and fix it with a M4x5 grub screw on one of the flats of the shaft.
Note: When tightening the grub screw press the pinion shaft unit softly at the free wheel housing and the belt disc together to prevent axial play. Tighten the grub screw with strength (use **L**octite).
The picture below shows the assembled unit.



Motor mount

(Assembly group 7)

	0718	Motor support	1
	0717	Spacer 6x8x3,7mm	1
	SW061205	Spacer washern 6x12x0,5	1
	SW061210	Spacer washern 6x12x1	3



The TDF-Motorshaft must comply the following conditions:

- complete length of the shaft from motor shield = 20mm
- 20° chamfer / 2mm long at the end of the shaft
- minimum 16mm appropriable length, hardened and grinded to ⌀ 5,99 h5
- in this area there are no flattenings allowed
- minimum hardness depth 0,6mm (60 - 64 HRC)
- the area above the 17mm can be formed as you like

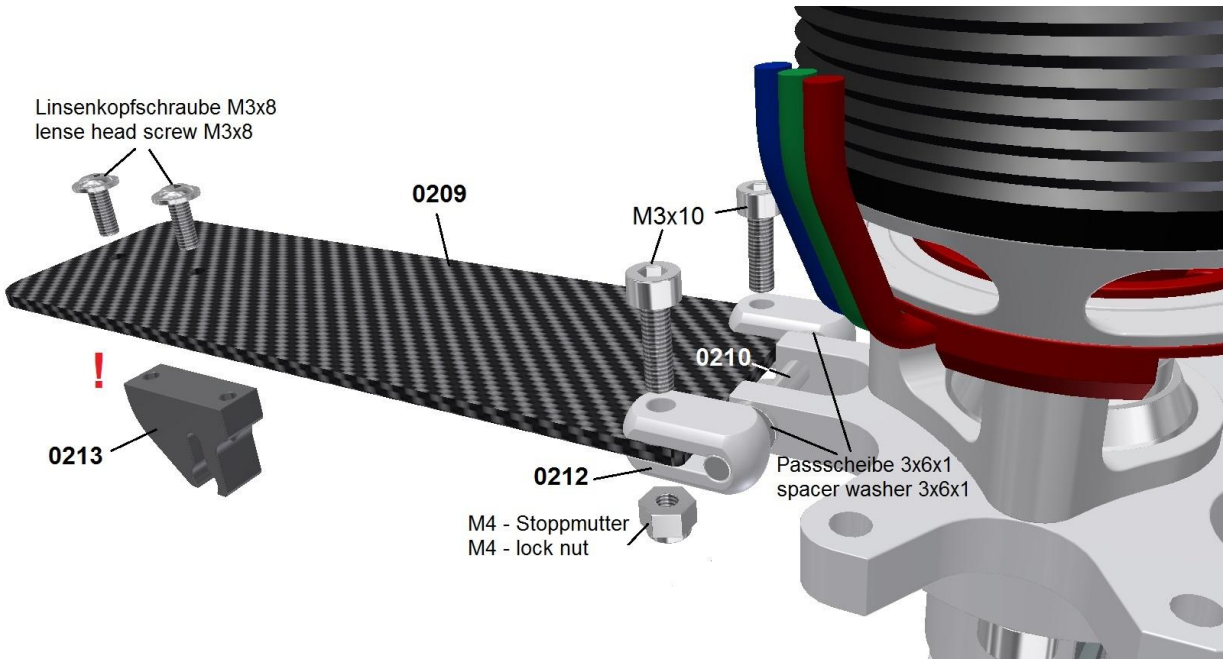
Attention! When inserting the motor shaft into the free wheel the motor should be turned to the right. This helps to spread the conical tips of the clamp bodies.
Don't use brute force otherwise the free wheel will be damaged. Tighten the M4 screws stepwise and alternating to prevent any distortion.
Read the notes in the text on the right!

The recommended PYRO 650 or PYRO 700 motors use a plane continuous 6mm diameter shaft. The fixing collar is exactly flushing with the motor flange.
As the shaft is diving 16mm deep into the free wheel housing there will remain a gap of 4mm between the collar and the bearing.
The fitting of the bearing seat is dimensioned ensuring removing the bearing for exchanging the free wheel. Due to this the bearing can unintentionally move to the top outside the bearing seat.
To prevent this situation a brass spacer 0711 and some shim washers are added to the bag of assembly group 7.
When using one of the recommended PYRO motors you just have to slide the 3,7mm high brass spacer on the motor shaft before mounting the motor to the motor support (see picture on the left).
The motor base 0718 will be positioned with the flange into the turned deepening and aligned according to the three holes. After the tightening with the three M4x30 screws from below the brass spacer should still have an axial play of about 0,3mm.
In no case the ring is allowed to be higher as the gap between motor and bearing. In this case the motor bearing and the bearing of the free wheel spacer would be distorted when tightening the screws.
When using motors of other brands shim washers have to be used accordingly. Some motors have a stepped shaft or a safety ring in this area. In this case use as much shim washers that the bearing 0711 cannot move more than 1mm out of the free wheel housing. To ensure that the bearings are not distorted some play should remain.

ESC plate mount

(Assembly group 2)

	0209	ESC plate	1
	0210	Hinge axis 3x35	1
	0212	ESC plate hinge	1
	0213	ESC plate fastener	1
	SW030610	Spacer washer 3x6x1	2
	M0310	Hex socket screw M3x10	2
	NS03	Nyloc nut M3	2
	L0308	Lense head screw M3x8	2



The lock of the ESC plate 0213 will be screwed with the M3x8 lens head screws to the ESC plate 0209.
(As option you can get a special designed plate for the Kosmik-ESC with the order number 0209K)

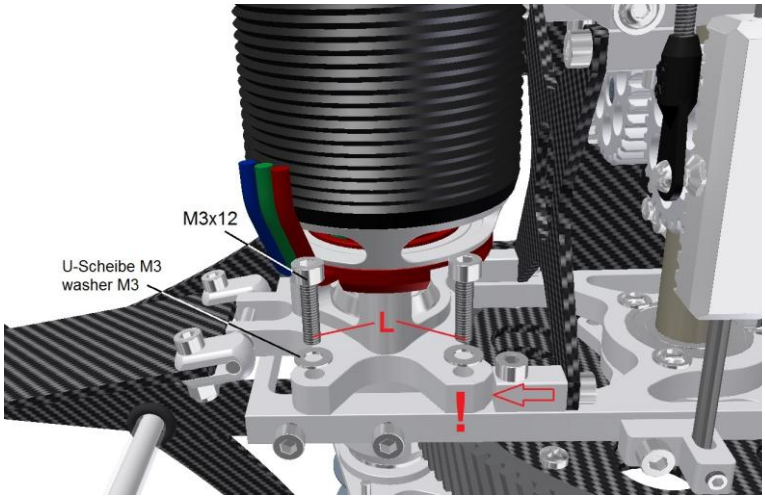
Attention! The screws are cutting into the plastics and have to be tightened carefully to prevent from over winding.

The hinge axle 0210 will be slipped in the cross-hole of the motor mount. Place a shim washer 3x6x1 a on each side followed by the ESC plate hinge 0212. Check the centered position of the axle.

The ECS plate will be pushed into the hinges and screwed tight with two M3x10 screws and two M3 nuts. You can spread the hinges a little bit in case of a too thick ESC plate. If the clamping is not enough to fix the plate properly use a drop of superglue at the front face of the hinge.
The axle should turn easily in cross hole of the motor mount. Apply a drop of dry fluid to the axle.

Installation of the motor unit to the chassis

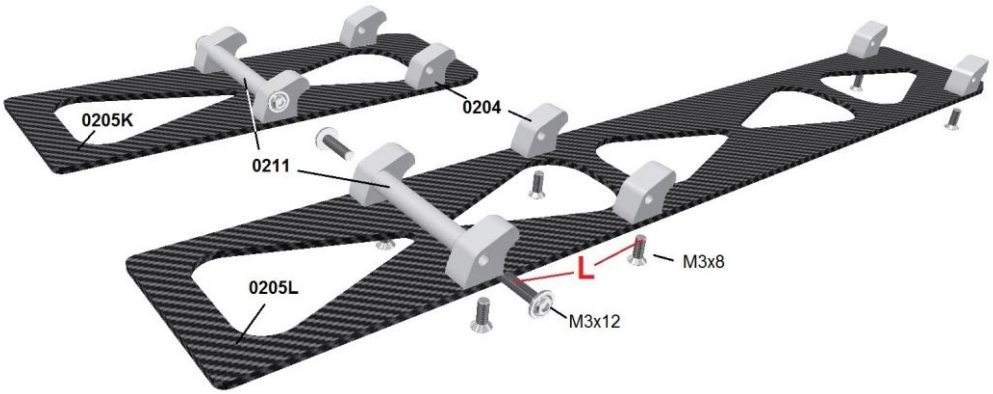
	M0312	Hex socket screw M3x12	4
	W03	Washer M3	4



Insert the motor unit from above into the frame of the lower bearing plate. Due to the support on the plate an exact parallelism between pinion shaft and rotor shaft is given.
The motor mount will fixed on the plate with four M3x12 screws and four M3 washers (use **L**octite).
Attention! The holes in the motor mount are drilled a little bit larger. So you can adjust the play between pinion and main gear a little bit when necessary.
Usually you get a correct adjustment when sliding the mount towards the brackets of the X-stiffener (see red arrow).
The pinion should not clamp at any position of the main gear. Otherwise you can adjust the right play by inserting thickness gauges on both sides to get a reproducible distance. After tightening the screws remove the thickness gauges and note the used thickness. So you can reproduce the situation after a reinstallation of the motor unit easily.

Quick exchange battery tray

	0204	Mounting hook	4 / 6
	0205K	Carbon battery plate (6-7S)	1
		or alternative	
	0205L	Carbon battery plate (8-12S)	1
	0211	Battery tray fixation stud	1
	L0312	Lense head screw M3x12	2
	C0308	Countersunk head screw M3x8	4 / 6



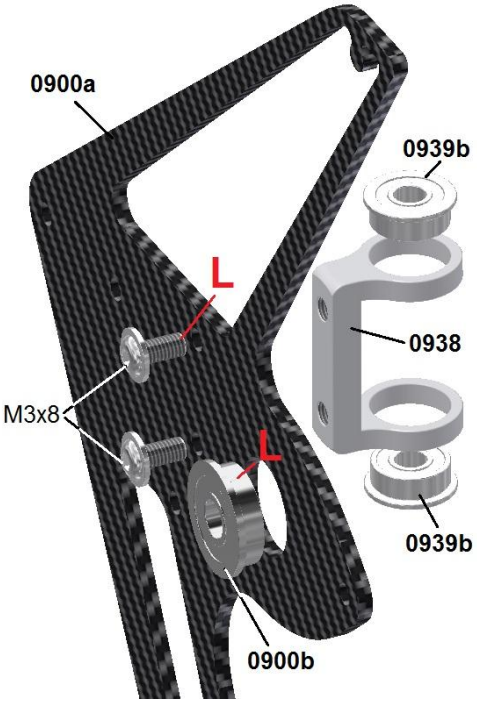
There are two different battery trays. 0205L for long 8S to 12S battery packs, or the 0205K for short 6S or 7S battery packs. In principle the design is identical just the long plates have to additional fixation hooks.
Fix the hooks 0204 with M3x8 counter sunk screws to the plate. Between the two front hooks the locking bolt 0211 will be mounted. To align all hooks in parallel you can use the locking bolt during the fixation of each pair of hooks. Just screw it without **L**octite with the M3x12 lens head screws between the pair of hooks when you fix them to the plate. Tighten the counter sunk screws tight using some **L**octite to fix the hooks properly and prevent them from twisting. Loosen the bolt again and proceed in the same way with the next pair of hooks. Finally the front hooks are mounted and the bolt remains mounted. At this position the M3x12 lens head screws will secured with **L**octite.

Chapter – 9 Tail gear

(Assembly group 9)

Preparation of tail gear housing right

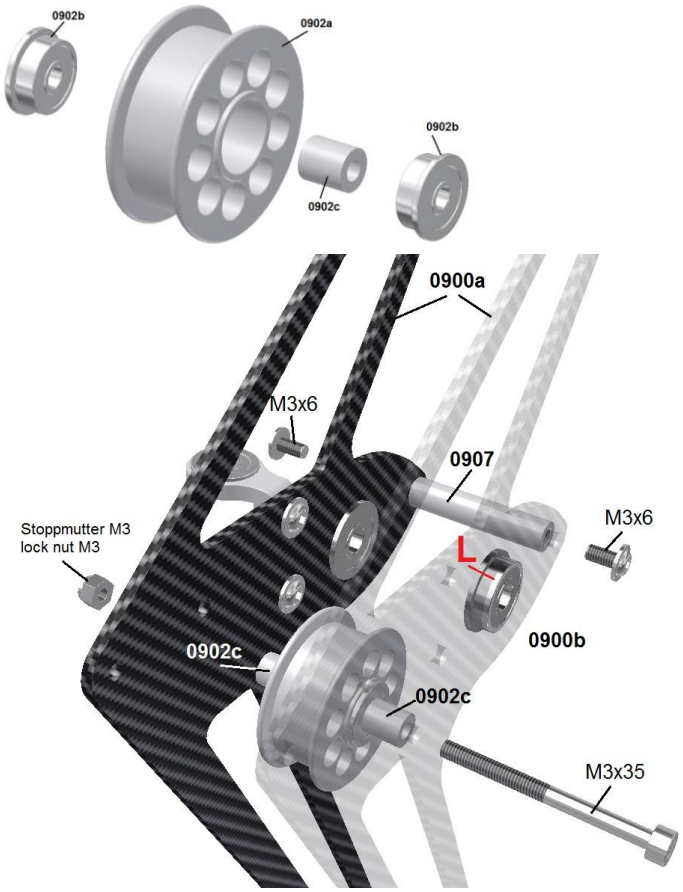
	0900a	Carbon tail gear housing and vertical stabilizer	2
	0900b	Flaged bearing 5x13x4	2
	0938	Bell crank support	1
	0939b	Flanged bearing 4x10x4	2
	L0308	Lense head screw M3x8	2



In the picture left you can see the preparation of the vertical fin plate which will be mounted later on the right side.
The plate is also used as a bearing seat for the tail shaft bearing 0900b, which is already mounted by us by using **L**octite.
Attention! Take care the collar of the bearing is positioned at the inner side of the tail fin. This secures the bearing from moving. The bearing is looking about 1mm outside the outer surface of the fin plate.
Screw the bell crank support 0938 according to the drawing with two M3x8 lens head screws to the vertical fin plate 0900a.
When mounting or dismounting the bearings 0939b take care not to bend the two flanges with the bearing seats.

Mounting the deflection puller between the carbon tail housing

	0902a	Deflection puller	1
	0902b	Flanged bearing 3x10x4	2
	0902c	Spacer 3x6x6,65	3
	0907	Spacer 6x28	1
	L0306	Lense head screw M3x6	2
	M0335	Hex socket screw M3x35	1
	NS03	Nyloc nut M3	1

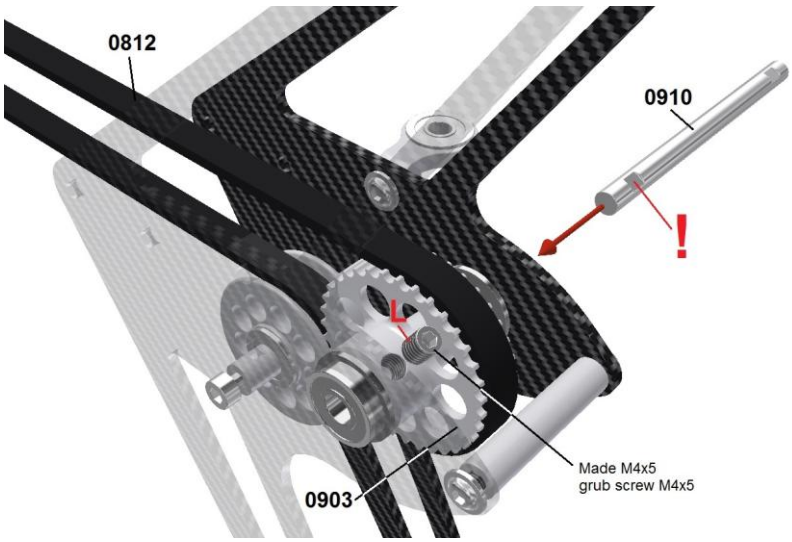


Press the two bearings 0902b together with one of the spacers 0902c into the hole of the pulley 0902a.

As you can see on the picture on the left the pulley will be mounted between the two vertical fin plates 0900a.
Two other spacers 0902c will be added on the left and the right side of the pulley.
The long M3x35 screw will be inserted through the lowest hole coming from the left vertical fin plate.
The left plate is shown transparent to allow seeing all parts.
Fix the spacer 0907 in the rear holes of the plates with two M3x6 lens head screws.
Tighten the two screws and the M3x35 screw stepwise and alternating. This prevents the plates from twisting and keeps them aligned.
Before tightening the screws you can bend the two lower tips of the vertical fin plates together and check if they are aligned.

Assembly of the belt disc

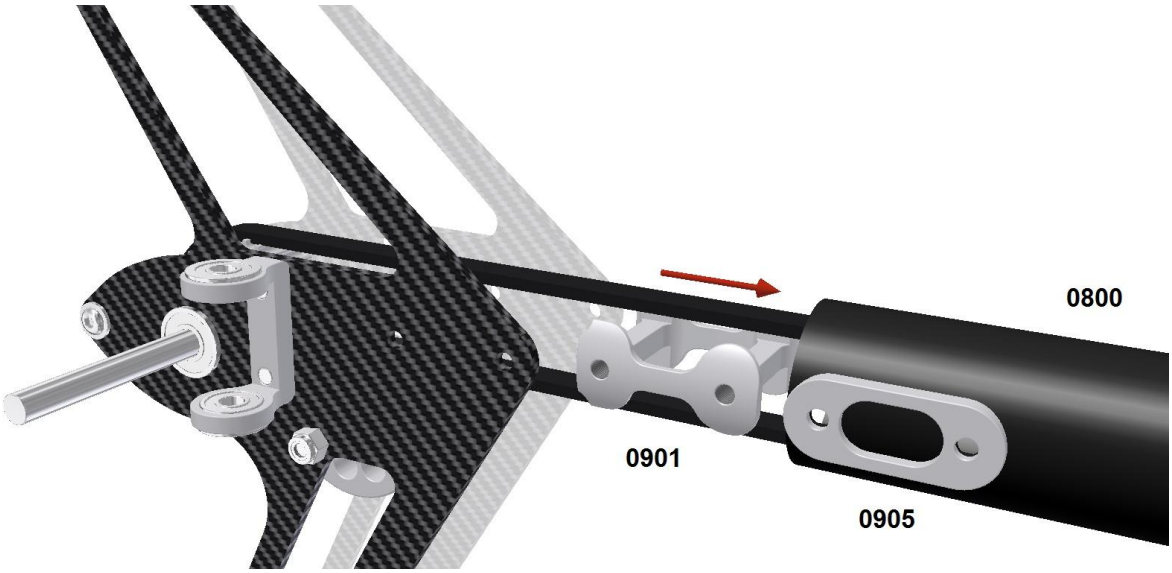
0812	Belt	1
0903	Belt disc	1
0910	Tail output shaft 5x70	1
G0405	Grub screw M4x5	1



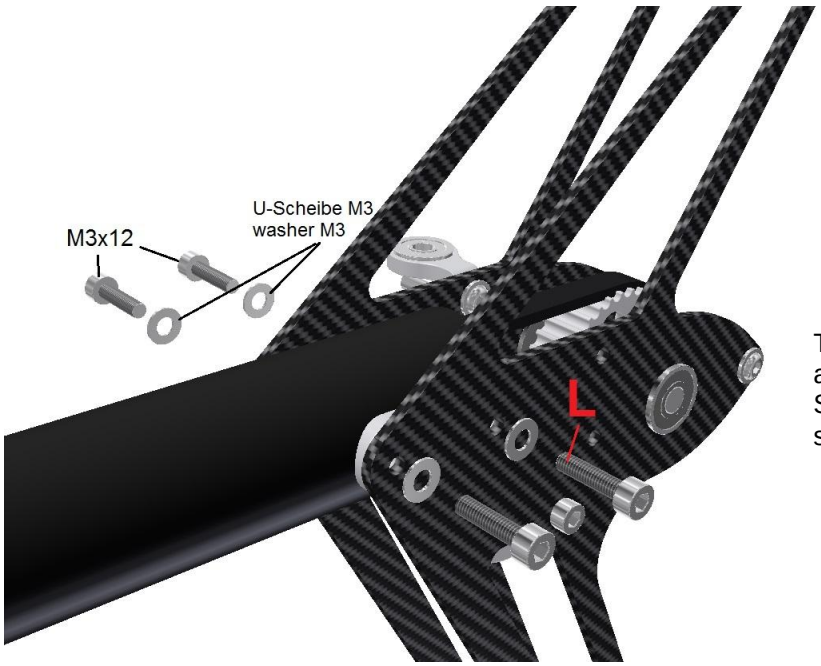
Lay the belt 0812 arround the belt disc 0903 and slide the disc from above between the two bearings in the vertical fin plates.
Take care not to tilt the disc. In some cases it is necessary to spread the flexible plates a little bit at the top.
After positioning in the center of the bearings the disc should be fixed under small tension without any play.
Afterwards the tail rotor shaft 0910 will be inserted from the right side through the bearings and the belt disc.
Attention! The side with the larger distance between the end of the shaft and the flat area has to be inserted from the right side into the tail gear unit.
Insert the shaft until the end is aligned with the outside of the left bearing and turn it to align the flat area with the hole for the M4x5 grub screw. Tighten the grub screw and use **L**octite.

Mounting of the vertical fin plates to the tail boom

0800	Boom 25 x 850	1
0901	Fixation insert	1
0905	Adapter for vertical stabilizer	2
M0312	Hex socket screw M3x12	4
W03	Washer M3	4



Pull the tail belt through the tail boom 0800 by using a long wire hook or a cord. Position the fixation insert 0901 between the two strings of the belt and position it in the tail boom aligning the threated holes with the holes of the tail boom. When sliding the tail unit on the tail boom position the two adapters 0905 on both sides.



The unit will be screwed with four M4x12 screws and four washers to the end of the tail boom.
Secure the screws with **L**octite and tighten them stepwise and alternating.

Connecting the tips of the vertical fin

	0900L	Tip protection left	1
	0900R	Tip protection right	1
	M0308	Hex socket screw M3x8	1
	N03	Nut M3 - flat	1

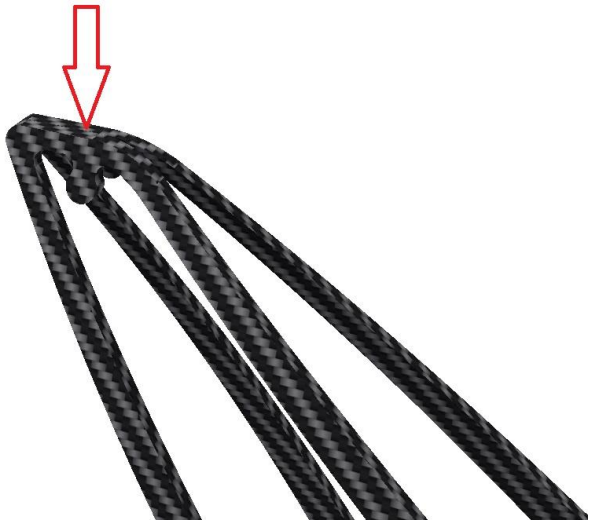
Press the ends of the two vertical fin plates together and screw them with the two plastic caps 0900L and 0900R. The fittings act as protection of the tips and as protection from sinking into soft ground.

One cap has a round counter bore for the M3x8 screw and the other one a hexagonal one for the nut.

Do not use Loctite for this connection as you cannot fix the nut properly for loosening.

Securing is not needed as the tensioning of the two vertical fin plates act as a feathering ring and clamp the screw.

The double fin has the advantage compared to conventional fins of a high stability (also with slim plates) and is not breaking even during hard landings. There will be no resonances at the whole RPM range and they participates to the vibration reduction in the helicopter.



Bend also the upper ends of the vertical fin plates together. The easy solution is to use two small tie wraps.

Who wants to have a pretty solution can use thin black yarn. Make nice crosswise windings around the tip and the nipple. Finally a small drop of thin superglue is enough for a strong fixation. For disassembly you can cut the connection with a knife.
Also here gives the connection of the both tips a high stability. It acts during a crash in inverted position as a roll bar and shows no vibration.

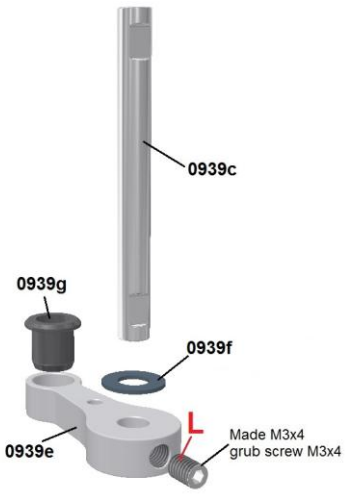
Tail pitch slider

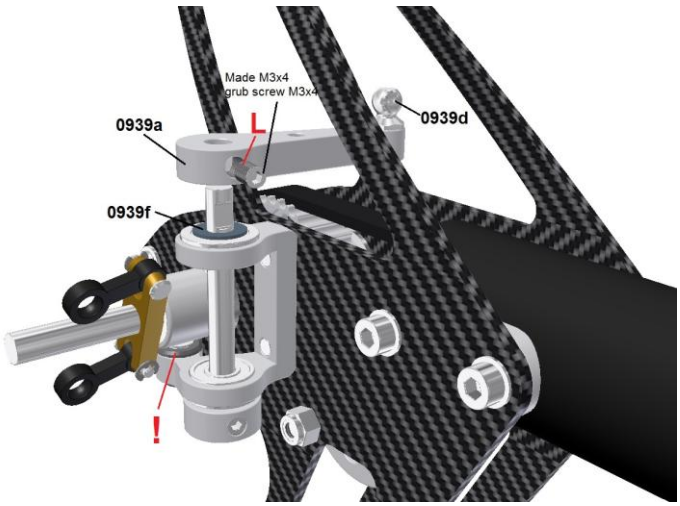
0915a	Tail pitch rod	2	
0915b	Pin for tail pitch rod	2	
0915c	C-clip	2	
0916	Tail pitch slider	1	

The sleeve of the pitch slider is chamfered with both bearings. Therefore, this unit is only available complete, under the part order no. 0916. The tail pitch rod 0915a, as well as the pins 0915b and the C-clips 0915c, are individually available. In case of a crash, usually only the tail pitch rod may break.

Bell crank

0939a	Upper bell crank	1	
0939c	Shaft 4x40	1	
0939d	Threaded ball link M3x4 / 4mm long	1	
0939e	Lower bell crank	1	
0939f	Spacer washer 4x8x0,5	2	
0939g	Bush for ball link	1	
G0304	Grub screw M3x4	2	

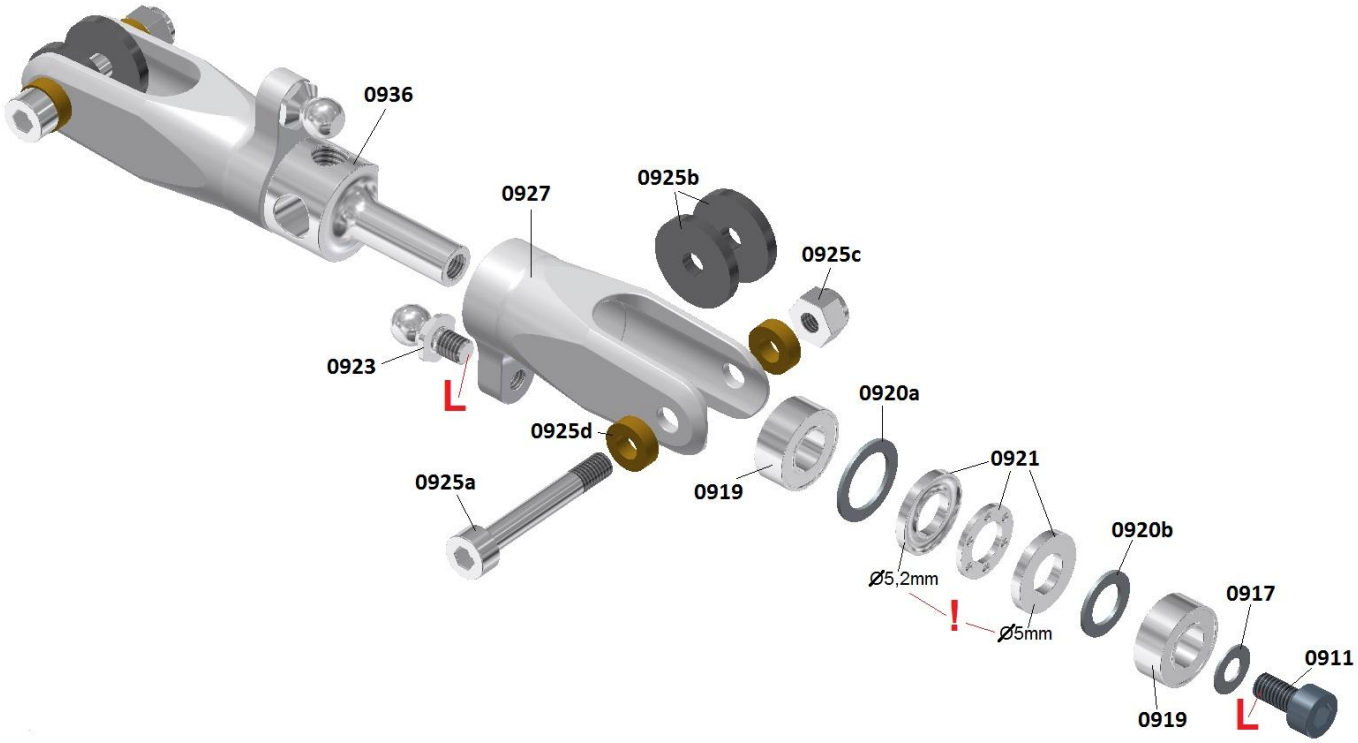




(left picture) The bushing 0939g will be pressed from above into the lower bell crank 0939e. The axle 0939c will also be slide into the hole from above and fixed at the flat surface area with a M3x4 grub screw. The shaft should look outside the bell crank by 1,5mm.
As shown in the right picture slide the axle from the lower side into the bell crank support. Put in a shim washer 0939f between bearing and bell crank.
Attention! First slide the pitch slider onto the tail shaft to be able to insert the ball link of the tail pitch slider into the bushing (grease bushing with Dry Fluid). Slide on the second shim washer and the upper bell crank from above with the hole for the grub screw facing forward. Press the two bell cranks together softly when tightening the upper grub screw to prevent axial play. Finally screw the ball link 0939d with some Loctite to the upper side of the upper bell crank.

Tail center hub with tail blade holders

	0911	Hex socket screw M3x6 - 10.9	2
	0917	Spacer washer 3x6x1	2
	0919	Radial bearing 5x10x4	4
	0920a	Spacer washer 7x10x0.5	2
	0920b	Spacer washer 5x8x0.5	2
	0921	Axial bearing 5x10x4	2
	0923	Threaded ball link M3x4 / 4mm	2
	0925a	Hex socket screw shanked M3x21	2
	0925b	Spacer for tail blade	4
	NS03	Nyloc nut M3	2
	0925d	Compensation weight 3x6x2	4
	0927	Blade holder	2
	0936	Center hub	1
	G0404	Grub screw M4x4	1



The assemblies of the tail blade grips are done in the following procedure:

First push the radial bearing (5x10x4) 0919 into the blade holder 0927 until it stops. The bearing has to be pushed to the recess in the rear (expand the blade grip with heat if needed). It is followed by the largest of the three spacer washers (7x10x0.5) 0920a.

Thereafter, insert the three greased parts of the axial bearing 0921 in correct order. First the ring with the larger 5.2mm bore, then the ball cage and finally the ring with 5mm bore. Make sure the rings do not swivel 180° upon inserting them. Perhaps you make use of a pin and draw the parts over the pin into the blade grip. The circular milled groove of the rings must always face the ball cage. Then comes the spacer washer 0920b (5x8x0.5) followed by the second axial bearing 0919.

Attention! A faulty assembly may lead to blocking blade holders later on.

The complete pre-assembled blade holder is now slid onto the rotor hub 0936. If the blade holder does not slide all the way to the flange of the hub, the cause in most cases will be that the spacer washer 0920b has slipped sideways. Try again after centering the spacer washer with a pin.

The complete unit is then screw tightened with screw 0911 and washer (3x6x1) 0917 to the tail rotor hub 0936.

Attention! For the purpose of attaching the unit to the tail rotor hub 0936, exclusively use the special screw 0911 (M3x6 hardness 10.9). Fasten this screw tight with **L**octite.

After assembly, the blade hubs have a remaining axial lash of a few tenth millimeters on the hub. This is meant to prevent the bearings from clamping. This has no disadvantages for the common flight practice. The centrifugal forces pull the blade holders to their outer stops.

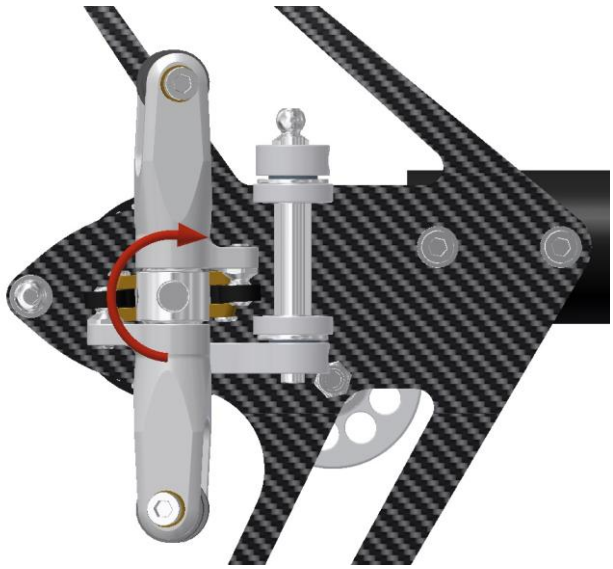
Enclosed are appropriate 1.5mm plastic washers to fasten 5mm tail blades 0925b. If possible, please do not use any other washers. The screws 0925a, for the purpose of fastening the tail blades, are only tightened fast enough to keep blades swiveling lightly. Only use this particular sized shaft screw. Any other normal screw with a complete thread will cut its way through the thin sleeves of the bore.

Fasten the link ball 0923 to the blade holders with **L**octite and assemble the tail blades later so that the link balls are positioned forward into the direction of rotation.

Attention! The complete hub 0936 is attached to the tail shaft in such a manner that the recessed surface points to the gear box. Secure the grub screw M4x4 with **L**octite. Avoid spilling any **L**octite into the bore, otherwise the hub will glue to the shaft.

While you are fastening the grub screw, pull the tail rotor hub 0936 in a position, in one line with the recessed flat surface of the shaft.

In case the tail pitch slider does not slide smoothly on the tail shaft, this is most often due to the pitch rod 0915a, which is still dragging on the ball links. In such case, use a pair of flat pliers to carefully squeeze the assembled arms a little from the outside. This will help them to adapt better to the ball links. Apply runny DRY FLUID HELI to the shaft and the ball links (shake before use).



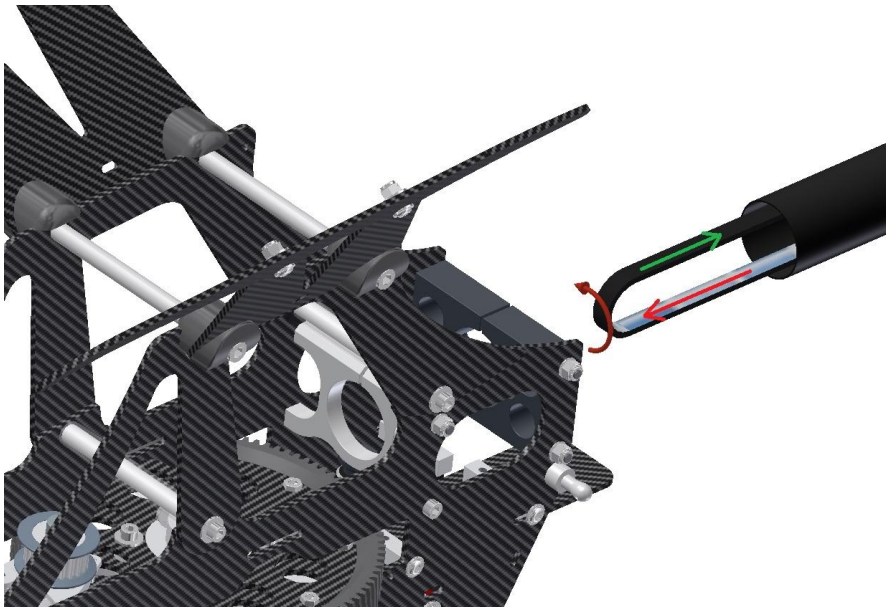
Attention! Keep in mind that the tail blades of the TDF rotate in the opposite direction to most of the other existing model helicopters. If you observe the tail blades from the right side respective to the forward flight direction, they rotate clockwise. I have done this with all my helicopters ever since the beginning.

This is important to know, considering the pulling direction of the belt and the location of the belt pinch. The upper belt stream is the loaded side (working stream), while the lower belt stream is the relaxed side (empty stream).

The belt pinch, as well as the belt tensioner up front in the core mechanics, must generally operate on the relaxed side of the belt (empty stream).

Chapter – 10 **T a i l b o o m** (Assembly group 8)

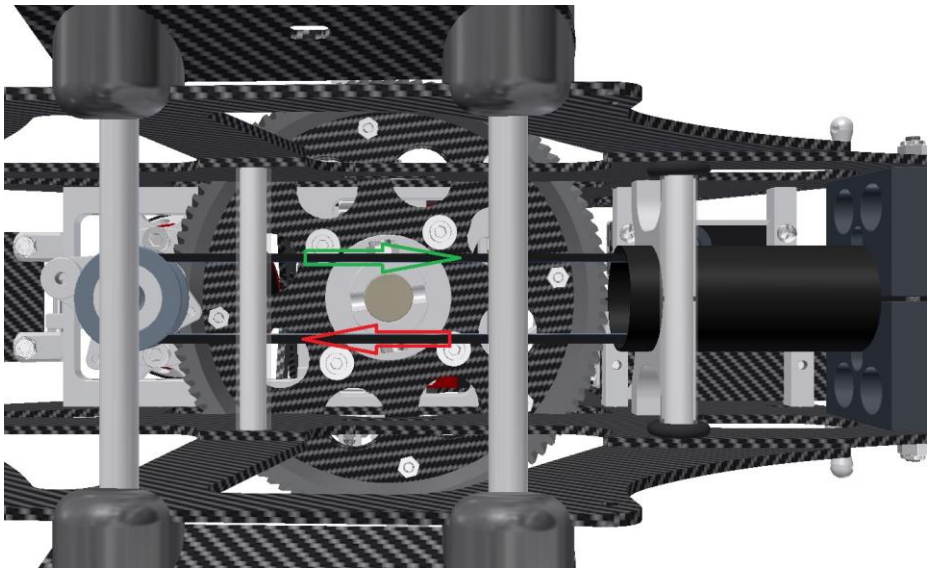
M o u n t i n g o f t h e t a i l b o o m t o t h e m e c h a n i c s



Turn the core mechanic and tail boom upside down then pull the belt toward the front out of the tail boom and align it in such a manner, that it runs straight without being twisted.

The imprinted arrows signify the moving directions of the belt strands. The red arrow signifies the working strand of the belt and the green arrow signifies the relaxed strand. If you pull the belt into the direction of the red arrow, the tail blades must rotate in the correct direction (clockwise at the front view on top of the tail rotor).

Look from the front to the tail boom. Twist the belt 90° to the left (counterclockwise) (see circular red arrow) until the loop is in a horizontal position and no more vertical as shown in the picture.



Guide the belt through the two clamping flanges without twisting further until you can lay the belt over the belt disc. At the same time slide also the tail boom into the two clamping flanges. In the picture the red arrow signifies the working strand of the belt and the green arrow signifies the relaxed strand.

If you look from the top to the pinion shaft the pinion shaft unit will turn clockwise in operation.

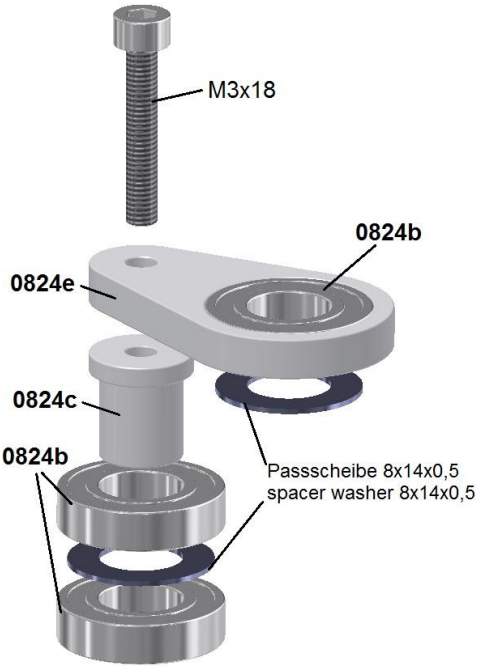
If you turn the motor in the right direction, with the free wheel connecting the tail has to turn in the right direction as described above.

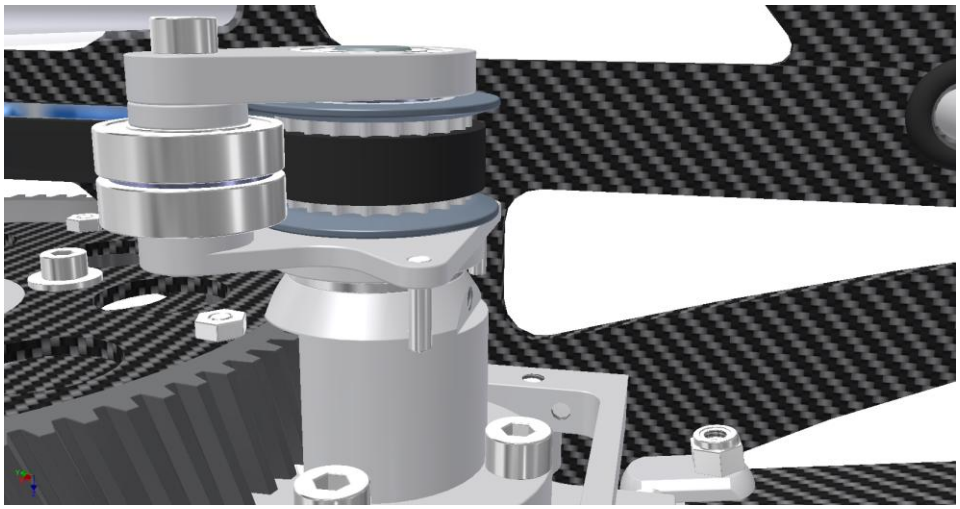
Attention! The tail boom will not be clamped for the moment.

Finish belt tensioner mount

(Assembly group 8)

	0824b	Radial bearing 8x16x4	3
	0824c	Bearing support	1
	0824e	Lower belt tensioner flange	1
	SW0891405	Spacer washer 8x14x0,5	2
	M0318	Hex socket screw M3x18	1



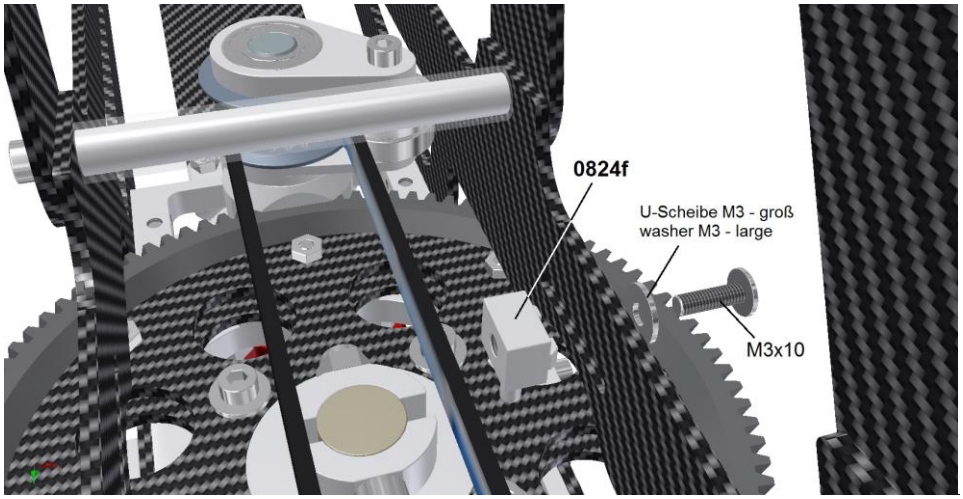


The belt tensioner will be mounted onto the pinion shaft unit as shown in the right picture (mechanic is shown upside down). You can see the details in the left picture.
Put a spacer washer 8x14x0,5 on the end of the pinion shaft and slide the lower belt tensioner flange 0824e with the bearing 0824b (already pressed in) on the shaft.
Put the other two bearings 0824b with a spacer washer 8x14x0,5 in between on the bearing bolt 0824c. Slide this unit between the two belt tensioner flanges to the belt.
Align the holes of the two flanges and the bearing bolt and put in the M3x18 screw. Apply some **L**octite into the thread hole of the upper bearing flange and tighten the screw.
Attention! After tightening the screw the belt tensioner should turn easily around the pinion shaft. If this is not the case the both bearings might be distorted against each in the flanges. You can improve this by exchanging the spacer washer between the lower bearing flange and the belt disc by a thinner one to get some axial play (8x14 spacer washers you can find in the bag of the rotor head).

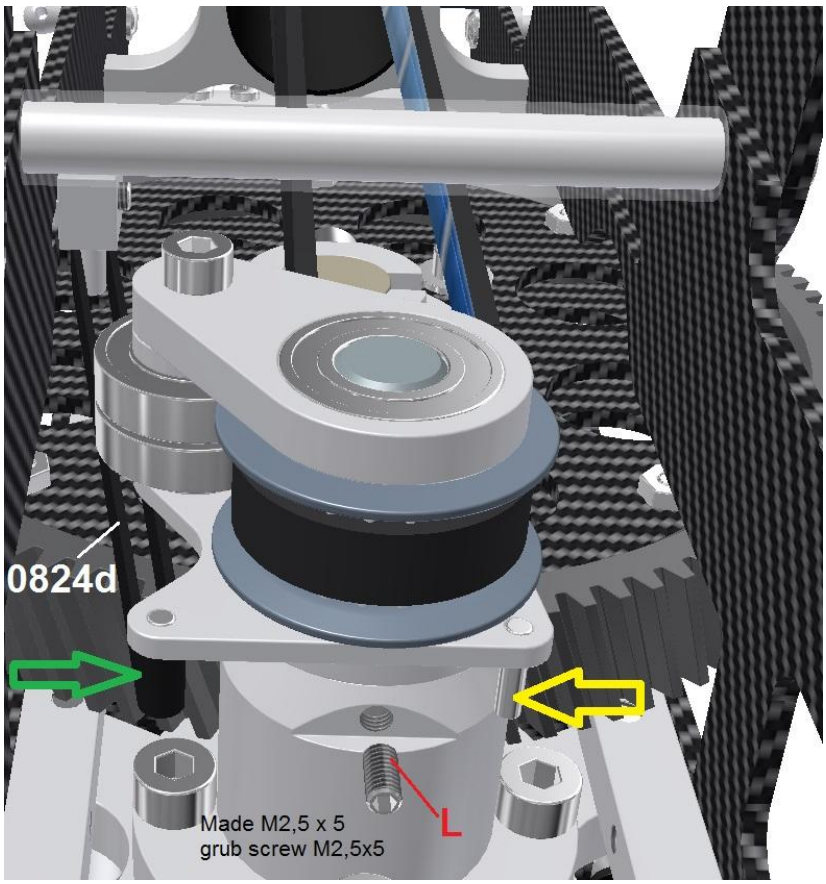
Rubber band mount

(Assembly group 8)

	0824d	Rubber band	1
	0824f	Rubber band mount	1
	L0310	Lense head screw M3x10	1
	WL03	Washer M3 - large	1
	G2505	Grub screw M2,5x5	1

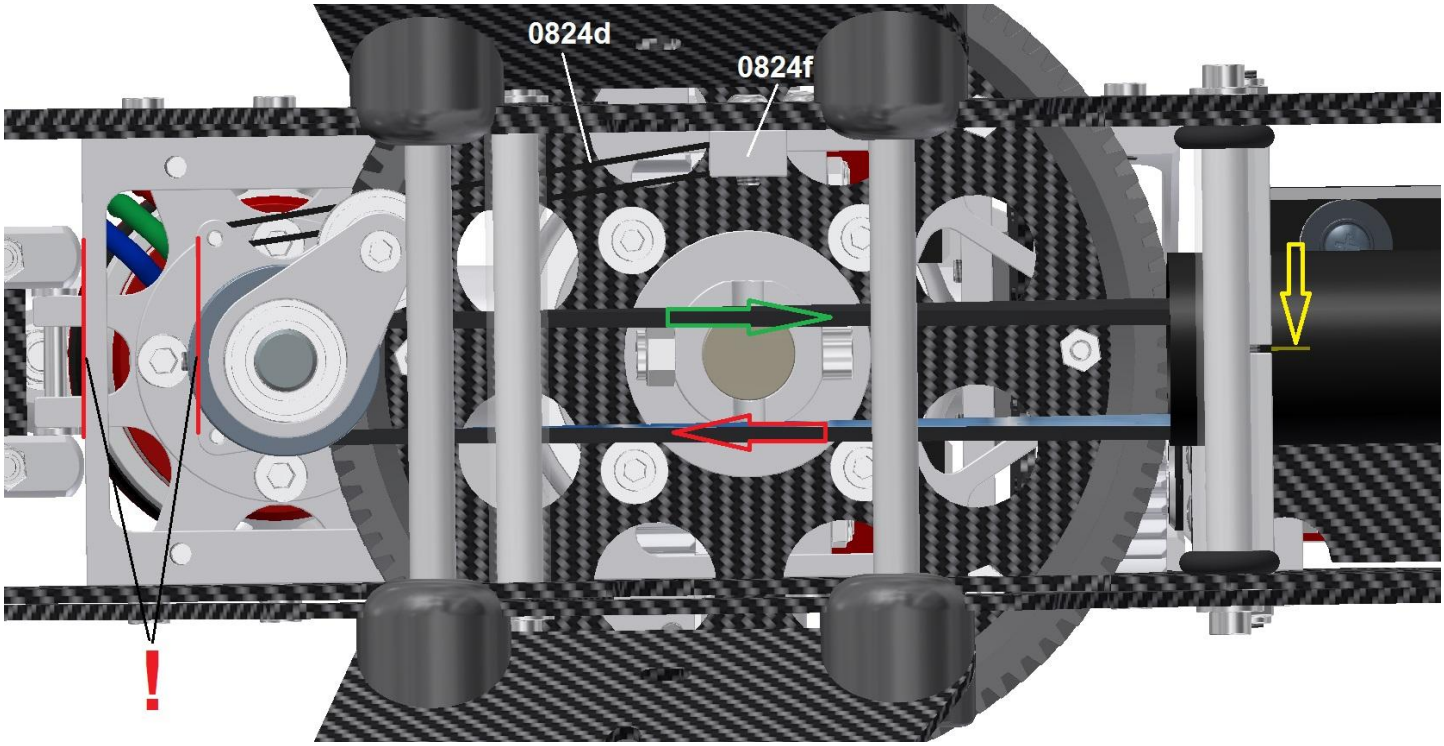


The support of the rubber band 0824f will be fixed with both noses in the long hole on the inner side of the chassis with an M3x10 lens head screw and a M3 washer large (no Loctite needed).
Slide the bracket in the center of the slot to have the same adjustment travel on both sides.
Then tighten the screw.



First hook in the clamp rubber 0824d on the pin of the clamp rubber support 0824f and then pull it over the front over the pin (green arrow) of the upper belt tensioner flange.
The grub screw M2,5x5 will be screwed with some **L**octite into the small thread hole at the front of the motor mount.
Attention! Tighten the grub screw very carefully until the stop. Do not continue tightening after reaching the stop as the grub screw is pressing against the bearing even the thread is just 2mm deep. Therefore this assembly was already performed by us.
If you want to remove the M4x30 Allen screw complete, you have to remove the grub screw.
The grub screw is used as a stop for the belt tensioner. The second pin of the upper belt tensioner flange (yellow arrow) touches the grub screw in case of a high stretching of the belt under extreme high tail rotor load.

Adjustment of the belt tension and clamping of the tail boom



Initially torque the lower screw of the rear plastic clamping flange a little bit, so the tail boom can still be turned and moved.

Look on the helicopter from the rear and align the tail boom with the tail rotor shaft being perpendicular to the main rotor shaft.

Turn the helicopter carefully upside down again and mark the slot at the front clamping flange with a bright pen (see yellow arrow).

Now the belt will be pre tensioned and the tail boom clamped.

Take the tail boom with one hand and press with the thumb to the rear clamping flange. Now the tail boom is slided backwards and the belt will be tensioned.

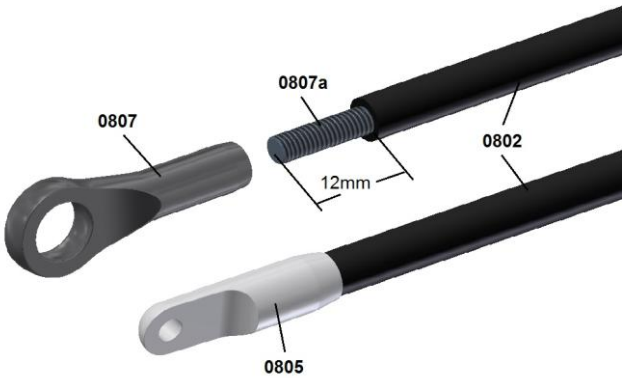
Attention! Pull the tail boom backwards until the front edge of the upper belt tension flange is parallel to the front edge of the lower bearing plate in the chassis (see the two red lines in the picture above).

In this position the nuts of the threated rods will be properly tightened alternating. Ask for support by another person. One should hold the tail boom in the right position and the other one should tighten the screws.

Boom support

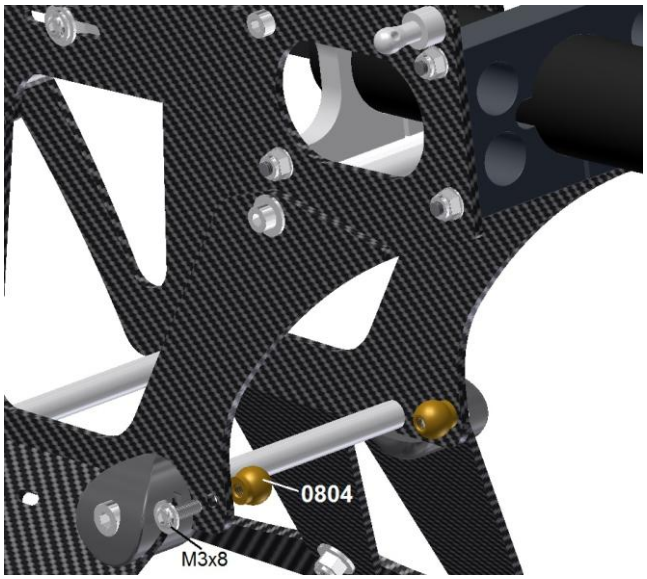
(Assembly group 8)

	0802	Carbon boom support 5,5 x 580	2
	0805	Boom support end	2
	0807	Ball link 8mm	2
	0807a	Stud bolt M3,5 x 29	2



Mount the boom support ends on both sides of the tail struts (see image above). At first, attach the M3.5 threaded rod 0807a on one side using superglue, so that it still protrudes by 12mm (upper drawing). Put the threaded side into the carbon boom which has been sawed off and de-burred only roughly because in this area the thread is mostly damaged. On the opposite side the boom support end 0805 is glued with superglue (lower drawing). Roughen the first 10mm of the carbon strut using some sandpaper and push the boom support end until it reaches the stop. Only cover the carbon strut thin and use a larger amount of glue for the hole of the support end. Immediately wipe off leaking superglue.
After the glue has dried the two ball links 0807 are attached with a gap of approx. 1mm to the carbon boom and aligned such that the eye is parallel to the hole of the boom support end 0805.

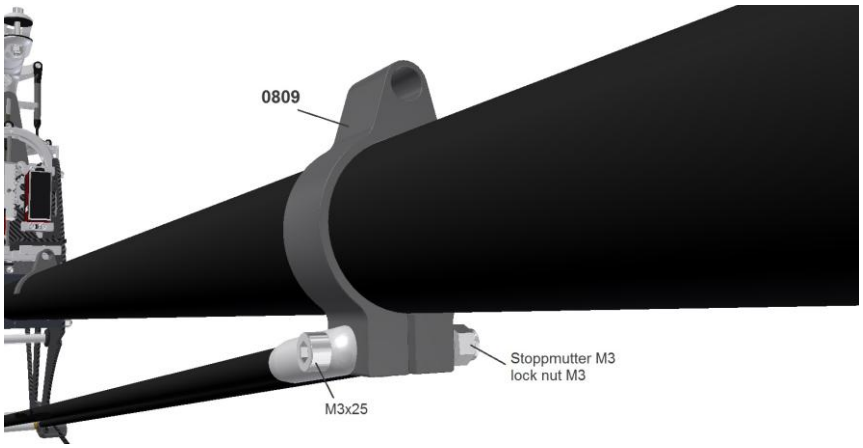
	0804	Attaching ball	2
	L0308	Lense head screw M3x8	2



The two strut attaching balls 0804 will be screw with two M3x8 lens head screws to the inner side of the chassis. Normally there is no **L**octite necessary, as the screws cannot turn out due to the sidewise canting.

Do not put the struts on the balls at the moment.

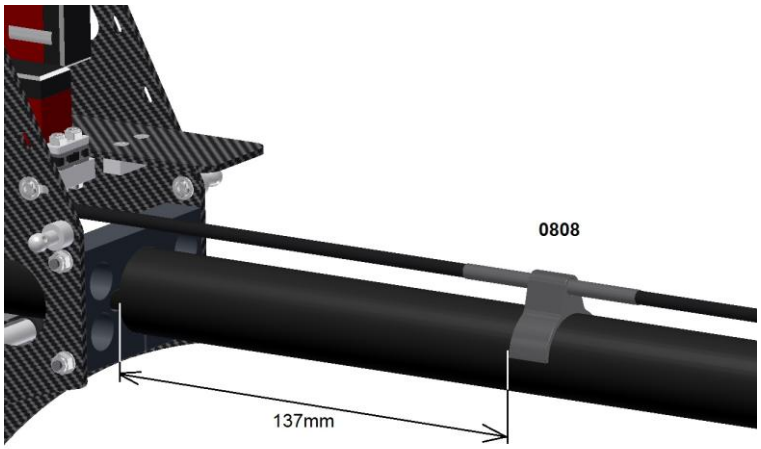
	0808	Push rod guide front	1
	0809	Stud clamp	1
	M0325	Hex socket screw M3x25	1
	NS03	Nyloc nut M3	1



The clamp 0809 can be spread as much as allow to slide it on the tail boom.

Fix the two struts with the M3x25 screw loosely.

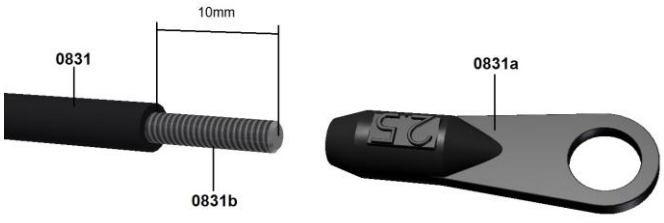
Put one of the 8mm ball links to the attaching balls in the chassis so the clamp is sliding to the right position.
Check if the second strut has the same length as the first one by holding the rod end loose onto the assembly ball.
Is the length not correct you can turn the ball end until it fits. Then you can press the rod end onto the ball.
Now align the clamp that the guidance for the control rod is centered above the tail boom. Tighten the screw to fix the clamp.



The front push rod guide 0808 will be fixed with thin double sided tape in a distance of 137mm to the rear clamping flange on the center of the tail boom.

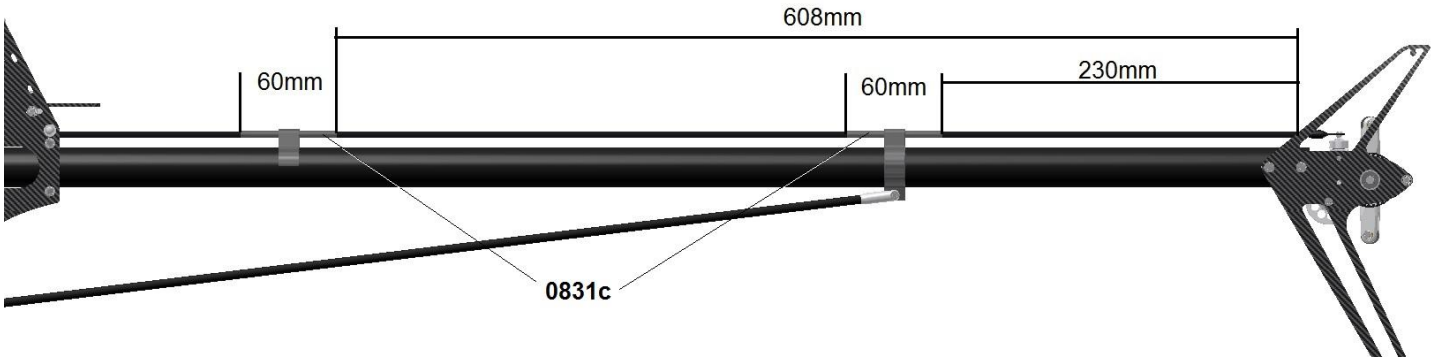
Tail rotor push rod

	0831	Carbon tail push rod 4x 807mm	1
	0831a	Ball link 19mm	2
	0831b	Stud bolt M2,5 x 25	2



Glue the thread rods 0831b with thin superglue into both sides of the push rod 0831. A 10mm piece should protrude on each side.
Note: When screwing up the rod ends 0831a the first time on the thread rods you need a high force. To ease this you can tighten and untighten them once on the thread rods before gluing. You can hold the thread rod with a plier in the area which will be glued into the push rod later on. After the glue is dry screw just one rod end on the push rod.

0831c Shrinking tube 2

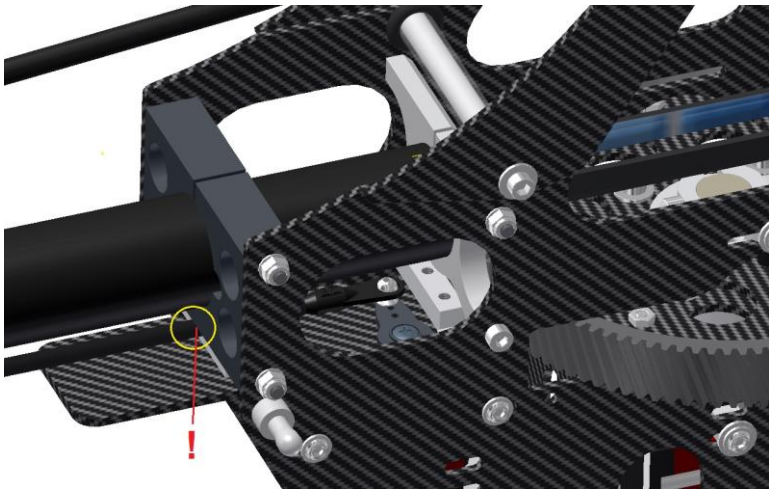


In advance of the assembly of the push rod the two 60mm long shrink tubes have to be shrinked on the push rod.

You can find the positions in the picture above measured from the end of the push rod to the rear end of the shrink tubes.

Grease the outside of the shrink tubes to ensure a good sliding in the guides.

The push rod will be inserted into the guides from the rear. Then the second rod end will be screwed at the front. Between both rod ends and the end of the push rod there should remain a gap of about 1mm.

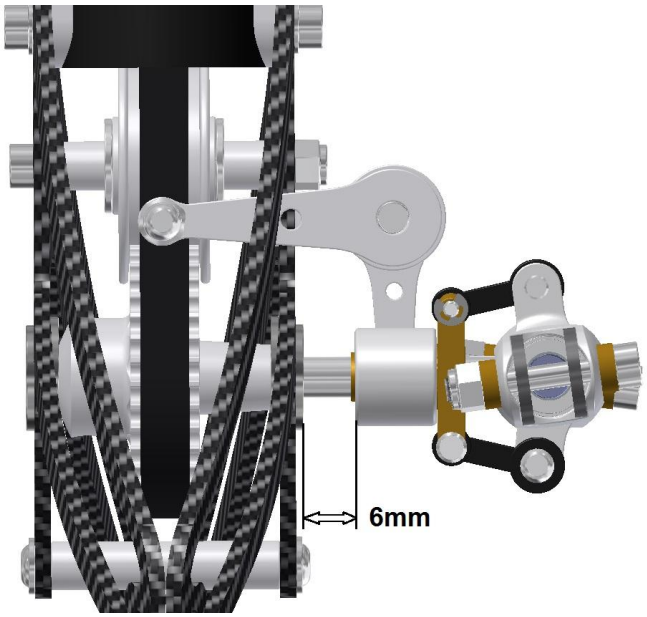


Press the front rod end onto the ball pin of the tail servo.

Attention! In case of chaffing of the control rod with the rear clamping flange (yello cricle) the tail servo is positioned too low in the mechanics. This can be the case when you use servos with a large distance between fitting flanges and the upper side of the servo.

In this case mount shims between the servo brackets and the servo to raise the servo.

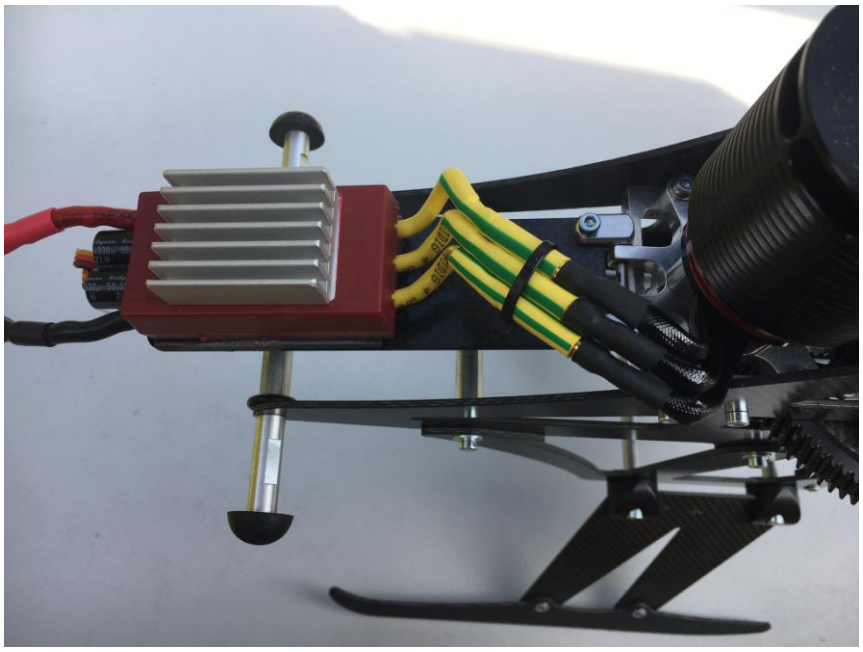
Turn the servo lever perpendicular to the servo housing.



The length of the rod end will be adjusted with the perpendicular positioned servo lever to get a distance between the pitch slider to the outer surface of the bearing of about 6mm.
In this case the blade grips have in neutral position already an angle of attack which will act against the torque of the main rotor (see picture on the left side).

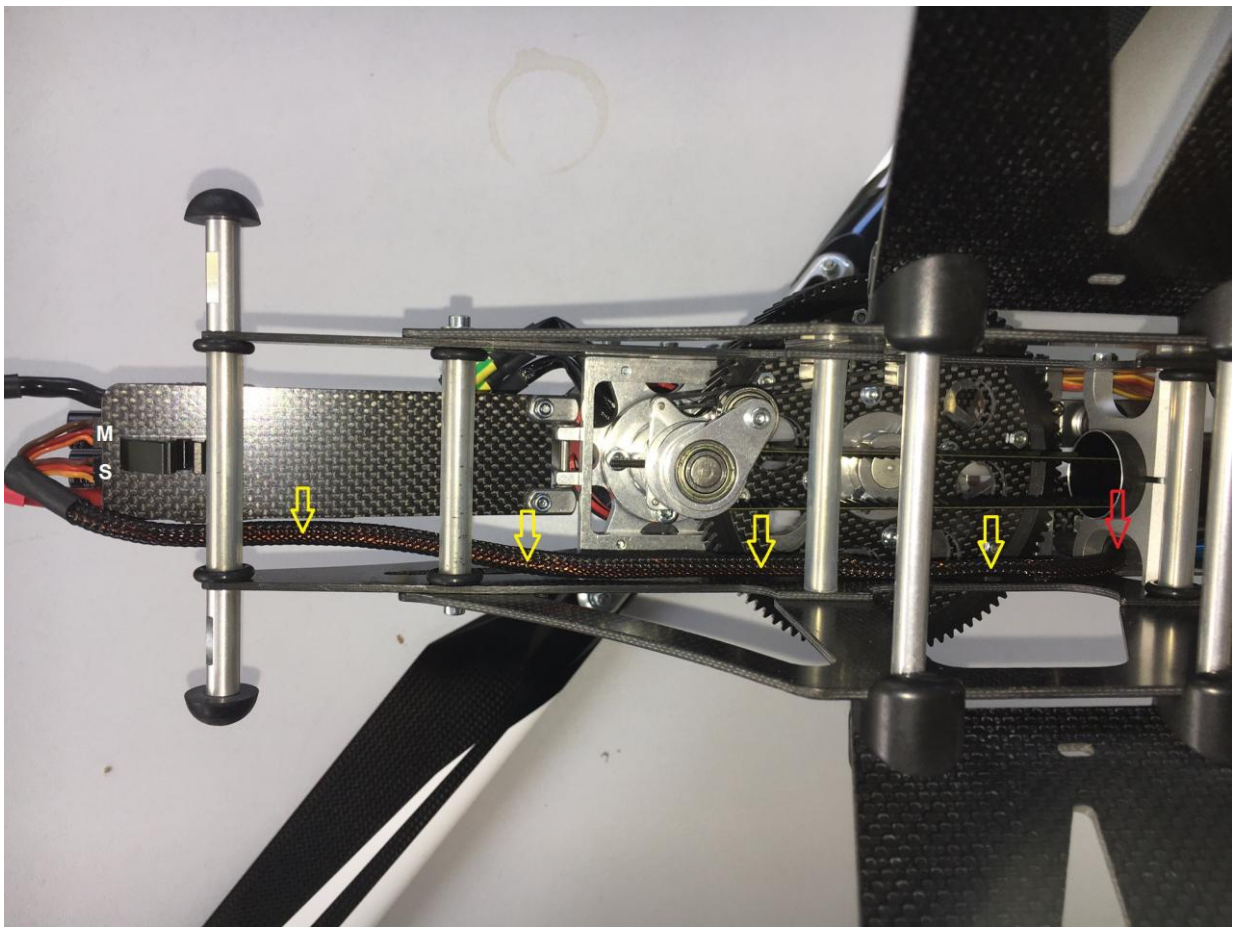
Chapter – 11 Installation of the remaining RC components

Mount of ESC



Stick the ESC with double-sided tape as far as possible to the front of the ESC plate. The front edge of the ESC should be aligned with the front end of the plate. The capacitors can overlap at the front.

Attention! AS the lens head screws of the ESC plate fixation are sticking out of the plate use thicker double-sided tape beside the screw heads to prevent the ESC from touching the screw heads.
Rout the cables to the motor in a radius as shown on the picture at the left. They need some flexibility for tilting the plate.
Keep the battery connection cables short.

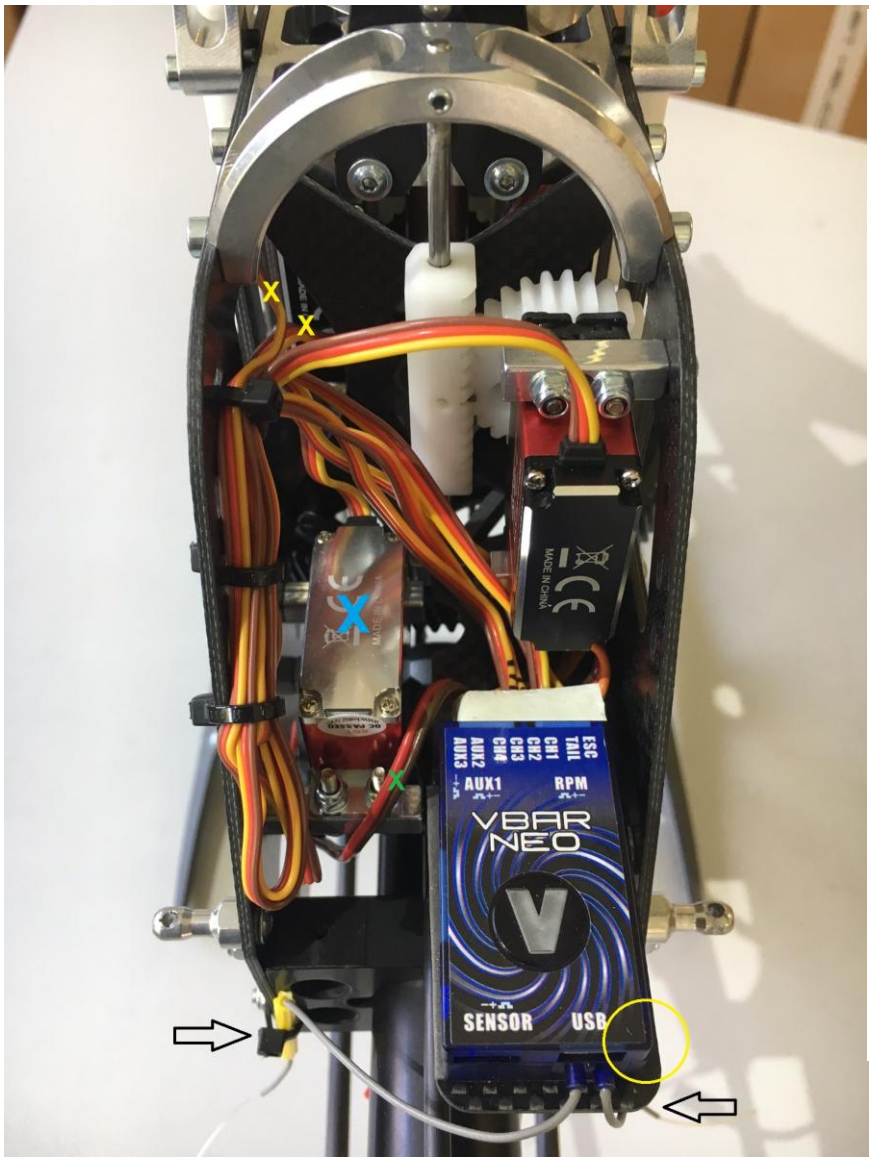


The two cables – (**M**aster und **S**lave) will be routed on the right inner side of the mechanics to the rear. Rout them above the spacers (see yellow arrows, picture above).

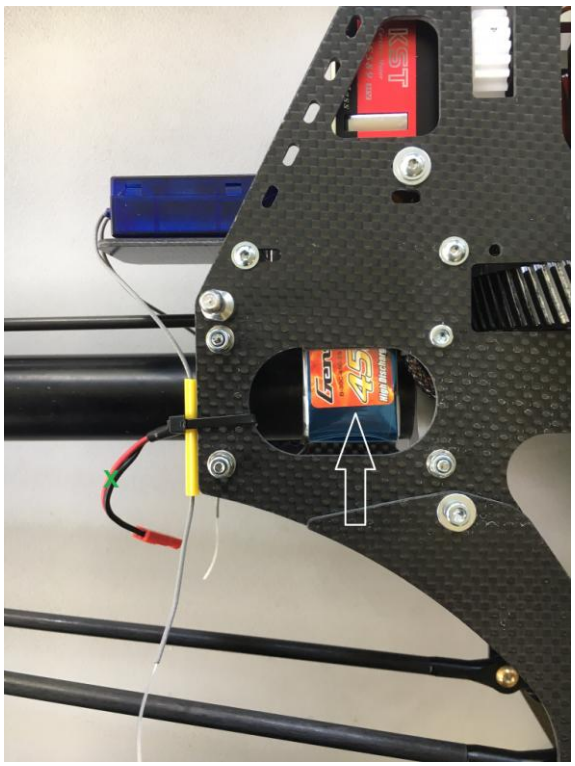
Remove the ring cores so the cable is long enough.

Route the cable through the hole of the front tail boom clamping flange (red arrow) and then upwards through the half round hole of the FBL plate.

FBL system and receiver

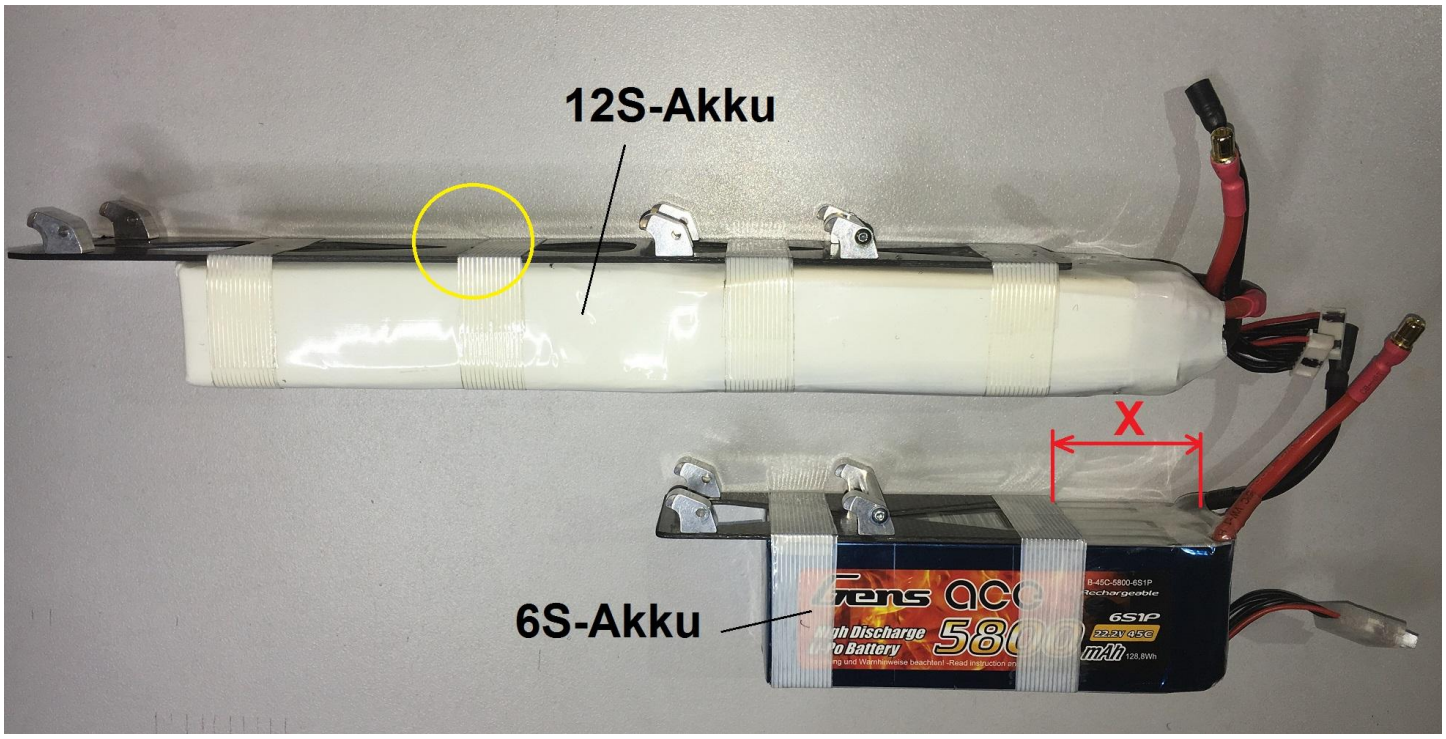


Ideal solution is a FBL system with integrated receiver as shown in the picture on the left. But also the installation of a separated receiver can be done without problems.
I suggest gluing the FBL system on the designated carbon plate
Position the system as far as possible to the front and the center. Otherwise the right, rear corner can touch the canopy (yellow circle)
Test the clearance first by provisional fixation with e.g. a rubber band and mounting the canopy.
If you use a separated receiver stick it on the top side of the tail servo (blue X). The connections for the servos should face to the rear to have good access.
The cables of the two aileron servos (yellow X) should be routed on the left side of the X-stabilization to the rear.
The excess cable length can be folded in loops and fixed to the rear end of the left chassis plate.
The black arrows show a possible downward routing of the antennas with tubes. As the canopy is made of GRP and not from carbon the rooting is not so critical if you keep enough clearance from the chassis. The cable with the green X is foreseen for the BEC- backup-battery.



The picture on the left shows the position of a 2S-450mAh BEC-backup battery on the inside of the right chassis plate (white arrow).
The connector (green X) will be connected in advance of each flight.
On this picture you can also see the routing of the antenna from the side.

Flight batteries



The picture above shows examples for the fixation of a 12S and a 6S battery to the respective battery trays.

The batteries can be connected with Velcro fasteners. I suggest this only when you have several batteries and just one battery tray.

In general I suggest to fix each battery used to an own battery tray to have a quick exchange. Also the CG is always the same than.

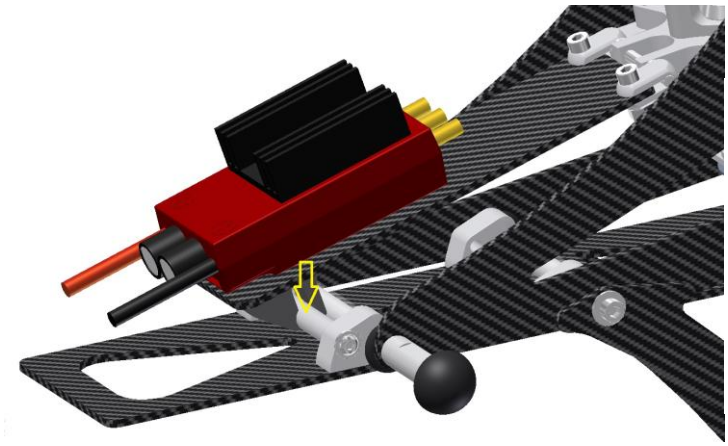
It makes sense to not use Velcro fasteners but reinforced tape for fixation. This saves weight and space as the tape is much thinner as the Velcro.

Evaluate the position by fixing the battery provisionally with a Velcro to the battery tray and hook in the tray in the mechanics. Put on the canopy and lift the helicopter. Turn the blade grips without blades perpendicular to the mechanics. Lift the helicopter with a finger under each blade grip. The mechanic should not tilt to the front or the rear but hangig in the same position as standing on the table with slight nose down.

By shifting the battery you can adjust the correct CG. In the example shown above the 6S battery has a weight of 850g and the dimension „**X**“ is 50mm. A 6S or 7S battery should not weigh below 800g. You will not get a correct CG without the battery touching the canopy.

The 12S battery shown in the example above weighs 1450g.

Attention! Do not use Velcro fasteners for the long battery tray in the area of the yellow circles. This area is located directly under the belt tensioner and could touch this under circumstances.



For locking of the battery tray press the ESC plate downwards until the lock of the ESC plate is snapping hearable to the bolt of the battery tray (yellow arrow).
Best practice is to grap with the fingers below the battery and press with the thumb on the ESC. For releasing grap with the fingers below the ESC plate and press with the thumb on the bolt on the opposite side.
Attention! Never forget to lock the battery before flight! It will fall inevitably down into the canopy.

Chapter – 12 Applying the decor on the canopy

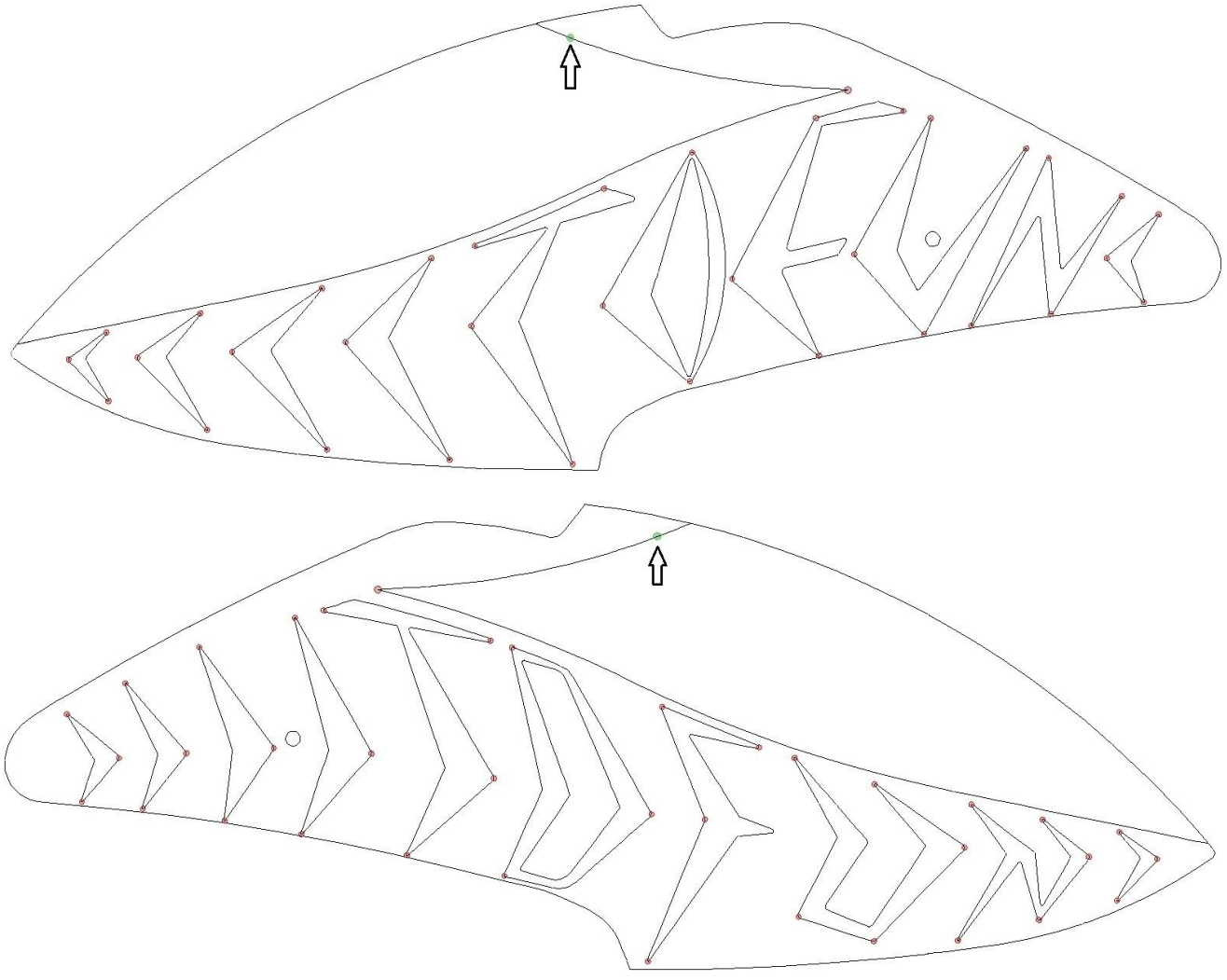
The canopy has the same shape as the one from the old TDR. You can also use the old decor foils. A video for applying this décor you can find on our homepage.

The new modern TDF-design consists of a similar window which is a little bit slimmer and is tapering out longer to the rear. The same procedure is used with first sticking the side parts and afterwards the center part.

Do not try to stick the décor foils dry on the canopy. It just works when humidify the glue side of the foil and the canopy itself with water and dishwashing liquid.

Attention! The foil has to be to be pulled off imidiately when putting it with the paper into the water because the waxed layer will separate from the paper after 20 sec. and stick to the bonding surface of the foil and the foil cannot be used anymore. Best way is to pull the foil from one corner and pull it directly into the water with the adherent side so that sections of the adherent side do not come in contact and stick together.

The rest of the design consists of different sized arrows and a character styled similar as the arrows. These segments have to be applied one by one. This is easier to do as with one large sticker but the poisoning is hardly possible without reference points.
Therefore we applied reference points with a gauge to allow an easy positioning of the single parts. For the arrows we placed the three points of the tips. For the characters ***T D F*** / ***U N*** the prominent corner points are applied which are easy to identify. You can see the points and the stickers in the picture below.
The point marked with an arrow is the upper edge of the left and right part of the window. Maybe it is not absolutely centered to the middle of the canopy. The distance should be 24mm to 25mm.
After drying of the décor foils you can remove these points easily by using e.g. brake cleaner. Test at an unremarkable position if the thinner you want to use is damaging the canopy or the foil.



Tail boom stickers

Enclosed with your kit is the text label in your desired color. It is not recognizable, however; it is rolled up together with two stripes of 360mm length and 15mm height. There is a transparent cover sheeting on the letters and the circumcircle foil has not been removed because very often the filigree letters do not retain well on the wax sheet upon removing the foil around the letters.

It is better to remove the complete sticker from the wax paper together with the transparent cover sheet.

In order for you to identify the front and back side, I have marked the beginning of the text with a black marker line (at the location of the H from HENSELEIT HELICOPTERS).

Cut the two stickers between HENSELEIT and HELICOPTERS. You can identify this position when holding the sticker against the light. One part of the sticker will be positioned before and the other part after the tail clamp. Keep a distance of 10mm between the clamp and the sticker.

Note: Apply the sticker in dry condition without water and dishwasher fluid. Therefore you have to take care to have the right position when starting to apply the sticker. Lay down the helicopter on the side to be able to look exactly from the top on the area.

Take the stripe with both hands from the left and right side after removing the wax sheet. Then close up to the tail boom. Look exactly perpendicular on the helicopter lying on the side and take care the foil is positioned in the center and parallel on the tail boom. Carefully set the label onto the tail boom and sweep it on. Then remove the transparent rip-off foil.

Now start to remove the needless foil around the text label from the tail boom, at the other end (where the T / S is located of HENSELEIT HELICOPTERS). Release one corner with your finger nails to get a grasp on the foil and carefully remove it. Observe how the foil separates from the letters. Should any of them lift off, push them down with a sharp object. Usually this works well because the letters stick to the tail boom far better than to the wax sheet. If the letters tend to lift off easily, give it another stronger sweep across the complete sheet. At the end, you need to remove sheet remains from the closed parts of the letters O, P and R. Preferably, you would remove the remains with a needle, by pricking it into the remains and lifting them away.

Repeat the complete procedure on the other side of the tail boom. In contrary to the diagram, the text label does not propagate from the front to the rear, but rather the other way around. Finally press the letters carefully on the tail boom.

Chapter – 13 **Settings**

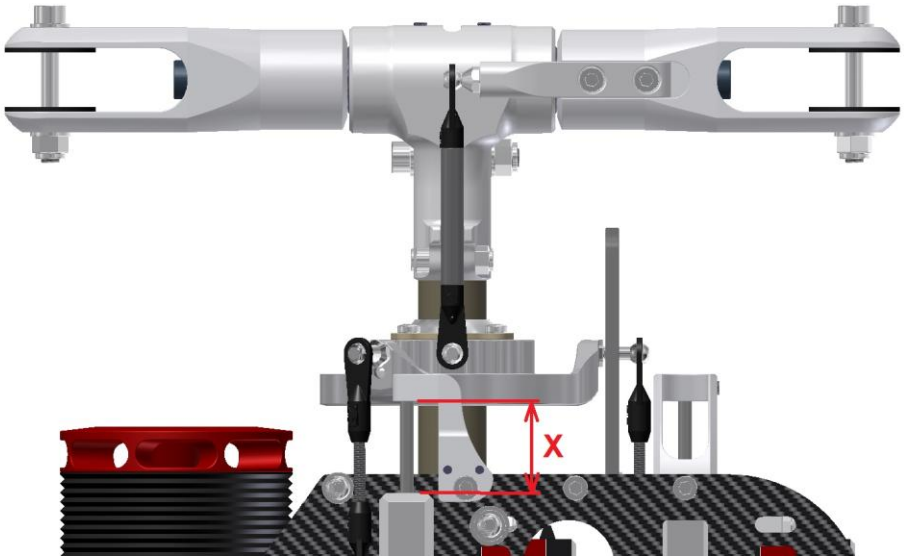
Pitch

Starting from the basic setting of the swash plate in the neutral position (on page 35), in which the blade holders are 0 °, the desired pitch maxium and minimum values are first set. Follow the instructions of your FBL system.

In general, this is not different with the **LDS** (**L**inear **D**rive **S**ystem) as with conventional swash plate controll. I am not going so far into the full benefits and background of the system I have already introduced in the TDR-II, since a lot of articles have already been published. If you would like to have more detailed background information, you can also download the TDR-II manual and look there again, but the setting values described there can not be transferred to the TDF, since the link geometry is somewhat different.

Due to the smaller lever arm of the toothed wheel, the servo forces do not have to be so high, and the high pitch angles will be achived by a greater servo way. Due to the linearity over the entire range, the adjustment of the desired pitch angle is very easy because you can simply measure the distance of the rack to the rack holder at 0 ° (red X - picture below) and then adjust the difference in mm to get the desired Pitch value. A swash plate gauge is no longer necessary for measuring the maximum values.

1mm stroke of the rack corresponds to a blade adjustment angle of 2.4 °.



Zahnstangenhub in mm	Pitchwinkel in Grad
0,5	1,2
1	2,4
1,5	3,6
2	4,8
2,5	6
3	7,2
3,5	8,4
4	9,6
4,5	10,8
5	12
5,5	13,2
6	14,4
6,5	15,6

In the table, the corresponding pitch angles for adjusting the collective pitch are shown in steps of 0.5 mm. The values are of course also in the other direction for the negative pitch range, which is set just the same.

I recommend to set the maximum and minimum pitch values in the yellow range depending on the individual needs and the setup used.

More than 15 ° pitch are not recommended, because even the setup with 12S and a 700 engine comes to the performance limit (at least, if one flies in the higher speeds).

Under 12 ° pitch are also not recommendable, since here at particularly low speeds the climb performance is relatively modest.

Next comes the point of the cyclic settings. The manufacturer of your FLB- system usually specifies a reference angle for the cyclic basic setting so that the system knows where. Often the value is between 6 ° and 8 °.

For this purpose, the swash plate should be at 0 ° position and then the menu point should be worked through according to the manufacturer's specification. Either the swash plate automatically moves to a cyclic position, which must then be measured and, if necessary, corrected until the predetermined reference value is reached, or it is necessary to move this value out of the horizontal position of the swash plate itself.

Also hereby you can measure directly on the rack how far it has to move in order to reach the desired reference value of the manufacturer.

That one cyclic servo rod moves downwards and the other upwards does not matter. As a result, only the swash plate remains at its predetermined height.
However, you can not take the table values for this because, in the case of cyclic moves, the swash plate does not slide up and down parallel to the rotor shaft, but makes a pivoting movement about its center point.
As a result, the difference between the different link ball positions between the inner ring and the outer ring results in a requirement.
That means the cyclic deflection on the blade grip is smaller than a collective one with the same tooth rack stroke.

Just calculate with the following values: 1mm toothed rack stroke is approx. 1.6 ° cyclic blade adjustment.
Now you only need to divide the required value by the degree and get the stroke to be set.
Example: 8 ° is required (so the tooth rack stroke would be 8 °: 1.6 ° = 5mm stroke).

For the measurement, give a pure aileron cyclic input without a elevator or collective pitch, then the one aileron servo rod moves downwards by 5mm and at the same time the other aileron servo rod moves 5mm upwards.
At its height, the swash plate remains unchanged in its position.

Finally, you usually have to program the cyclic maximum values and limit them by a software cyclic-ring.
The FBL- system ensures that when the cyclic input of aileron and elevator cames at the same time, the deflection does not become too great since both values add up. With this function, the swash plate always maintains the same maximum angle, no matter which direction you swing it.
This prevents mechanical boundary transitions.
In any case, activate this function, if this is not already the case automatically. Set your cyclic maximum values in the swash plate neutral position so that the reciprocating stroke does not exceed 10mm at the same time with a combined cyclic full aileron and elevator input.
However, close to the maximum collective pitch values, these values are then no longer achieved, but this does not matter.
After setting up in the operating mode, move the swash plate to the maximum values of all conceivable combined vertices to see if it mechanically jammed anywhere.
At the same time, carefully turn the rotor head from the top to the right (clockwise) to check whether there is any tension on the linkage in any position.
Of course, you can also make the whole setup with a classic pitch gauge, taking care that the helicopter is standing stable and that the blades are really at 0 ° when the swashplate is at the neutral position.
This must be done in any case at the latest now, if everything else is set so far anyway.
It is precisely with such a stiff system, that the tracking differences have a particularly negative effect on the flight performance.
Place the TDF on a flat, non-slip support and install the main rotor blades.
Align the blades as accurately as possible and place the rotor head in a position along the helicopter so that one blade is above the tail tube. Then calibrate your pitch gauge on a reference surface on the helicopter, which is at right angles to the rotor plane, e.g. the engine cover.
The gauge should be placed as accurately as possible along the helicopter lateral axis, before setting it to zero. Turn the display screen towards the helicopter tip, because you can then also carry out the measurement on this side, namely on the rotor blade, which looks to the front.
Then attach the balance to the rotor blade and adjust the value of the linkage to zero. To do this, always pull off the linkage at the the swash plate to adjust it.
Again, you do not need to try long, but can calculate. The M2.5 thread of the link rod has a pitch of 0.45mm. This means that the smallest possible adjustment, namely a half turn of the ball joint, causes a change of 0.225 mm. This corresponds to a difference of approx. 0.5 degrees.
In the worst case, this will reach 0.25 ° to your desired destination, which is quite sufficient. Try to get this on the other blade as well. However, your new value should correspond to the already set blade and not the previous desired value, since the absolute dimension is not decisive, but the equality of both blades is important.
To set the zero pitch, do not use this questionable method, where the rotor blades are turned through 90 ° in the blade holders so that the tips are positioned as indicators.
This can perhaps be done with a helicopter of the 450 size, with the blades much shorter and lighter, but not with a machine of the 700size class. The leverage forces acting on the swash plate are poison for the linkages, the ball joints and the servos.
Also, this type of measurement is not correct.

Tail

The setting of the neutral position has already been described on page 55, so that only the maximum deflections have to be limited. To do this, move the control stick to the maximum level, and adjust the percentages so that the control sleeve with the brass inner part touches the ball bearing in the right-hand side tail fin when the control stick is fully right.
When the control stick is fully extended to the left side, the brass part of the control sleeve should just touching the flattened surface of the tail rotor hub 0936.

Finally, check once again whether all servo deflections, both the swash plate and the tail rotor are moving the right way around and also control wheather the sensors work in the correct direction.
The swash plate always has to tilt in the opposite direction on all sides, into which you move the helicopter.
The tail rotor control bridge must move towards the gearbox housing when you rotate the fuselage to the left (counter-clockwise) as viewed from the top of the helicopter (rotor shaft axis).

ESC

I always make the basic programming of the Kontronik ESC (Mode 4) for helicopters. Refer to the Jive guide and follow the instructions.
For this, the transmitter and the receiving system must be switched on and you must at least be able to switch 0% and 100% on the gas channel to program the ESC for the setting.
Since you have to program different gas curves anyway (in this case, it is actually gas straights) for the individual flight conditions, you can do this right away.

I recommend to program 3 speeds, the percentage values on the controller being between 40% and 85%.
Depending on the setup and individual preferences used, revs of 1000 rpm to 1850 rpm are recommended. Higher revs makes no sense with the light TDF, since here no flying advantage is achieved, but only unnecessary energy is wasted.
The system is only loud and restless, and any midi servos that may be used will then reach their performance limits under unfavorable circumstances.
The tail rotor performance is also high enough at moderate speeds due to the high gear ratio of the belt drive.

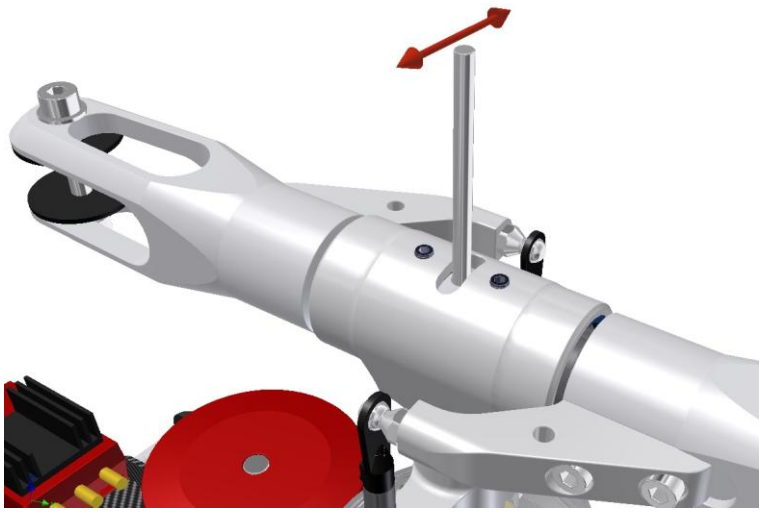
Now two parameters should be adjusted. Once, the BEC voltage for the recommended HV servos should be set to 8V, and you may need to change the rotation direction of the motor when the motor is running in the wrong way.
Place the helicopter without rotor blades on the table so that it is stable and free. Switch off the engine on the transmitter and connect the flight battery. Switch the throttle to Idle Up1.
When the rotor rotates now, the motor runs right. If the motor rotates, but the rotor is not, the direction of rotation is wrong.
Attention! Do not run the engine in the wrong direction. This can damage the freewheel.
If the rotor does not rotate switch off the motor quickly, program the ESC for the right direction of rotation, or replace two wires of the controller motor connection so that the motor rotates correctly.

Note: When looking at the helicopter from above, the engine rotates to the left (counterclockwise) and the rotor to the right (clockwise).

Rotor blades

The main rotor blades should have a length of approx. 680mm to 710mm with a weight of 175g to 210g.
Also blades wich are swinging to much forward during flight are not favorable, especially if one uses Midi-Servos.
For a 6S or 7S setup I recommend rather the somewhat shorter blades.
The DH tail blades with a length of 107mm have proven to be a good tail rotor blade. More than 115mm makes no sense because of the high tail gear ratio.

Adjustable feathering spindle damping



In the fully relaxed state, the damping is too soft. Therefore, take the 3mm pin out of the tool bag to make a basic setting for the first flights. After a few flights, the O-rings will settle slightly so that you can then slightly increase the preload.

Insert the pin into a hole in the straining screw in the center hub and try to find the direction in which it can be moved. Before the assembly, the thrust nuts were turned to the center of the stop so that only one direction is possible.

The best way to do is to use a felt tip pen to mark the direction you need to turn to make the damping harder at one side of the slot in the centre hub. So you do not have to try each time.

The slot is designed so that you can always move the pin by exactly one hole when moving from stop to stop. On the circumference of the straining screw are 9 holes so that you have to adjust the pin 9x for a complete rotation.

Always insert the pin into the hole as far as it will go so that the holes in the plastic part are not damaged. For the first presetting from the basic position (thrust nuts are very inside the stop), a twisting angle by 5x repositioning the pin is a good starting value.

Please consider the following:

A very soft damping setting entails the risk of a contact of the main rotor blades with the boom (boom strike) in certain flight maneuvers. Also, the fuselage can make a slight pitching motion about the transverse axis during hovering, it swings under the rotor.

A to hard setting may result in resonances between the main rotor and the fuselage at low head speeds.
This is particularly dangerous on the ground (ground resonance), since the helicopter can even tip over. The critical speeds are usually between 600 and 900 rpm at the head.
Depending on the blades and weights your blades have, a completely different resonance behavior can result. Use caution when using harder damping settings.
Due to the adjustable damping, you can try out very quickly where the helicopter feels best. If you loosen the damping from a harder setting, the tensioning screw will be able to be screwed back very easily without resistance because the O-rings initially remain in the state by being last.
Therefore, turn the tensioning screw back as far as you can, and sway the blade unit a few times to release the O-rings. Then turn the tension screw back, but not quite as far as before.
In order to avoid the straining screw turning slowly in flight, remove the 3mm thick silicone cord from the bag labeled "Anti-twist device" which was in the rotor head bag.
Cut off an 8mm long piece and insert it into the hole of the straining screw, which is located on the side of the long hole, in the direction of which the tensioning screw would twist. The silicone hose then looks out of the straining screw approx. 3mm and ends flush with the surface of the rotor head center hub. Now, turn the tensioning screw with the pin slightly in the direction of the loose so that the silicone cord presses against the edge of the oblong hole. So it can no longer fall out. Do not squeeze the silicone cord too hard, otherwise it will peel away.

Chapter – 14 **First flight**

Before flying, you should put the helicopter on the table again and look at it calmly from all sides. In the head once again everything go through.

- All screws have been tightened, even those which have been solved in the later construction phase.
- If all cables are securely routed, neatly inserted and secured if necessary.
- Operate all control inputs correctly and also control the sensors in the correct direction.
- If the rear blades are mounted correctly (please keep in mind that they are rotating differently with the TDF than with most other helicopters).
- If the rotor head damping is correctly set (maximum 5 holes for the first flights) and secured.
- Are all linkages attached.

Take DRY FLUID GEAR and lubricate the main gear, if this has not already been done. It is best to apply the small toothbrush with the small enclosed brush. The pinion is then automatically greased by the pinion. Also grease the rack, if not already done.
Mount the cannopy and check whether the linkage of the swashplate touch it anywhere.
Look for a calm and dry day for the first flight. It makes no sense to fly a new model with hurry under adverse weather conditions just to get a little earlier in the air and then lose days after repairing the model.

There are also risks with a first flight. Always be on the safe side and ensure that there is sufficient safety clearance between you and the model.
Also, many curious people who are too close to the action are not exactly conducive for the own nerves.
Make a final Servotest on the pitch, if everything goes right.
Take time to mount the canopy and secure it with the pins.
In any case, turn the rotor head crosswise to the helicopter prior to mounting the canopy so that the linkages are not in the way.
Attention! In any case, place the helicopter on a non-slippery surface such as grass. Even rough, dry concrete is a necessity, but grass is the best for the first flights. Dangerous are places with hard slippery subsoils or even ice.
This can lead to extreme ground resonances when the rotor is running up due to the slipping of the skids so that the helicopter will tip over.
Also make sure that the lower speed (idle up 1) is not set too low (controller should not be less than 50%), so that the blades can be aligned by the centrifugal forces.
Do not overtighten the blade screws, because just before the flight, when the blades are not aligned, the blades can shake very strong if they can not orient themselves as early as possible by the centrifugal forces.
I always thighten the screws so that the blades are just clamped so tightly that they do not fold by their own weight while holding the helicopter in knif edge position. If you shake the helicopter a bit, they should do so.
Start the engine and run it up to Idle Up 1.
Get familiarize with the helicopter. If Idle Up 1 is a bit restless and does not yet run smoothly, briefly switch to the next higher speed and then down again, so that the blades align correctly.
Now you probably have to adjust your tail sensitivities to the individual flight conditions and speeds.
Keep in mind that the hovering sensitivity can be set higher than in the fast forward flight.
You may be able to make a final adjustment a little later if you are familiar with the helicopter that you can fly it more spaciously and quickly.
Do not be astonished if the tail is swinging slightly during the first 10 flights while hovering and is not quite calm yet. This is because the new belt is still very stiff and does not really run smoothly. This will change soon and will improve from flight to flight.
Note: Avoid turning the rotor backwards by several turns at the table. Due to the fact that the tail rotor rotates with the belt and the belt does not then run from the bottom over the guide pulley onto the large pulley at the rear, but from the top freely through the long tailpipe, there is the danger that it runs down from the belt pulley.
In flight operation, the belt does not run on the center of the pulley but is flush with the left belt pulley side.
The belt pulleys are deliberately wider, so that you can change to an optional 8mm wide belt. The 6mm strap is usually strong enough.
If the belt produces loud whistling or chirping noises during the running process during operation, the teeth can also be applied with Dry Fluid Gear. After that it usually runs softly and smoothly.
If the belt touch the inside of the boom very often under load, the belt tension can be increased somewhat by slightly pushing the rubber suspension in the oblong hole backwards, or even slightly more tensioning the boom tube itself.
Note: Due to the fact that the freewheel is mounted directly on the motor shaft, the friction resistance is more noticeable than in a system where it engages the rotor shaft. Just in the new state, you will register a relatively fast loss of speed in autorotations. Therefore, avoid autorotations during the first 10 flights.
Finally, still have many nice and relaxed flights with the TDF to enjoy. The maintenance or repair of the machine proves to be quite easy, since everything is very clear and easy to reach.
If you have any questions, do not hesitate to contact me by e-mail.
Also, check out if there is a more up-to-date version of the manual for download, as the latest findings are added.

Jan Henseleit

D i m e n s i o n s (TDF - equipped with 712mm long baldes)