Three – Dee NT

Manual

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Attention ! Important!

Please read before opening the bags

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Three–Dee NT

- The Henseleit Three-Dee NT Helicopter combines extreme manoeuvrability and speed together with rapid climb rate within a wide range of rpm and low noise levels.
- The Three-Dee NT can fly between 1300 and 1900 rpm with no loss of performance and extremely low noise levels.
- The Three-Dee NT is designed around the OS 91 FX-HGL, and at only 4.3 kg all up the performance is stunning on straight fuel.
  Light and strong CFK / Aluminium construction of highest quality.
- Designed with maintenance friendly construction with no unnecessary components.
- Skid plates with fast fixing system, designed to release in most crash situations reducing air frame damage.
- Aluminium high performance cooling fan / flywheel as a standard.
- Patented MFS (moving fly bar system) rotor head with sliding flybar does not need pitch compensator, which in turn gives an extremely short distance between upper main bearing and centre hub, MFS halves the pitch movement required without changing the bell-hiller levers (ideal for a 120° CCPM setup).
- Easily accessible engine, that can be removed and replaced in minutes.
- RC-system protected within the side frames.
- The Three-Dee NT has an extremely low centre of gravity due to its compact design this greatly improves cyclic performance and control response over the full flight envelope.
- Proven high performance belt drive system for main reduction and tail drive gives simple yet robust set up and high relability with low maintenance.
- Full aerodynamic canopy encloses the complete mechanics allowing for a low coefficient of drag during high speed flight.
-
- Engine: OS 91 FX – HGL
- Main rotor reduction: **7,7 : 1** (standard for the OS 91) / optional 8,3 : 1
- Tail rotor reduction: 1 : 4,92
- Recommended rotor rpm.: 1200 – 1800 rpm.
- Recommended fuel: straight fuel with 12% oil
- System: cw and ccw is possible with different crankshaft for the OS and mirror image cooling fan / flywheel
- Tank: 500 cc (15 min)
- Rotor diameter: Main rotor: 1540-1600 mm Tail rotor: 270 mm
- Trunk length / height: 1430 mm / 360 mm
- All – up weight without fuel: 4300 g !!!

S u m m a r y

1.0 Basic Information about the “Three – Dee NT”

The original Three Dee’s basic concept has been developed into Three-Dee NT. Its logical development has come from many hundreds of hours of flying, and feed back from many customers over recent years. The one step reduction drive belt system from the Three Dee is transferred and combined with many of the components from the Henseleit Rocket, to bring the advantages of both models together. New solutions have also been used to improve performance. For instance, the tail rotor is belt driven, this gives a great reduction in weight. To be able to fit the belt through the boom a small spur gear speed up drive is used from the main shaft. To achieve maximum flexibility, the construction is designed so that it is possible to fit the Rocket tail box with drive shaft. This is necessary, if you wish to use a larger rotor diameter (for example 1,80 m) as a longer boom is needed for which there is no suitable belt available. If you wish there is also an option not to drive the tail rotor during autorotation.
The proven MFS (moving flybar system) rotor head is transferred from the Rocket to the Three Dee NT with only two minor changes, the paddles are lighter and the flybar is longer to achieve greater manoeuvrability. 3D pilots will find it easier to fly this helicopter, because of the reduced cyclic inertia and the light weight of only 4.3kg all up.
On the **MFS** (moving fly bar system) rotor head system the complete pitch compensator is no longer used. To obtain collective pitch movement, a sliding fly bar system is used. This construction has got the following advantages. The required lift, that the swash plate needs to produce the collective Pitch range, is halved compared to traditional systems.The bell-hiller levers, which are fixed on the pitch arms remain horizontal throughout the pitch range. This feature has the advantage that asymmetric blade pitch doesn’t occur during cylic inputs, because with **MFS,** the mixing levers are only making small movements. It is clear, that the pitch loads are greater, therefore there are advantages to using a three servos CCPM system compared with mechanical pitch control, which only uses one servo. The advantage of **MFS** is to obtain a large pitch range, without excessively long servo arms, as found with normal CCPM. The halved swash plate stroke makes it possible to use less servo movement found at extreme stick positions. To make this possible it is important to use high quality servos with high power and little slop. With CCPM you can reduce the percentage of pitch movement in TX set up, but for the elevator and aileron the full percentage is maintained. This will avoid the large ineffective servo movements found at high pitch angles with large cyclic deflections. To fully use this advantage the Three-Dee NT is equipped with a Push-Pull bell crank cyclic system**.**
The 80mm diameter precision machined Aluminium cooling fan with the same blade geometry as the Rocket, is fully capable of cooling the higher temperatures generated by 15 cc engines. The model is designed to run zero Nitro fuel with no problems, even on hot summer days. The hardened rotor shaft is only 131mm long making this the shortest and strongest in its class. The canopy is very similar to the Rocket canopy with the addition of small bulges to clear the large drive pulley. This fully aerodynamic design completely encloses the mechanics allowing for a low coefficient of drag during high speed flight.
During the design process I followed my philosophy of creating everything to the highest quality standards while keeping the design simple using as few parts as possible to maintain the highest accessibility, ease of maintenance and reliability. The in-depth handbook and clear instructions should make assembly easy. Through the practical combination of design and experience with the Three-Dee and the Rocket, a new strong and durable all rounder has been created that is very flexible and will cope with all the demands of different Pilots. From hovering to extreme 3D flying and high speed flight, this helicopter does it all.

2.0 Equipment requirements

I have the advantage of flying and testing my own helicopter designs and therefore can give good advice and tips for equipping and tuning the Three-Dee NT. This has proved to be very useful in the last few years. Time and again pilots have confirmed that following my advice and recommendations has lead straight to success. Though pilots have their own specialised techniques for the helicopter set up, small changes can make all the difference to the flight characteristics of the model, however you will save yourself a lot of time, and can enjoy flying right from the beginning if you follow my recommendations. I will be, of course, grateful to hear of your experiences and suggestions for improvements at any time.

Engine:	OS MAX 91FX-HGL	R.C.Models Part-No.	3D 91R
	OS MAX 91FX-HGL	R.C.Models Part-No.	3D 91L
Tuned pipe:	Hatori 700		
NT – manifold set:	for OS Engine	Henseleit Part-No.	NT-0380
Glowplug:	ENYA 4		
Lötterle carb:			
(**definitely necessary**)	RSV 10/2000	Henseleit Part-No.	NT-0362
Starter adaptor:		Henseleit Part-No.	NT-0399R
		Henseleit Part-No.	NT-0399L

RC – installation: For swash plate control you will need powerful, robust and precise servos. I strongly recommend the following!

Swash Plate Servos: Futaba S 9206 (times 3) No other servo is recommended.
This servo puts out 9,5 kg/cm only with 4,8 Volts. It is not digital and therefore require less current. Digital servos are not recommended, as the power consumption is considerably higher.

Throttle servo: Any high quality standard servo

Tail servo: Futaba S 9250 / JR 8700 or a servo recommended for Gyro used.

Gyro: CSM ICG 540 Or equivalent high quality gyro.

Receiver: **PCM**- Receiver

Receiver nicad: Sanyo 1700 mAh Ripmax No 4K1700 AUSF. No JR equivalent.
Approx size. 67 x51 x17 (135 g) bigger nicads are not necessary and take up to much space.

Main Rotor Blades: NHP Razor Pro Blades 710mm / 185g

Tail Rotor Blades: Henseleit Part-No NT-0309

Fuel: about 12% oil / no nitro !

Attention: Do not use paddles weighing more then 40g on the Three-Dee NT !

3.0 Assembly instructions

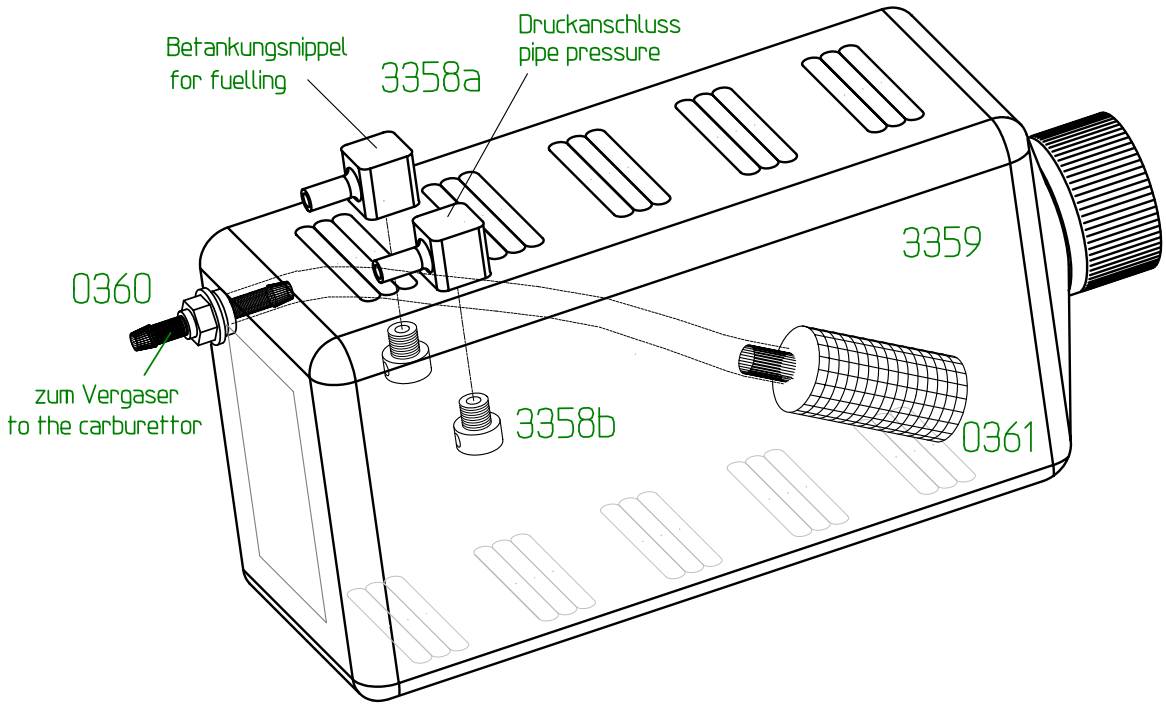
Before you start to open the bags I would like to say something about the construction. Items are collated into specific groups of construction and are marked on each bag. The assembly of the helicopter is structured in a logical way, so you are advised to follow carefully. Please read the instructions for each part of the project and follow the assembly step by step. The itemised list with the name of the bag and description of items are in the appendices, so that you can check if all the items are enclosed. With so many screws and small parts it is possible that some items are missing or put into the wrong bag. Only when they are required for assembly, empty the bags with small items onto a clear surface. It is too easy to loose small screws, washers and balls never to be found again. All specialised jobs are already carried out, so you don't need to worry about getting in any special tools. Some assemblies are already put together but are still explained in the instructions. These instructions will come in handy in the future, if you have to carry out repairs.

In the appendices there are three drawings, where you can see an overview of the tasks ahead. The first drawing shows the whole helicopter without rotor head, spaced out to show each individual item. The second drawing shows the rotor head on it's own and the third drawing shows everything assembled. Also in the handbook you will find drawings of assemblies to give you an overview of how the items are put together. Because the Three-Dee NT is a metal and composite helicopter it is possible that some items will not assemble easily. If this is the case, do not use excessive force. Think why it might not fit together and try to fit or adjust carefully or preferably give me a ring and ask what to do.

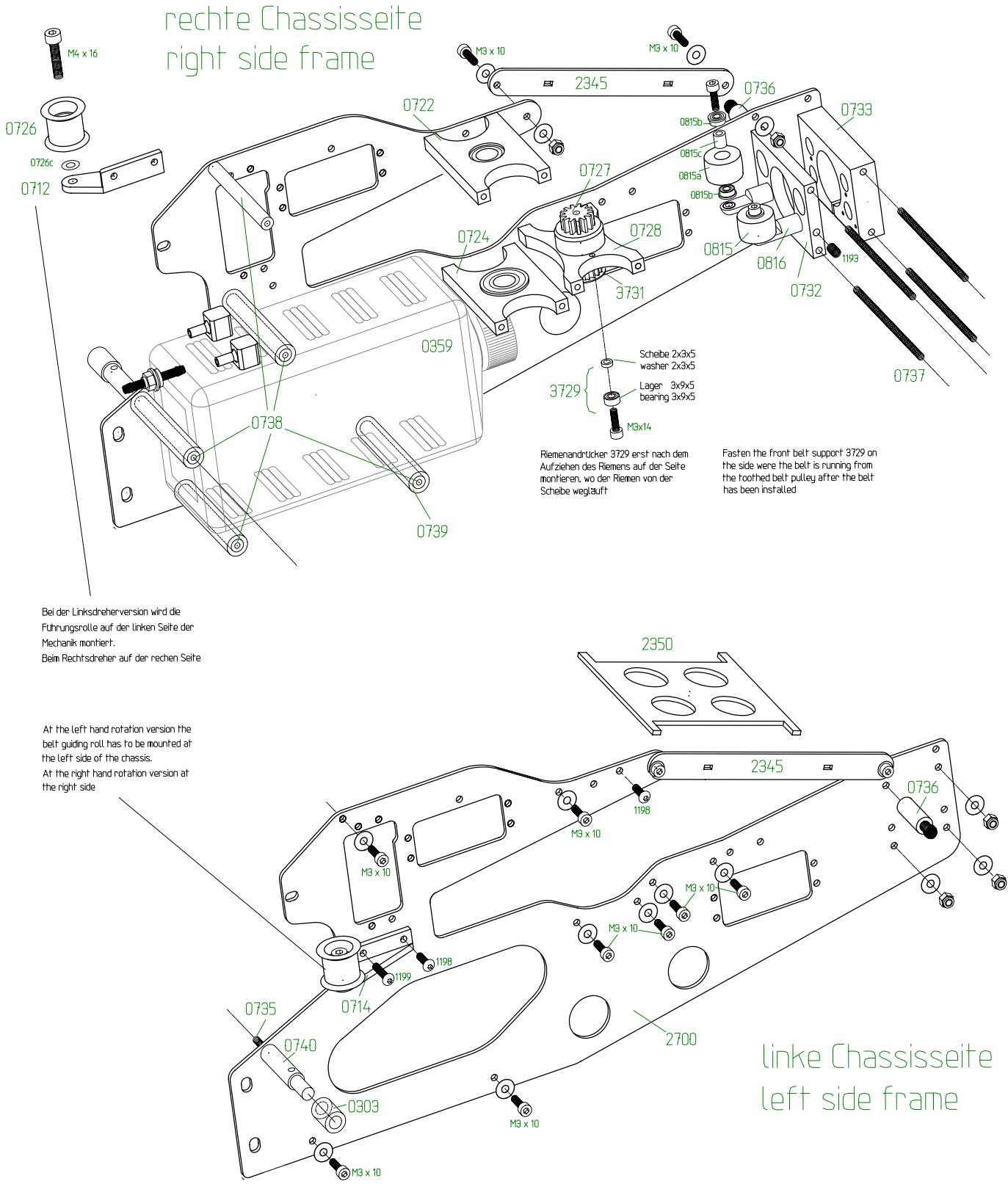
Normally the Three-Dee NT is delivered as right hand rotation outside mainland Europe, unless it is specially ordered with the standard left hand rotation OS 91 engine. (These versions of the Three-Dee NT come with special right hand rotation crankshaft as standard.) Check if you have the correct drawings.

3.1 Fuel tank

In the fuel tank you will find the filter clunk 0361, a double nipple 0360 and two 90° nipples 3358a+b which have to be fitted as follows. First smooth the three 5mm holes carefully (Attention! The tank wall is very thin). Cut off a 95mm long fuel tube and fix the filter clunk to it (secure with tie wrap). The free side of the tube is pushed as far as it will go on the unthreaded side of the double nipple (no tie wrap is required).
The nipple has to be fitted (according to the drawing) from the inside of the tank through the hole and fixed from the outside with the washer and nut. As an aid you can use a thin wire, that you push from the outside of the hole through the opening of the tank. Fix the nipple onto the end of the wire and guide it through to the hole. Whilst tightening the nut, hold the outer edges of the nipple carefully with a pair of pliers, be careful not to squash the nipple.
For mounting the 90° nipples take a piece of 2mm spring steel wire which you have to put through the crosswise drilling from the brass nipple 3358b. Set up the nipple from the tank opening through the inside of the hole and screw the 90° alu piece 3358a from the outside onto it until it is thight. Than pull out the wire and turne the nipple clock wise into the right position. A additional gasket is not required. Put the lid on the tank and tighten using a little silicon rubber sealer in the threads, so that it does not open during flight.



3.2 Assembly of the chassis



Take out of the "*CFK-PARTS*" bag, the two side frames 2700, the RC-main plate 2350 and the two side strips 2345. Open the bag marked "*CHASSIS*". First fit the belt guide roller 0726 onto the belt guide roller support 0712 or 0714 according to the drawing (don't forget the spacer washer between the bottom bearing and roller support and tighten M4x16 screws using loctite). The guide roller support has to be screwed lightly onto the side frame with a M3x10 dome head screw and nut on the rear hole.

Now screw the lower bearing holder 0724 (the bearing has to show to the top) and the upper bearing holder 0722 (the bearing has to show to the bottom) and the assembled tail drive shaft bearing holder 0728 lightly onto the right hand chassis frame. Attention! The back screw of the upper bearing holder 0722 has to be a dome head screw M3x10, because a larger screw head would touch the swash plate push rods. From experience at this point little or no loctite is needed.

Four out of the five 6mm thick spacers 0738 are sleeved with silicon tube 0739. Screw all plate holders lightly onto the right hand side frame as per the drawing. Screw the canopy mounting support 0740 on which the prepared M3x16 threaded studs 0735 have been fixed using loctite. The spacer which is placed at the front hole of the guide roller support is fixed with a dome head screw M3x12 through the front hole of the guide roller holder. For the other side you have to take a M3x10 cap head screw and a washer later.

Loosely screw the left side frame onto the prepared right frame and fix the tail boom holder 0732 and 0733 each into the lower hole in the frame as per the drawing (slot shows to the bottom). Attention ! The aluminium front tail boom holder 0732 has to make an electrical earth between the boom and chassis to stop any RF interference. Lightly rub down the chassis and the boom in the contact area to give a good electrical connection. Fasten the graphits rolls 0815 with the supports 0816 as the drawing shows. The M4x4 grub screw must be turned into the threaded hole before assembly the boom holder between the side frames. The rolls should point up vertically. The graphite rolls cover the tail belt with a thin graphite surface after some flights so that the belt becomes antistatic.

Next fit a nut with some loctite onto one side of the three studs M3x72 0737, so that the thread is protruding the nut by 1mm. Push the studs through to the other side, only tighten the nut slightly. You need to remember which side is the one with the loose nuts, so that you can tighten them later when you fit the boom. The last threaded shaft has to fasten the two rear canopy supports 0736. Fit the two pipe supports 0388 onto the back tail boom holder 0733 using M3x10 dome head screws (see drawing).

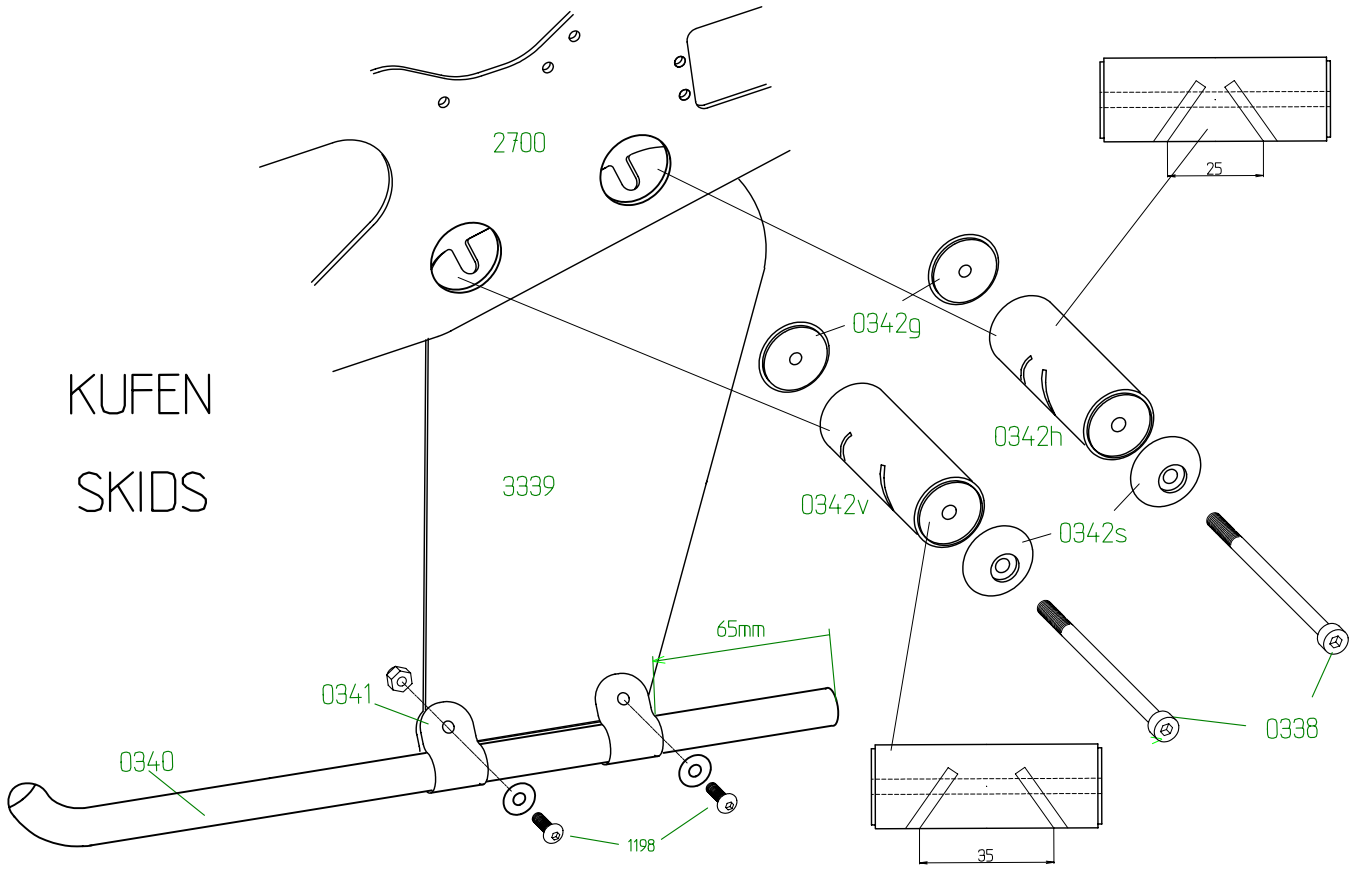
Now place the assembly onto an even surface and tighten all of the screws, <u>except</u> the lower tail boom holder screws, tightened evenly in several steps (similar to tightening the wheel nuts on a car). Do not tighten canopy mounting support 0740 on to the front spacer 0738 immediately as the tank has to be taken out again to fit the servos.

Use a nail file to make the tongues on 2350 fit the notches 2345. When you are satisified with the fit roughen up a 3mm strips on the inside corners of the assembly, to make a good glue joint. Fasten the parts at the side frames provisional (see drawing). Place a drop of cyno glue into the corners from above. Take care that no glue runs down and bonds the side strips to the side frames. Wait a few minutes for the glue to dry and then unscrew the assembly completely from the chassis. Now put micro ballons which you can find in the bag marked "*Different Parts"*, in to each corner between of the assembly and drip some cyno on top. This type of joint is very strong. The joint does not need to be thicker than 2mm. Do not fix the assembly onto the chassis yet.

3.3 Skid assembly

Open the bag marked "*SKIDS*"

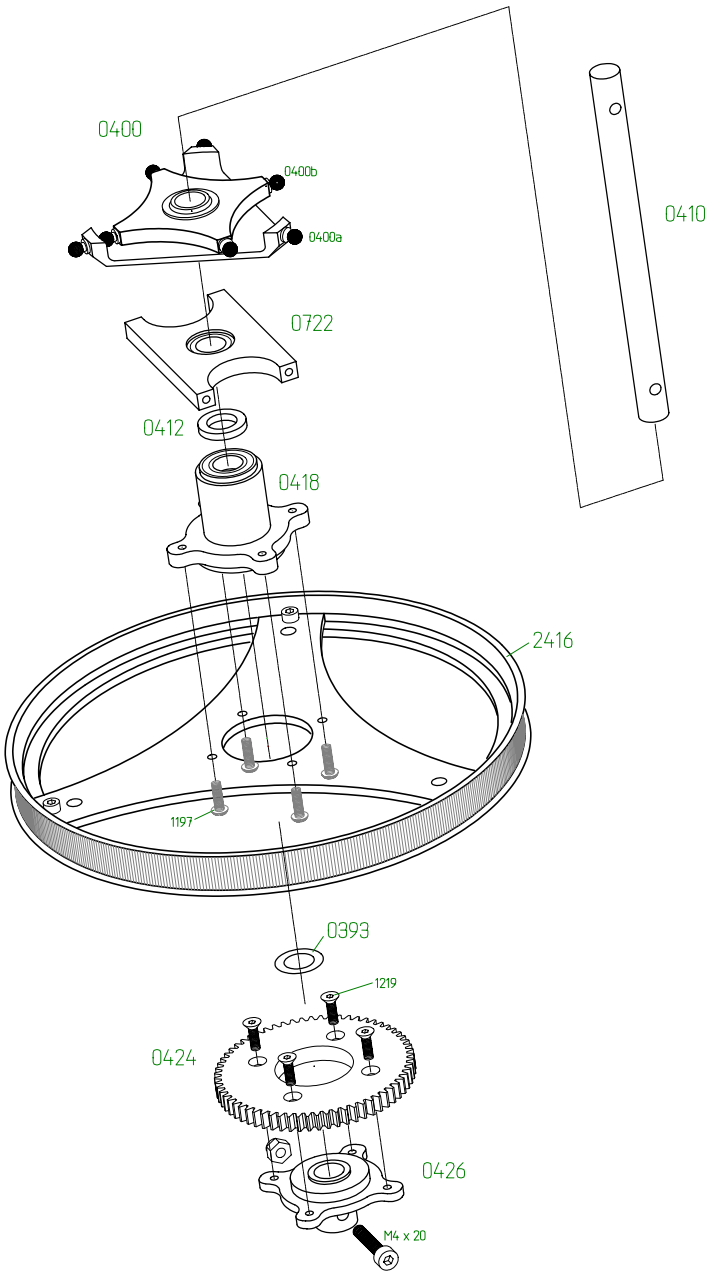
The under carriage plate holders 0342v (front) and 0342h (back) have different slot positions, so that the skids will be parallel after assembly. Put the relevant plate holders according to the drawing from the bottom into the prepared side frame holes. Spread the chassis a little for that. Put the M4 x 70 under carriage studding 0338 through the aluminium cover 0342s and than through the assembly and screw the second aluminium cover 0342g with the M4 thread from the other side onto it. Now take out the under carriage plates 0339 and roughen both sides where plate holders grips the plates. Make sure that this area is roughened properly, as the plates are only held by the gripping action of the nylon, and could slip out. The reason for this fixing method is in the case of a crash the plates can come out without damage. (This has been experienced on several occasions.) Now assemble the skid clamps 0341 and the skids 0340 with the M3 x 10 dome head screws, with the head pointing to the outside. Put a big M3 washer under each screw head and nut. Do not tighten the nuts yet. Put the skid plates into the mounting slots, the bolts have to be moved around so that the plates fit into the slot to full depth and have the correct angle. Now tighten the undercarriage retaining nuts 0338 in regular steps as the plate holders are made of nylon and have to settle down. Finally turn the skids so that the front is pointing up and the skid protruding 62 – 65mm from the back of the skid clamp. When this is done, tighten the nuts. A additional drip of cyan glue between the skid clamps and the skids prevent them from turning arround because of vibrations.



3.4 Main shaft unit

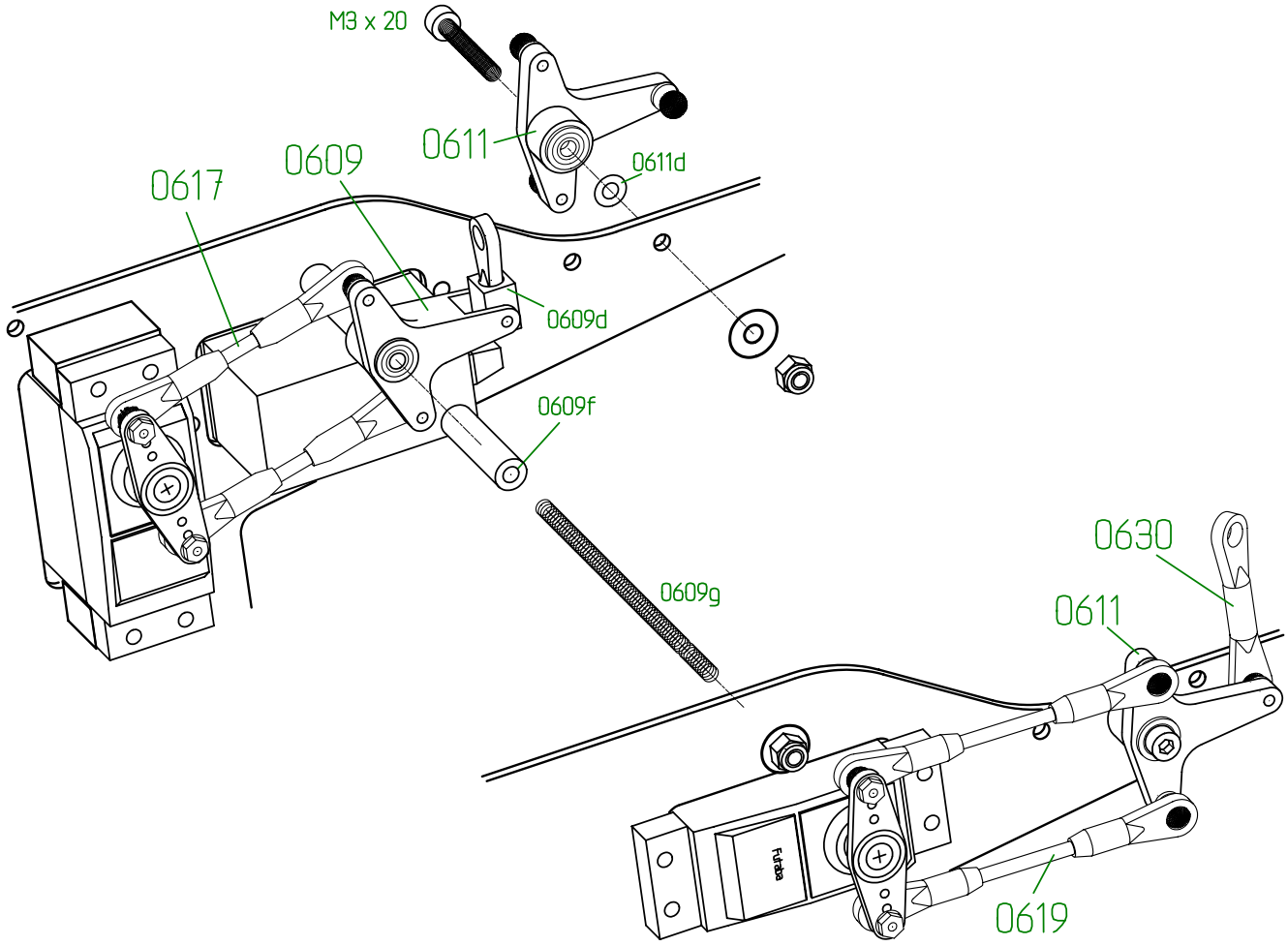
Open the bag marked "*MAIN SHAFT UNIT*".

First screw the gear wheel 0424 to the main gear centre hub 0426. Secure the M3x10 counter sunk screw using a little loctite. The large toothed belt pulley 2416 has to be screwed onto the one way drive shaft 0418 with the M3x10 dome head screw . If the toothed belt pulley fit, is too tight on the hub, open up the hole a little with sand paper, so that no distortion occurs. Assemble the prepared units between the rotor shaft bearing holders 0722 and 0724 on the chassis (see drawing!). A spacer from 0,2mm has to be placed between the hub 0426 and the one way drive shaft 0418. The spacer 0412 is placed last underneath the upper bearing holder 0722. Next push the rotor shaft 0410 from above through the upper bearing, hub and through the lower shaft bearing holder. Push the M4x20 screw through the hole of the main gear centre hub 0426 and the rotor shaft and tighten the nut well. Place the toothed belt 0417 over the belt pulley and lead to the front, inside the guide roller.
Now screw the RC main frame onto the side frames. Check to see if the rotor shaft has any axial play. If so loosen the 4 screws of the upper bearing holder 0722 and push down to remove any slop. If this does not work use the spacers included, remove the upper bearing holder 0722 and slide them on from the top over the rotor shaft and screw the bearing holder back on. When there is no play or binding tighten the screws. Do not fit the swash plate yet.



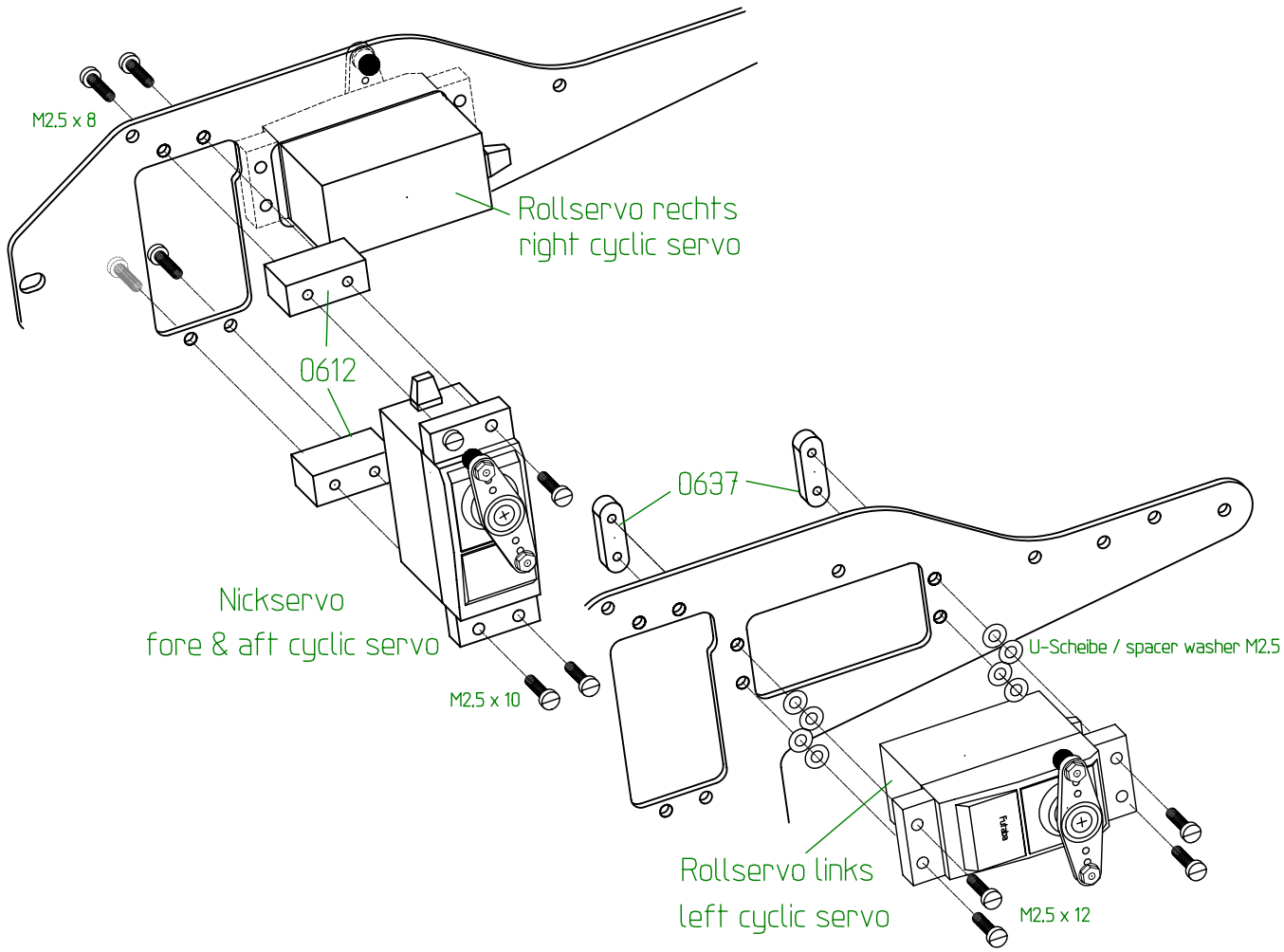
3.5 Push Pull unit

Open the bag marked "*LINKAGE*" and take out bag "A".
Both the push-pull levers 0611 and 0609 are fitted with two bearings and a bearing spacer. To press the bearings in you can use either a parallel clamp or a vice. One bearing has to be pressed in up to the flange. From the other side fit the bearing spacer and press the second bearing in to place. A pen can be used to move the bearing spacer slightly to one side, so that it is possible to push on to the inner ring to remove the bearing if it has to be changed. Fix the M3x4 threaded balls onto the lever according to the drawing using some loctite. Remove any burrs from the threads of the balls. Attention! two of the threaded balls 0609h have threads shortened to 3mm, these are screwed in to the fore and aft cyclic lever 0609. The two right and left cyclic levers are screwed onto the chassis using M3x20 screws – see drawing. Attention! The spacer washer 0.5x3x6 should go between the bearing and the side frame. Place the large M3 washer onto the chassis inner side and tighten the M3 nut. The for and aft cyclic lever together with the stud shaft and the two spacers 0609f are fixed so that the threaded balls point to the right - see drawing.



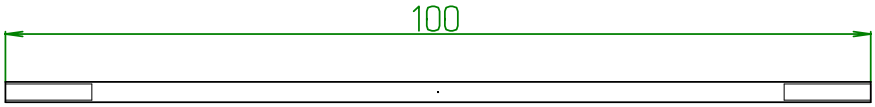
3.6 Assembly of the swash plate servos

In bag “B” of the “*LINKAGE”* bag you will find the fixing screws for the right and left cyclic servos and the throttle servo. Also in bag “C” you will find the servo mounts and fixing screws for the fore and aft cyclic servo and the tail servo.
First fix the two left and right cyclic servos on both sides of the chassis according to drawing. With Futaba-Servos two M2.5 spacer washer has to be fitted between the chassis and the servo on each screw, so that the push-pull lever 0609 does not foul the servo. Fit the servo grommet sleves from above and the M2.5x12 screws are pushed from the outside into the fixing holes. Hold the servo fastening plates 0637 with a pair of pliers from the inside and tighten the screws using only a little loctite. It is useful to fix the fastening plates with a little glue on the side frames so that it is much more simple in the future to unscrew the servos.
Fix the 12.3mm fore and aft cyclic servo stand offs 0612 with the M2.5x10 screws onto the fore and aft cyclic servo and push these into the slot in the right chassis frame according to the drawing. Attention! check the position of the servo (the servo lead points up). From the outside, attach the stand offs with the M2.5x8.screws (It is important to use the right screws). From the servo side 10mm long screws are used and from the chassis side only 8mm long screws. If you used 10mm screws on both sides they will interfere with each other consequently you would not be able to tighten the blocks. The servo cable is pushed through the small slot back into the chassis and placed to the back under the right cyclic servo. Just behind the right cyclic servo the servo cables are tied together with a cable tie.
Throttle and tail servos are <u>not</u> assembled in this chapter.

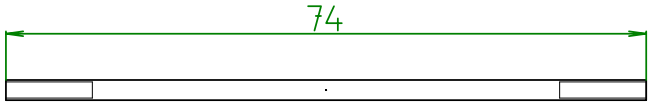


3.7 Rods

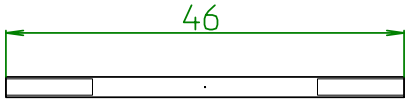
Take the bag marked “D” from the the “*LINKAGE* “ bag. On the drawing below are various rods shown. Underneath is the part number, description, and the number of rods required.
The figures in brackets are taken with a vernier gauge and are to be read as follows:- Measurement between the ball link screw holes and measurement between the threaded ball centres. It is easier to measure between the ball link screw holes. Study the drawing and find out where each rod belongs. Screw on the ball links until the thread disappears, and measure the distance between the ball link screw holes with the inside of the vernier. Correct the measurements (one turn is 0.4mm). Make sure that the ball links are fitted the right way around, so that the 2.5 is pointing outwards. To press the ball links on the wrong way around is very difficult. The linkages 0630 between the left and right cyclic push-pull lever and the swash plate have to be at 30º to each other, so that they are at right angles to the balls. The given measurements are guides, which may be corrected later in chapter 4.0 (Fundamental adjustments). Screw the ball links onto the rods and adjust to the given measurements. Two of the 36mm long rods are glued into the tail push rod 0631 using either Epoxy or cyno. Remove all residue of oil and roughen the outside of the rod where they are pushed into each other. If you are working with cyno you will have to be quick, as glue will cure before the rod is in position. The rods must be pushed in so that 10mm of thread is showing from each side of the tail push rod. Now fix the two 0617 rods and the four 0619 rods onto the push-pull-levers. Here the length of the rods has to be set accurately. When adjusting the left and right cyclic push rods length try to set them so that the 2.5 identification on the links are opposed 180º when they are the correct length so that they are easier to push on to the ball. Now slide the swash plate onto the rotor shaft and connect the push rods.



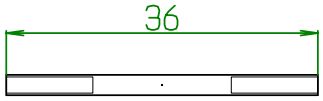
1x NT-0629 Gasservo – Vergaser (ca. 84 / 124)
throttle servo – carburettor



2x NT-0625 Taumelsch. – Mischhebel (ca. 56 / 95,5)
swash plate – bell-hiller levers

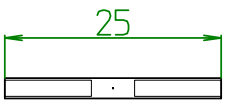


2x NT-0623 Taumelsch. – Paddelstange (27 / 66,5)
swash plate – flybar



4x NT-0619 Rollservo – Rollhebel (17.5 / 57)
left & right cyclic servo – push pull lever

2x NT-0633 Einklebegewindestangen für Heckanlenkung
CFK – tail push rod insert



2x NT-0617 Nickservo – Nickhebel (ca. 6.5 / 46)
fore & aft cyclic servo – push pull lever

3.8 Preparation of the RC-System and assembly of the servo arm

Before installing the rods at the swash plate servos and assemble the other servos, first set up the RC-components and fit the servo arms in a correct angle. For that connect all servos to the receiver, adjust all trims to the middle, dual rate and exponential functions to zero and adjust the servo travel to 100% both ways. Also any mix functions should be deactivated.

For CCPM (3 servo 120º left and right roll servos at the rear / elevator servo at the front), check the movement of each servo. Put the throttle and the tail servos into position on the table before installation. The indicated turning direction always relates to the view from above the servo.

Attention: For positive pitch the swash plate has to move downwards and for negative pitch upwards. The reason for this is that the blade linkages have to be connected to the trailing side of the blades.

Transmitter movements	**Servo turn direction**	(**CW =** clockwise) (**CCW** = counter clockwise) (**O** = no movement)
Full throttle	Throttle servo = CCW (Lötterle carb.)	
Tail right (left hand rotating system)	Tail servo = CCW	
Tail right (right hand rotating system)	Tail servo = CW	
Positive Pitch	Elevator servo = CW / left Roll servo = CW / right Roll servo = CCW	
Negative Pitch	Elevator servo = CCW / left Roll servo = CCW / right Roll servo = CW	
Forward elevator	Elevator servo = CW / left Roll servo = CCW / right Roll servo = CW	
Back elevator	Elevator servo = CCW / left Roll servo = CW / right Roll servo = CCW	
Roll left	Elevator servo = 0 / left Roll servo = CW / right Roll servo = CW	
Roll right	Elevator servo = 0 / left Roll servo = CCW / right Roll servo = CCW	

The information above relates to the installation and position of the servos in the Three Dee-NT (see drawings). Now put the pitch stick exactly in the middle. Check the gyro is sensing the correct way, so that you have no unpleasant surprises at the field! (Use the gyro in normal mode and not in Heading Lock.) If you put the gyro on the table and turn it left, you simulate a left turn of the model. This has to create an opposite output at the tail servo. This means that the tail servo is turning the nose to the right. Leave the system turned on, so that the servo output shaft does not move from the neutral position.

Now fit the servo arms to the left and right cyclic servos so that they are right angles to the servo. If this is not the case, turn the arm in 60º steps until the optimal position is reached. Cut off the 4 unwanted arms, and smooth the edges (this works best on a sanding machine).

In the bag ”E” you will find the threaded link balls for the cyclic servo arms. Take the third hole at 13.5 mm from the centre. Attention! The balls have to be fitted to the underside of the servo arms. First push the ball right up to the servo arm hole and then put a washer and the nut onto the thread. Use some Loctite to secure it.

Fix the left and right cyclic servo arms into the correct position while the system is turned on, so that the servo output stay in the correct neutral position.

Attention! Loctite should be used to retain the servo arm screws on metal output shaft servos.

Check that the linkages that come from the push-pull lever are the correct length and fit without binding. Sometimes it is necessary to turn one ball link one turn in or out to get a connection to the servo without binding.

A very small amount of binding does not cause a problem and will remove any play from the system.

Take the 18,5 mm high aluminium swash plate lock from the bag “*DIFFERENT PARTS*” and slide it from the back under the swash plate. With the slot to the front, position the swash plate lock on the upper bearing holder directly under the swash plate and move the swash plate down carefully.

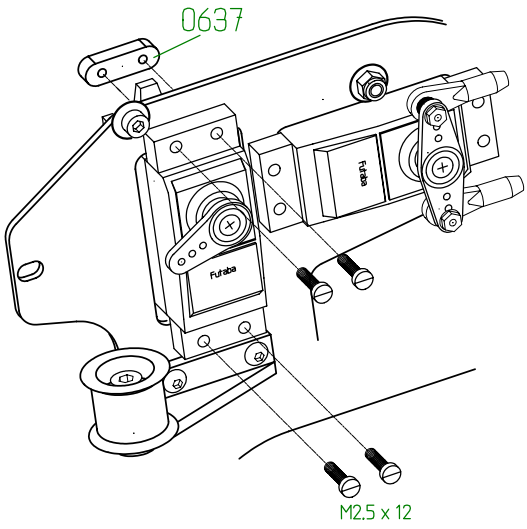
The left and right cyclic push-pull leavers must be at right angles to the upper bearing holder 0722. The fore & aft cyclic push-pull leaver is constructed so that the linkage is at the correct angle to the fore & aft cyclic servo output arm.

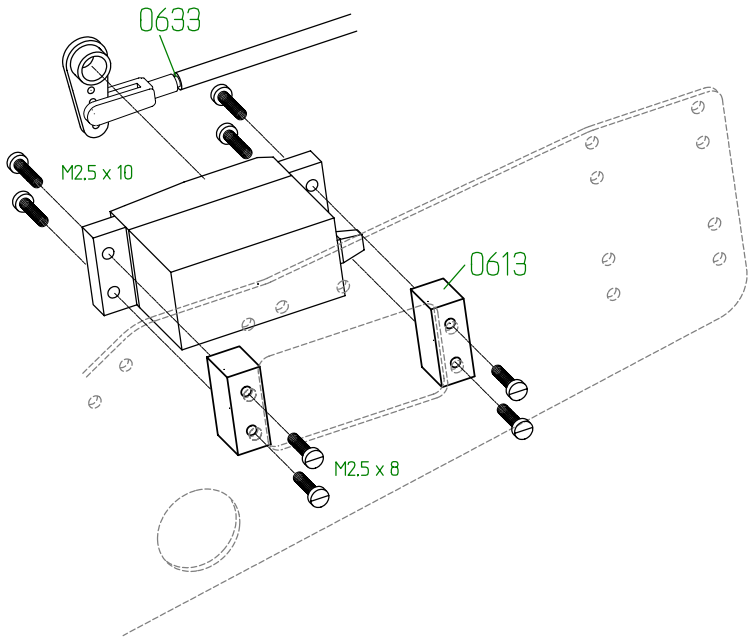
Therefore the servo arm has to be placed at the same angle so that the two links 0617 are the same length. The servo arm should only be fitted when the swash plate lock is in place to give the right fore & aft push-pull lever position.

3.9 Installation of the throttle servo and tail servos

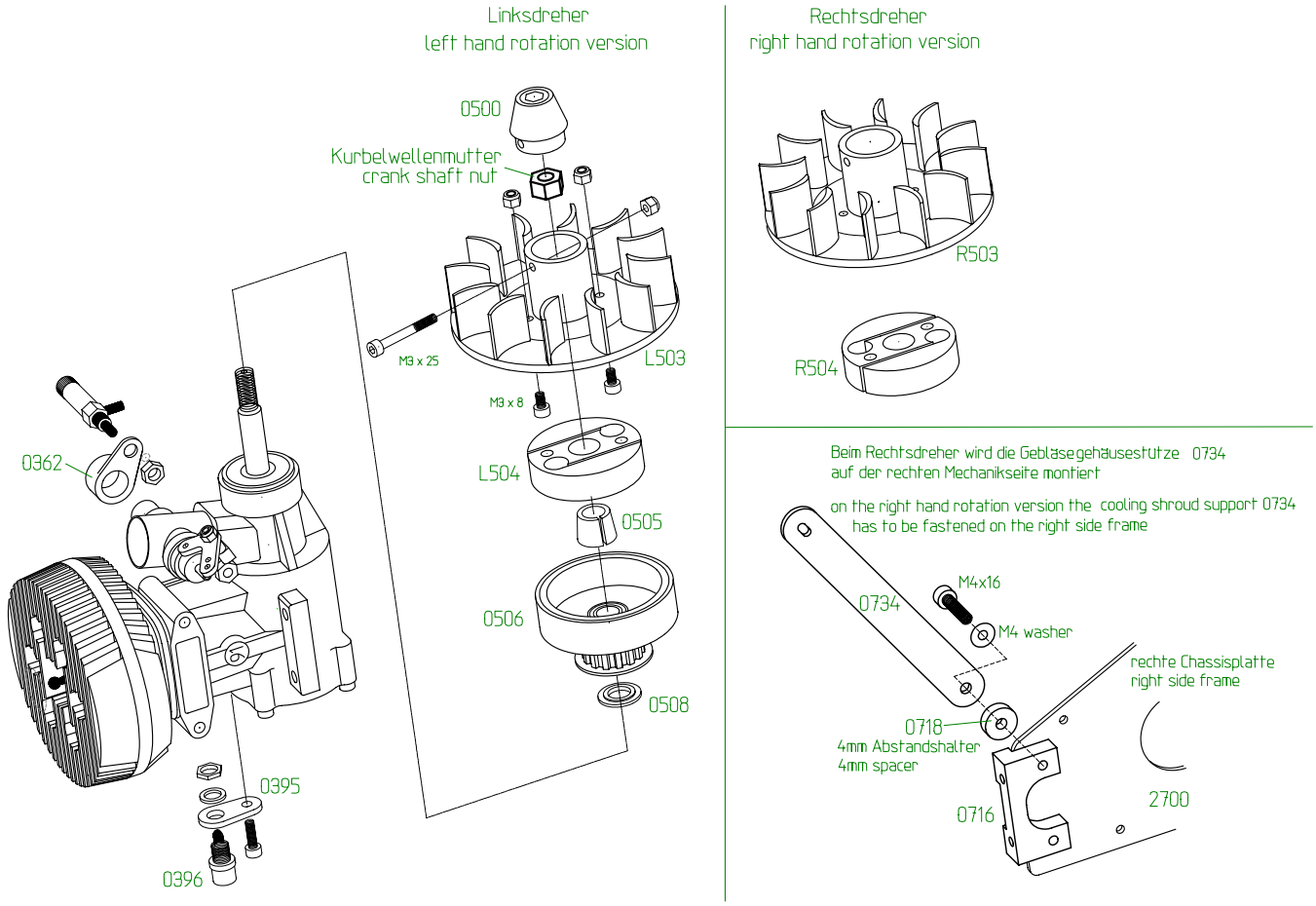
Fit the throttle servo from the outside to the left side frame. The servo cable goes to the top. Guide the cable under the left cyclic servo to the back. The assembly of the servo arms follows later.

Screw the tail servo with M2.5 x 10mm screws on the 11mm tail servo mounts 0613 and fasten it from the inside on to the left side frame with M2,5 x 8 screws, so that the cable is exiting towards the tail (see drawing). The servo arm has to point downwards.





3.10 Assembly of the engine unit



Open the bag marked "*ENGINE*"

First remove the nut and washer from the crankshaft. Take the special washer 0508 and slide it onto the crankshaft, so that the small step points up to the clutch bell 0506. This is very important as the washer will drag on the outer ring of the clutch bell bearing if not fitted correctly. Now push the clutch bell bearing with bearing onto the shaft.

Attention! There is a spacer 0506c between the two ball bearings, so that the inner bearing rings do not bind. This spacer can move out of alignment and may have to be adjusted with a screwdriver or similar before fitting. Next slide the taper collet 0505 as far as it will go onto the crankshaft and then place the clutch 0504 on top.

(A special tool is needed to remove the clutch. This tool is attached with two long M5 screws into M5 tapped holes in the clutch. To pull the clutch off the tool uses a central screw with a point ground on the end to locate in the end of the crank shaft.)

Fix the two M3x8 cap head screws onto the cooling fan flywheel 0503. Push them from the underside of the cooling fan and tighten on top with lock nuts. The two screw heads are located in the large holes in the clutch.

If you plan to use a governor that needs a magnet in the fan, you should drill a suitable size hole 5mm from the edge, between two blades. You should not need a weight on the other side, because the cooling fan flywheel is made of metal and is not put noticeably out of balance. You can glue the magnet into the hole using epoxy or cyan.

The cooling fan is pushed onto the crankshaft and tightened with the crankshaft nut without a washer. The sharp edges of the nut should point up so that they do not sink into the aluminium and therefore are not able to be tightened up enough. To avoid cutting yourself hold on to the cooling fan with a cloth when tightening the nut very well. Only a little loctite is needed. Do not use any tool between the fan blades or they will be damaged. If during flight you hear a ringing noise you may find that the crankshaft nut has come loose.

Last the starter cone 0500 is fitted. For this the M12 grub screw is fitted with some loctite from underneath into the partially threaded cone. Put an allen key from above through the cone and screw the grub screw from underneath up into the thread until it tightens. Grease the cone in the lower area, so that it does not jam in the cooling fan and fix the cone with a M3x25 screw to the fan according to the drawing.

To be able to push the tank 0359 between the plates, remove the two front side frame spacers 0738 between the chassis side frames. The two 90° tank nipples point forwards and the tank lid is between the lower bearing holder 0724 and the front under carriage plate holder.

Attention! First stick some double sided tape onto a piece of 5mm wall thickness slit silicone rubber tube and stick it onto the front lower edge of the lower bearing holder 0724. This will press onto the tank lid from above.
Fix the side frame spacer in the assembly again. The tank lies on both the bottom and the front spacers, that are covered with the silicon tube – see drawing 3.2

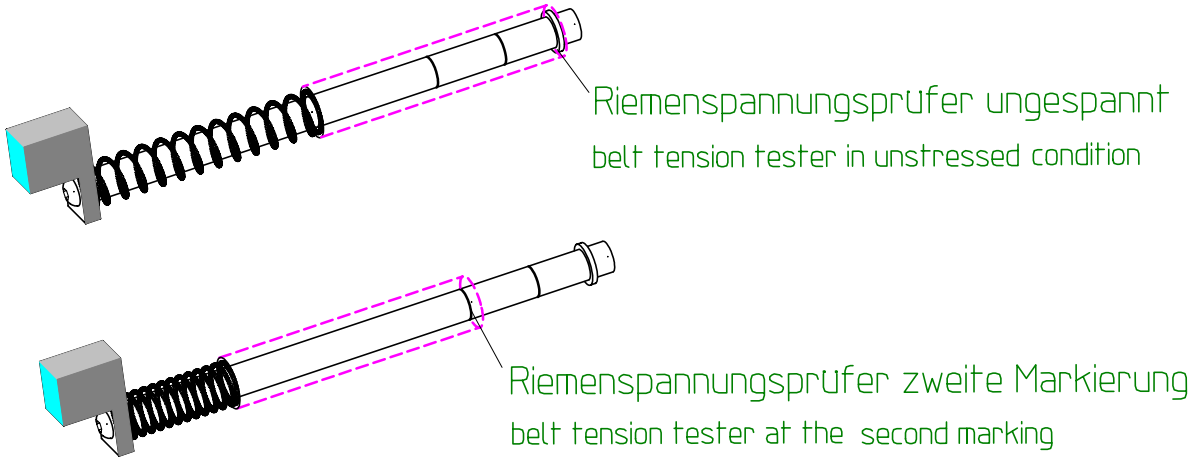
Screw the engine supports 0716 with the cut out to the inside of the side frame into the slots using two M4x10 screws and large 1,6mm thick M4 washers. The right engine support is fixed in the upper hole with a M4x16 screw together with the spacer 0718 and the cooling shroud support 0734. See little drawing!
On a left hand rotation version the shroud support has to be fixed on the other side (left side).

In the bag marked "*DIFFERENT PARTS*" you will find 3 Feeler gauges sizes 0,1 / 0,2 and 0,3mm. These are to even out the tolerances of the belt lengths. Grip the feeler gauges between the front edge of the chassis and the engine supports, whilst tightening the screws. The slots are wide enough to accommodate the engine supports in different positions. Adjust one engine support after the other with the same size feeler. Using a combination of the 3 feelers a gap of zero to 0.6mm it is normally enough to adjust the belt tension. Mount the supports with the 0.3mm in the gap. Push the engine support as far as it will go against the feeler and push it up all the way to the top of the slots and tighten slightly.
Now assemble the motor onto the supports with the M4x16 screws and the small washers and adjust on the longitudinal axis. Don´t forget to put the belt over the cooling fan before. Tighten the engine screws well. Because the engine support fixing screws are still loose you can still adjust them without distorting the crankcase. Apart from the M4x16 screw, that holds the cooling shroud support 0734, all other screws can be tightened.

The belt has to fit in within the belt guide roller 0726. The job of the roller is to guide the belt and reduce any belt vibration. If you are using the suggested OS 91 motor the height of the front belt wheel should be correct. View the helicopter from the left hand side and turn the clutch bell in engine rotation direction. Check to see if the belt has got a tendency to run out of the belt guide roller. If there is a problem loosen the 4 motor support screws and adjusted in the slots until the belt runs true. (Do not forget to take out the feelers after you have finished).

Belt tension:

In the bag different parts you´ll find a belt tension tester 3398. Take this gauge at the black plastic handle and press it on the side were no belt guide roller is mounted vertical onto the belt. The point has to be at the level of the front side from the chassis. Push the belt to the chassis until the tip of one of the belt teeth touch the edge of the chassis plate 2700. You´ll finde two markings at the tension tester. If the second marking appears in this moment the tension of the main belt will be correct. This marking indicate a pressure from about 1400g (see picture next page).



Glow plug connection:

Screw the remote glow plug socket 0396 into the socket support 0395. (Secure the nut with some loctite). Fix the remote glow plug socket support plate 0395 onto the engine front right hand back plate screw, so that it points to the front, parallel with the cylinder. A ground wire is not needed as the socket support is connected to the engine housing. Cut the cable of the enclosed plug clamp 0397 to 160mm length measured from the top of the clamp and solder the end onto the middle contact of the remote socket. Before soldering push a piece of heat shrink tube over the cable to insulate the solder joint. Later you can connect the glow supply from the starter box through the lower opening of the canopy without drilling additional holes or adding special supports.

Throttle:

As the original OS throttle does not work well with low nitro fuels, I suggest using the Lötterle carb (see chapter “Equipment requirements”). It takes 1/3 less fuel than the original so that the extra money you have to spend on the carb will be a good investment. Remove the high speed needle from the Lötterle carb. Loosen the clamp ring that positions the bell crank so that it is possible to move and turn it. Fix the high speed needle onto the high speed needle support 0362, which you will find in the bag marked “*ENGINE*”. Push the needle assembly from the outside through the 5mm hole and lightly screw on the nut. Put the needle support as far as it will go over the 10mm diameter brass assembly of the throttle, in which the idle adjustment screw is situated (do not tighten the screw yet). Fix the carb horizontally with the throttle linkage to the left side of the chassis. Now tighten the carb pinch bolt. Cut a length of fuel pipe 80mm long and push it onto the speed needle outlet nipple. Look at the helicopter from the right hand side and move the high speed needle support plate, so that the pipe from the needle only just misses the bottom fan side of the throttle casing. Tighten the grub screw with some loctite. Now turn the inlet nipple in the direction of the tank exit nipple and tighten the nut. Connect the two nipples with a 50mm long fuel tube. Look at the helicopter from the left hand side and rotate bell crank assembly to the correct angle to line up with the throttle servo arm and tighten. From the side the clamp is positioned so that the throttle bell crank sits as shown in picture 2 of the throttle operating instructions with the carb completely closed. Turn on you system and move the throttle servo to tick over and move the trim all the way down. In this position the servo arm has to be fixed onto the servo. Connect the throttle push rod to the 13.5mm radius hole in the servo arm and fit arm to servo so that the arm points directly at the carb (see drawing 3 in the appendix). The throttle rod 0629 is adjusted so that the throttle is fully closed. Fully open the throttle and use travel adjust to fine tune full throttle opening. Connect the 80mm fuel tube from the throttle high speed needle to the throttle slider.

The assembly of the cooling shroud is described in a later section.

3.11 Main rotor head

Open the bag marked "*MAIN ROTOR*" and also use the drawing of the Rotor head from the appendix.

Attention! unlike other rotor heads the linkages are connected to the trailing side of the blade holders. This means to apply positive pitch the swash plate moves downwards and for negative pitch it moves upwards. This is to prevent resonance appearing between the main blades and the moving fly bar system. Do not run leading pitch arm as this may cause an uncontrollable resonance causing the helicopter to crash!

The rotor head comes partly assembled. You only have to fit the fly bar seesaw into the rotor head centre hub and fix the four flybar seesaw guides 0122 with the M3 x 8 dome head screws 1197 Do not use any Loctite, from experience the screws do not come undone and they are easier to undo when necessary. During a crash the fly bar seesaw guides absorb some of the force and snap off.

First assemble the two flybar link guides 0100 at the centre hub 3120. Take a piece of sand paper to sand about 4 mm of each side from the flybar link guide pin 0101. Push the pins through the holes of the centre hub and the flybare link guides and look whether the guides are able to swing about 20° to each side. If this looks good push out the pins about 3mm to one side and cover the out looking pins with loctite. Put also a drip of loctite into the hole of the other side of the centre hub and push the pins back to middle position. Remove surplus loctite immediately. It is very important to do it in this way otherwise glue will run to the plastic guide and stop any possibility of movement. Wait some minutes until the glue is dry.

Fit the fly bar seesaw 0124 together with its fly bar guide box side plates 0126 and fly bar guide box top and bottom plates 0127. Fit the fly bar unit into the centre hub and attach the fly bar seesaw guides loosely with the dome head screws. Press the block onto the side against the t-shaped strips, before tightening the screws. When all screws are tightened the block should move freely up and down in the fly bar seesaw guides. Some grease enhances the movement and should be applied to the corners of the fly bar seesaw guides. It does not matter if the block is a little stiff in some areas, as long as it does not jam.

If the block has some play it can be corrected with the M3 x 6 grub screws 1189 on the side. Using some Loctite "easy tight" carefully take up any slop in the nylon slides with the grub screws. We are only talking about small adjustments of perhaps a few hundredths of a millimetre. Tighten the screws evenly and make sure that the block still slides smoothly up and down. This procedure can be repeated after a few flying hours, when the play has increased.

If you have not enough play in the axis of the flybar a piece of thin tape can be put between the seesaw guides and the center hub to increase the distance.

Slide the fly bar lever 0128 sideways through the fly bar seesaw bearing into the middle of the seesaw, with the M4 grub screw 1195 pointing down, apply some Loctite "easy tight" to the screw. The grub screw should not stick out, as the fly bar lever will catch on see saw assembly. The lever fits exactly between the two fly bar centre supports 0125, which are clamped in the middle of the seesaw.

Now slide the fly bar 0132 through the fly bar seesaw 0124, and centre to equal length on both sides of the seesaw, now tighten the grub screw. Use a good quality tight fitting allen key to tighten the grub screw.

When the Loctite has cured, spray a little oil between the fly bar lever and onto the bronze bushes. This is to be repeated every few flying hours.

Now slide the two fly bar collets 0135 onto the fly bar, turn the fly bar lever to the horizontal and tighten the collets against the ball bearings 0130, with the grub screws 1193 pointing down.

The blade holders now have to be fitted so that the pitch arms are on the trailing side of the blade holders.

According to the drawing the threaded balls have to be fixed to the bell hiller lever assembly 0118. Take the M3 x16 screws and a spacer washer 0.3 x 3 x 6 and fit through the bell hiller lever onto the pitch arm 0116.

Fit as per the drawing, the threaded link ball 0124a with the thread shortened to 3mm into the M3 hole on the fly bar seesaw 0124.

Look at the drawing of the Rotor head in the appendix.

Attention! Tighten all screws and bolts well and secure using Loctite.

Cover the paddle with heat shrink tube. There is more heat shrink tube in the kit than is needed, so that you can have a second try if you fail at first. First use a sharp knife to cut off the high spots on the paddle. Take a slightly longer M4 screw or an old fly bar and screw it lightly into the paddle. Cut off a piece of heat shrink tube, which is 20mm longer on each side and push it onto the paddle.
Take a big cooking pot with boiling water and dip the paddle with the tip downwards into the boiling water and keep it there for a few seconds. Finally form the hot plastic at the paddle root and the tip with your fingers so that it is close to the surface.
Cut off the overlapping plastic with a sharp carpet knife, or scalpel so that all edges are smooth. The paddle inside has to be enclosed a little by the heat shrink tube so that it don´t fly away by the centrifugal force. Put the paddles in a vertical position in a warm place so that the water can run out and evaporate. This takes normally several hours.

The paddles are screwed 35mm into the flybar to a distance of 155mm between the fly bar collet 0135 and paddle. It is important that the distance is equal on both sides. The paddles are not positioned yet. This is done later in chapter “Fundamental adjustments”. When screwing the paddles on hold them carefully at the base, to cause no damage. They are very delicate as a result of lightening. Take care not to damage the fly bar by holding it with a rough pair of pliers.
The 4mm hole which goes through the complete paddel is made for an additional weight if somebody prefere a little slower reaction. You can take a end of an old flybar and cut it to a length of 135mm. Screw a nut onto the end and secure it with loctite. Push the piece from the side were the paddel is connected with the flybar into the 4mm hole. The nut prevent a slip out of the weight during the flight.

Push the rotor head onto the main shaft. Fit and <u>firmly tighten</u> the rotor head bolt 3136 and a washer on each side with the M4 nut.

At the end of this chapter are explanations on how to dismantle and re-assemble the blade holder 0114 and bearings, the feathering spindle damper and the fly bar seesaw bearing. It is possible, that the blade holder bearing have to be changed after a bad crash or after many hours of flight. In most cases you only have to change the feathering spindle 0110.

If bearings have to be change, loosen the four screws that are holding the blade holder onto the blade holder retaining bush 0112. If the blade holder does not come off, heat it up gently with a blow torch to expand the metal. It is usually the inside bearings or the thrust bearings that are damaged and have to be changed. When removing the bearings and spacer washers remember the order in which they were assembled, so that the new bearings are put back in the correct order.

(See the drawing in the appendix).

<u>Attention.</u> Here is the order from the inside to the outside:

1. Radial bearing	0113	8 x 16 x 5
2. Blade holder retaining bush	0112	place recess side towards centre of head.
3. Thrust bearing	0115	8 x 16 x 5 Fit the plate with the inner diameter of 8.2 first.
4. Spacer washer	0111	0.5 x 8 x14
5. Radial bearing	0113	8 x 16 x 5
6. Washer	0117	M5
7. Cap head screw	0119	M5 x 12 strength specification 12.9

After assembling the bearings in the same order as listed above onto the feathering spindle. Warm the blade holder, take care to align the holes in the blade holder with the holes of the blade holder retaining bush and slide the blade holder on to the bearings on the feathering spindle. Fit the pitch arm and the M3 screws, into their holes and secure with some Loctite.

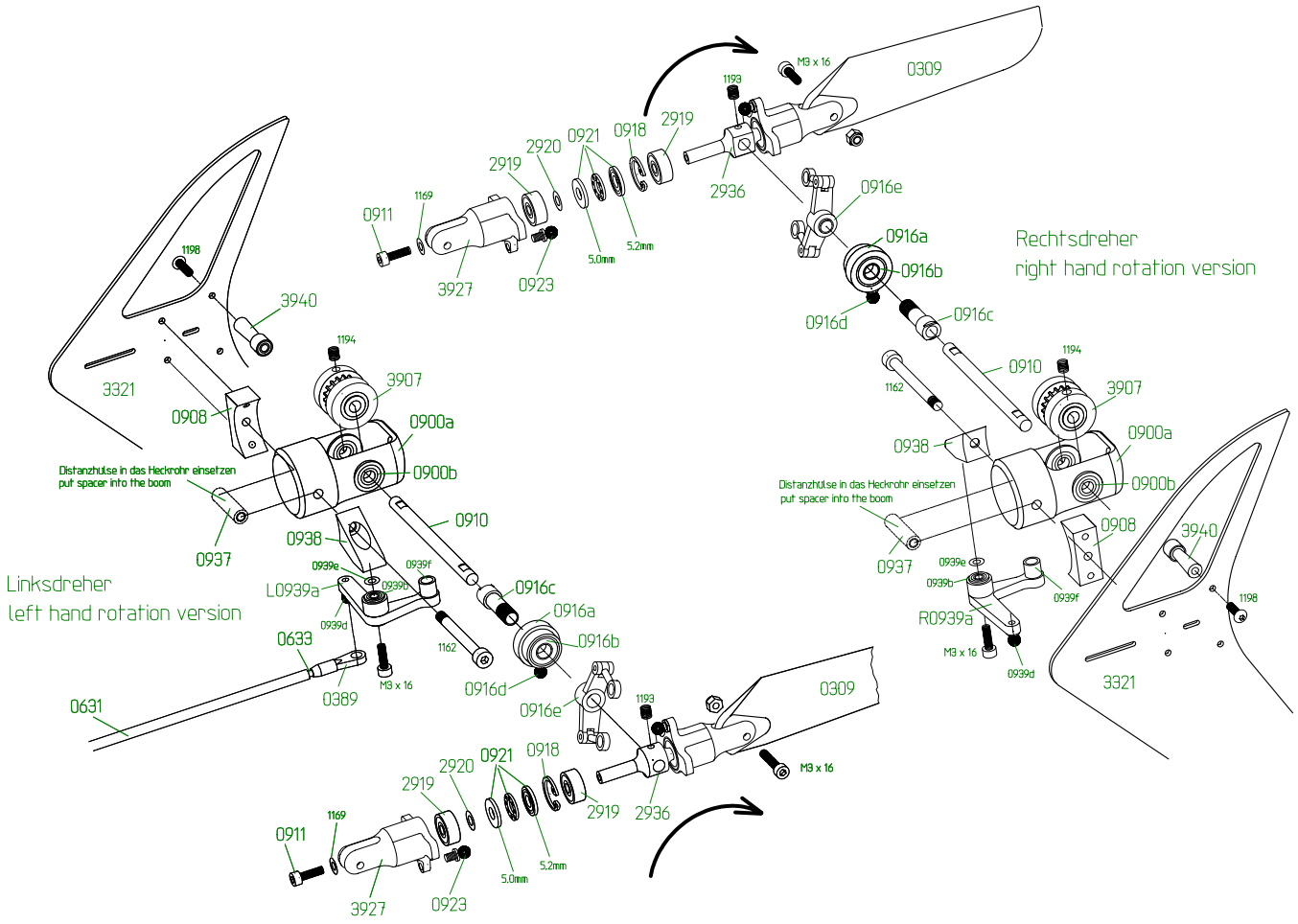
The feathering spindle is pushed into the O-ring inner bush 0109. In the rotor head centre hub 0120 is the outer bush 0104, which holds two O-rings 0102 on each side.

The feathering spindle needs to be changed after a crash or a bad landing. The O-rings and the inner and outer bushes should checked for damage as well. If the outer bush is broken, it can be carefully tapped out of the centre hub from the other side. Before fitting the O-rings, they should be smeared with some Vaseline.

In the drawing is a spacer washer 0107 between the O-ring outer bush 0109 and the first radial bearing in the blade holder. One each side is usually enough, however If there is too much axial play, some more spacer washers of the same type can be fitted if required.

If after a crash the fly bar seesaw is bent or the bearings are broken and it is not possible to remove the bearings with some force, it is advisable to send the whole unit to me for repair. In this case you will only be charged for the spare parts and postage.

3.12 Tail gear box



First push the two bearings 0900b into the tail gearbox from the inside. Use a parallel clamp if you cannot do it by hand. Use a protective plate between the outer gearbox wall and the clamp, so that the gearbox does not get damaged also make sure that the bearing does not jam. Put the tail belt 0812 over the tooth belt pulley 3907 and push the belt, together with the pulley, into the gearbox from the front, positioning the belt pulley between the ball bearings.

The belt pulley has a M4 tapped hole for a M4x6 grub screw 1194. From the other side push the tail output shaft 0910 through the ball bearings and the belt pulley, so that the front of the shaft sits level with the bearing. Align the retaining groove with the M4 hole. Use a little Loctite and tighten the grub screws (not too much Loctite, as there is a danger of the excess seeping out and gluing the tail belt pulley and shaft together). It does not matter which way the tail out put shaft is fixed because it is symmetrical. If the shaft does not slide easily through the bearings from one side try the other side before rubbing off some of the surface. It is normal to have a small amount of axial play on the tail gear shaft and this will not affect the tail rotor performance. If there is to much play you can put the special washers 2920 (0,1x5x10) between the pulley and the bearing.

Next fit the tail pitch slider 0916 – see drawing. Slide the aluminium ring 0916a together with the ball bearing 0916b onto the tail pitch slider bush 0916c. Apply some loctite to the inside of the tail pitch slider nut 0916e and tighten it up until it sits against the ball bearing. Wipe off any excess loctite immediately. Do not apply loctite onto the fine thread itself, because it will escape and glue the bearing together.
By tightening the tail pitch slider nut the ball bearings are fixed and have no axial play. Release it again a little if you feel a rough running bearing. Slide the assembled tail pitch slider onto the greased tail output shaft (it should not jam anywhere).

The tail blade holders 3927 are assembled as follows: First take the radial bearing 2919 and push it into the blade holder followed by the washer (0,1x5x10) 2920. Some grease on the inside of the blade holder make this job much more simple. Cover the thrust bearing with some grease and push it behinde the washer – see drawing. Make sure that you assemble the thrust bearing 0921 the correct way round. The two thrust plates have different inner diameters (5.0 and 5.2mm). The one with 5mm diameter cames first than the ball cage and than the plate with 5,2mm. Inside the Aluminium blade holder is a retaining groove for the “C” clip 0918. Push the thrust bearing far enough so that it is sitting behind the retaining groove. Use a pair of circlip pliers to fit the “C” clip.

Attention ! The “C” clip has to clip in the retaining groove tightly, otherwise later the complete blade holder will fly past your ears!

Next push the second ball bearing 2919 into the blade holder and push the assembly through the centre hub 2936. Attention! Don´t use any force because sometimes it happens that the washer 2920 in the assembly is not placed in the centre line so that it is necessary to line it up with a suitable tool. Fasten the blade holders with the special screws 0911 and the M3 washers on the centre hub use loctite!
Attention ! It is important, that both the threaded hole of the tail centre hub and the screws are degreased properly, so that the Loctite holds well. If one of both parts are still greasy, the screw will come undone during flight and this will have terrible consequences causing a severe crash or even personal injury.

Check, if the bolt has started to come undone after the first few flights. Usually it can be detected through vibration in the tail during flying.
Now push the tail centre hub together with the assembled blade holder onto the tail output shaft 0910 and fix it on to the retaining groove of the shaft with the M4x4 grub screws 1193. The flat side of the tail centre hub points inwards to the gearbox.

Press the tail pitch links onto the threaded balls of the blade holders. Check the drawing, for the position of the blade holders, so that they turn in the correct direction. In principal you could choose which way round the blades are turning because of the belt. But to make adjustments easier wich are explained in a later chapter do it in a way as the drawing showes.
Attention ! the linkages are connected to the trailing side of the blade holders.
Fix the bell crank 0939 onto the bell crank mount 0938 with the M3x16 screw (Do not forget the washer).

3.13 Boom / Tail belt tension / Support rods / yaw push rod

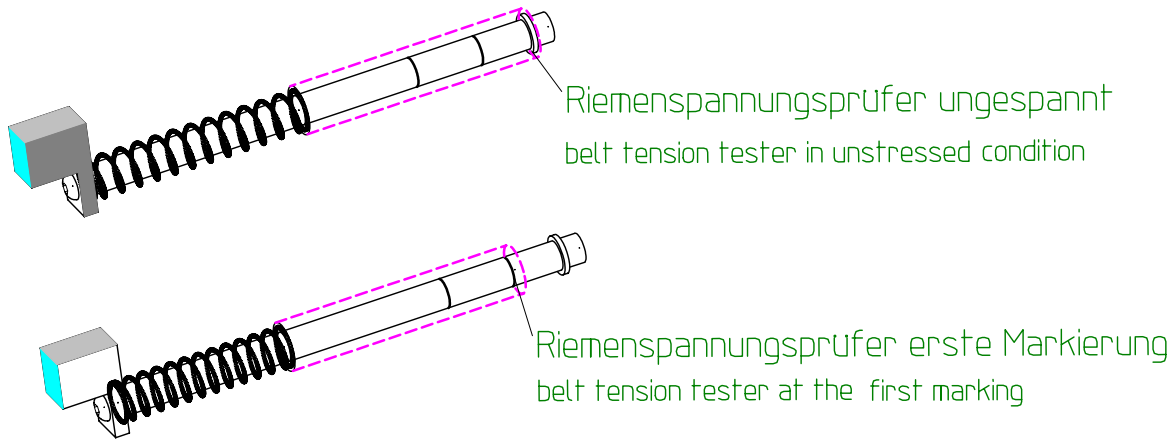
Fix the tail gearbox onto the boom. The boom has a reinforcement glued into each end. The Boom has two 4mm fixing holes in the tail end. Use some wet and dry to remove the laquer from the front end of the boom for the first 20mm to get an electrical connection to the alumimium boom support 0732. Pull the toothed belt through the boom from the back.To prevent damage to the boom when tightening the tail gearbox fixing screw, insert the spacer 0937 between the two holes onto the boom. Make sure that the belt runs each side of the spacer. The tail gearbox is now pushed as far as it will go onto the boom. If the tail gear box does not slide far enough carefully rub down the boom until a good fit is achieved. Take the allen screw M4x35 and push it through the bell crank mount 0938, the fixing holes of the tail gearbox and through the boom (see drawing). On the other side put some loctite on the screw, then screw into the tail unit support 0908. Take care that the delrin bell crank sleeve bearing 0939f is sitting over the ball of the tail pitch slider and that neither bell crank mount or tail unit support are jammed when tightening the screws.

Pull the tooth belt that is showing at the front of the boom tight and check that it is not twisted in the boom. From the front of the boom turn the belt through 90° clockwise to the right (90° counter clockwise on a left hand rotating system). Push the boom carefully into the two tail boom holders. Slide the boom into the assembly, so that it protrudes at least 10mm from the front boom holder 0732. Check that the belt has not slipped out of place. The belt is placed around the tooth belt pulley 3731 and the boom is pulled back so that the belt is tight. Remove the front belt support 3729 before mounting the belt. Do not fully tighten the bottom screws yet, so that the boom can still be adjusted. If the boom will not slide into the holder, spread the holder apart with a screwdriver in the bottom slot.

From the back, look at the tail rotor and roughly position it at right angles to the chassis. Turn the rotor head in the correct direction to see if the tail rotor turns in the correct direction (see drawing).

Tail belt tension:

In the bag different parts you´ll find a belt tension tester 3398. Take this gauge at the black plastic handle and press it through the window of the chassis at the opposite side of the tail servo vertical onto the belt. The point has to be at the same level of the axle from the servo arm. Push the belt until the tip of the belt teeth touch the teeth of the opposite belt side. You´ll finde two markings at the tension tester. If the first marking appears in this moment the tension of the tail belt will be correct. This marking indicate a pressure from about 700g (see picture below).



To adjust the correct belt tension slide the tail pipe in or out and carefully tighten the nuts of the bottom threaded studs 0737 to hold the boom in place. Also check the tightness the nuts on the upper threaded studs. If the belt tension is too tight it will adsorb a lot of autorotation energy. If the belt tension is too little it will cause the tail rotor to vibrate and you can hear the belt banging against the inside of the tail boom. This can also happen briefly on a stationary helicopter with correct belt tension, if you increase the rotor rpm. This is OK! The belt will not be damaged.

Front belt support:

There is a front belt support 3729 wich protect the tail belt from springing over on high load tail power. Look at picture page 8. for the place were the support has to be fastened. On a clockwise turning heli the bearing 3x9x5 has to be fastened on the left side were the belt is running from the toothed belt pulley (on a ccw turning heli on the right side). It is not possible to pull up the belt with this front belt support. You have to do this job after the support is removed. There is a distance from about 0,3mm between the bearings and the belt so that they are not in contact during normal flight. Only if the belt starts to skip over the bearings comes into contact and prevent this effect. Don´t forget the special washer and use only the special screw for the two bearings. It is much easier to do this job if you remove the skid plates again.

Assembly of the boom supports:

Take out of the bag marked "*DIFFERENT PARTS*" the boom support ends 0803 and 0805, the boom clamp 0809, the nylon screws M5x10 and the push rod guide grommet 0635. Using cyno, glue the front and back support ends 0803 and 0805 onto the two boom support tubes 0802. Before glueing roughen the ends a little and align them carefully, you have to work fast when fitting the ends with cyno. Put the boom clamp 0809 onto the boom by bending it open. From the front push each M5x10 nylon screw through the 5mm hole of the tuned pipe holders 0388 and screw to the boom support. From the back the boom supports are fixed with a M3x25 cap head screw onto the boom clamp and tightened onto the boom. (Position the boom clamp by viewing from behind).

Push rod guide:

In the bag marked "*CFK-PARTS*" you will find the push rod guide 0634. Fit the push rod guide grommet 0635 and slide it onto the tail push rod. Screw the quick link 0391 and ball link 0389 onto the glued threaded rods in the carbon rod. Connect the quick link to the servo arm 13 to 17mm from centre or where the gyro manufacturer suggests and at the back fit the ball link on the bell crank 0939. Adjust the servo arm by hand so that it points down at right angles to the servo case. Measure between the tail gearbox bearing and the pitch slider bush 0916c. The distance should be 8mm. If this is not the case it has to be adjusted by turning the quick link and the ball link. Roughen up the bottom of the boom 360mm from the gear box front edge. Stand the helicopter on the rotor head and support the boom so that it is horizontal. Glue the push rod guide 0634 with some cyno in position and at right angles to the boom. After the glue has dried, lightly grease the tail push rod on both sides of the grommet. If you need to fit a new boom, do not use an aluminium boom, because the change of length due to expansion and contraction is too great and changes the tension of the belt too much.

3.14 Stabiliser

Glue the fins together into the correct position. For this a 4mm wide strip on the vertical and horizontal fin have to be thoroughly roughed up using wet and dry. The tongue of the horizontal fin is pushed into the slot of the vertical fin and glued with cyno. Making sure that they are at right angles to each other. Now put some micro balloons into the corners, as with the RC- main plate, and bond with cyno. Now fix the stabiliser using M3x8 screws together with the large M3 washers onto the stabiliser support 0908 and secure with some loctite. Do not modify the horizontal stabiliser (eg drilling holes into it), unless it is covered afterwards. The horizontal fin is for stabilising pitching movement in fast forward flight. Without the horizontal fin the helicopter will not fly in a straight line.
There is a rear belt support 3940 wich protect the tail belt from springing over on high load tail power. Fasten the support as the picture shows on the vertical stabelizer. Look that there is a little gap from about 0,3mm between the bearings and the belt so that they are not in contact during normal flight conditions.

3.15 Remaining RC- components

Receiver nicad:

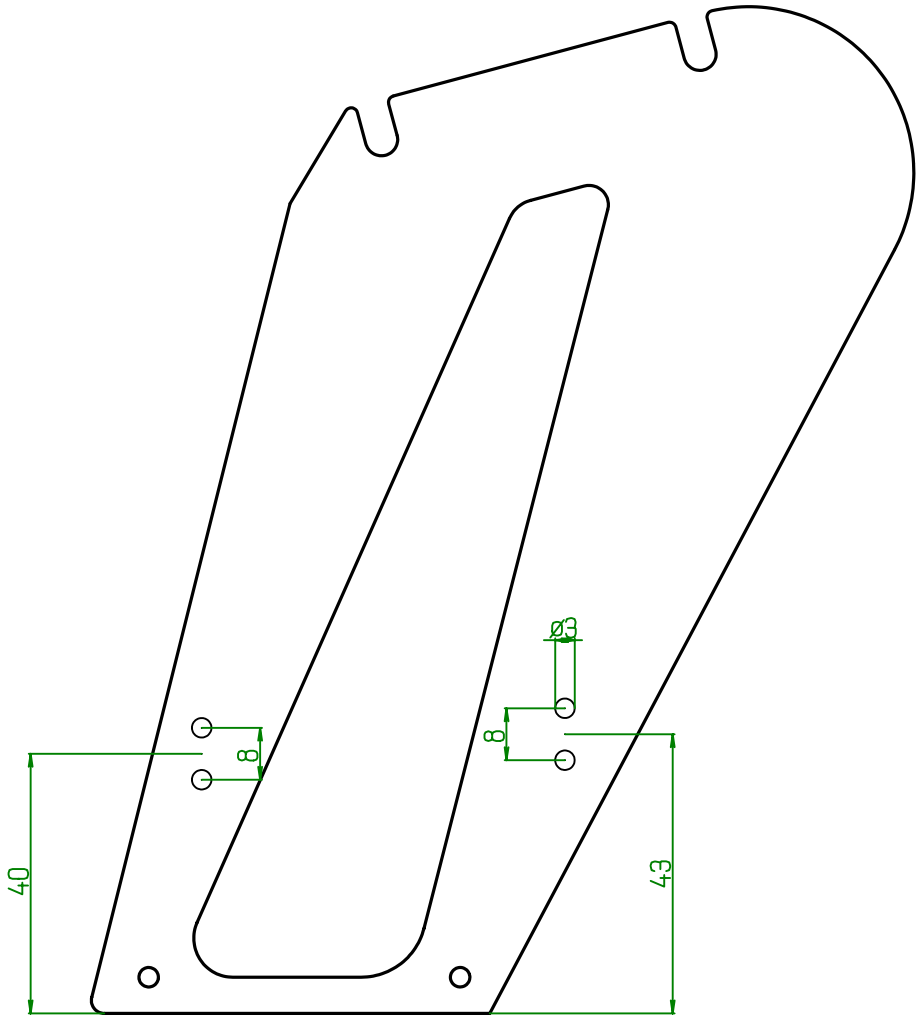
Fix the receiver nicad with the cable at the top between the front servos and the cooling shroud. The space is too small for nicads that are bigger than 18x51x70 mm. I use the Ripmax Sanyo 4K1700AUSF Nicad (see chapter “equipment requirements” on page 5). Nicads with the same measurements can be used. With this size nicad I can get 6 flights. (This is not so, when using digital servos for the swash plate). I do not use any switches because of safety, space and weight reasons. A compact, high quality 2 pole industrial plug with 0.5 mm² cable cross section seems to be better than the original cables. If you choose to use this system. Remove the old cable solder the new one onto the nicad, so that the lead with the plug is 200mm long. Cover the nicad with new heat shrink tube. Solder the other lead to an RX plug and push in the receiver.
Use double sided tape to make a strip 8mm thick and stick the nicad onto both of the front sides of the fore & aft cyclic and the throttle servo**.** Stick the strips onto the servos. The middle of the servos has to stay clear so that the servo arm is not restricted. The nicad is stuck onto the double sided tape, aligned with the chassis top edge and in the middle of the side frames. To press the tank down to the bottom side frame spacers, fix a layer of hard foam rubber between the 90° tank nipples and nicad. You can also glue a layer of hard foam rubber onto the servos and fix the nicad on the front with some Velcro. The nicad should not protrude more than 26mm from the servo front plate, so that the cooling shroud can be assembled. The nicad cable is guided along the left chassis top edge, under the upper bearing holder to the back of the RC-Main plate and behind the left Roll servo. There the cyclic servo and throttle servo cables are tied together using a cable tie.

Gyro, receiver and other:

Mount the gyro box on the middle of the two tail boom holders using two double sided pads. An extra supporting plate is not needed. Position the box so that the cables to the receiver or a separate gyro electronics point to the back and lead around the case back to the front. The cable therefore does not vibrate the sensor unit. If you are using a two box gyro system and or governor, you have to stack the electronic components either next to each other or on top of each other on the RC-main plate. In my helicopter the receiver sits on a rubber mat with the exit to the front. The cables are folded up neatly and are placed on either side. The whole thing is fixed with 4 rubber bands on the RC-box holders. To switch on I only plug the above mentioned plug. Make sure that the cables do not touch the one way drive unit 0418 or the swash plate and the electronic components are secure so that they do not move in flight.

Laying of the antenna:

Cut a 400mm length of fuel tube and thread the antenna through the tube. Push the tube up to the receiver and fix it with a cable tie onto the left canopy mounting support 0736. Push the antenna through the antenna tube 0337 (white plastic tube / 500 mm long). The fuel tube is then pushed onto the antenna tube 5mm. Drill 3mm holes in the front and back edge of the skid plate which is fastened at the opposite side of the tail servo (see drawing below).
These holes are used to fix the antenna tube using cable ties, so that 100mm is forward of the skid mount. Slide a 15mm length of fuel tube over the parts where the cable tie holds the antenna tube on the skid plate. (Soapy water helps to make the tube slide). The antenna runs from the receiver in a curve to the front and through the antenna tube back to the rear. At the rear, the antenna should not exit from the tube more than 100mm.
If there are any reception problems during the flight you also can run the antenna from the receiver to the rear skid hole and than to the tip of the horizontal stabelizer. Drill a little hole for a rubber band into the stabilizer tip. In this case take the skid plate at the side of the stabilizer.



3.16 Manifold / Tuned pipe / Cooling shrowd

Assemble the manifold onto the motor with some gasket sealer with two M4x40 screws. File off any sharp edges of the manifold flange, so that the exhaust gasses flow through freely (thoroughly blow out any filings).

Fit Hatori 700 tuned pipe with the 50mm long PTFE pipe joiner 0351 and two tube clamps from the separate Henseleit manifold kit, make sure that the pressure nipple from the pipe points to the left and the pipe has got a 2 – 3 mm gap from the manifold. Turn the ends of the pipe clamps upwards. The end of the pipe protrudes 100mm over the tuned pipe supports 0388.

Enclosed with the Hatori 700 is a thick silicon tube, which is not used to connect the manifold (it would not last very long). Put a 20mm section of this silicon tube slit length ways between the tuned pipe supports and the tuned pipe to protect the pipe from abrasion.

Hold the pipe with the tuned pipe retaining spring 0385 into the hole in the supports. Do not put a silicon tube under the spring, so that a RF connection to the tuned pipe is ensured. The pressure connection of the tuned pipe is connected to the top left of the tank exit using a 190mm long fuel tube. Run the tube down to the exhaust pipe nipple inside the chassis between the engine and the left engine support. Fix another 160mm long tube onto the top right tank exit with a stopper for refuelling. Run this tube down to the bottom of the chassis in the same way as the pressure tube but on the right side.

<u>Cooling shroud:</u>

Fix the cooling shroud 0331 onto the long holes in the chassis using the two M3x12 screws and washers. But before that glue a base of 1 – 2 mm thick hard foam rubber onto the front, that should press against the nicad to avoid movement.

Position the shroud over the cooling fan so that a small gap the same width is maintained around the cooling fan so that it does not touch the shroud. The underneath of the cooling shroud should be aligned with the bottom of the cooling fan.

Fix the cooling shroud support 0734 onto the shroud using a M3x12 screw.

Assemble the cooling shroud duct 0332 with the two glasfibre parts. Glue the back wall about 24mm from the top onto the backside of the shroud duct.. Glue the wall using fast setting glue to fit exactly onto the back of the shroud duct, so that an opening of 24mm remains in the upper area for the cooling shroud. Cut out the remaining contours according to the paper stencils, which are found in the appendix. Fold the stencil along the lines and hold it against the back wall of the shroud. Cut off the bottom side of the shroud along the broken line. Drill a 16mm hole into the front of the shroud just above the sparkplug. Now fit the shaft casing approximately 10-12mm onto the cooling shroud and mark the fixing threads with a felt tip on the cooling shroud. The back wall of the shroud has to be behind the manifold. The front runs down just over the cylinder head with about maximum 3mm space. Take the shaft casing off again and drill a 3mm hole though the felt tip markings. Fix the shroud to the casing using the two M3x6 screws and the U-washers.
Attention: The screws have to be fastened very carefully, because the thread is not very deep and the screws can be easily over turned. If this should happen through overuse by dismantling and assembly, just use 3.5mm metal screws instead of the cap head screws. These will cut automatically into the material.

3.17 Canopy

Now only the canopy has to be fitted and the screen painted. Yellow and black canopies are available. To make it easier I have attached a pattern for the screen in the appendix. Cut out both halves and stick the templates together using tape. Rest the template on the canopy, so that the tip of the template fits about 15mm from the front of the canopy and covers the seam. Arrange the template to fit, and hold it in place with tape on the inner edge. When you are happy with the position use the outer edge of the template as a guide to position the masking tape. (The best tape to use is thin masking tape from the model shop, which is very flexible and sticks well round tight corners). The template can now be removed.

Roughen up the area before spraying (best results are achieved using fine wet and dry paper). The whole canopy should be masked off with paper and tape. I suggest using one part polyurethane lacquer, which comes in spray cans (available in most model shops), to create a reasonably priced spray job without much work, but with good results. The paint is fairly fuel proof, without a second coat of two pack clear lacquer especially as the fuselage does not get covered with oil in the screen area. Car lacquer in spray cans will give a good result too. Spray on thin layers at short intervals to avoid runs.

Put the rubber grommets 0305 (with 4mm hole) into the fuselage mounting holes and stick the Three-Dee NT decals onto the middle line of the belt pulley bulge. Wipe the fuselage with a damp cloth, to remove any release agents.
Attention! Before taking backing off the stickers, make sure that you know the exact position on the fuselage, because the letters stick instantly and cannot be removed. Press the lettering onto the fuselage and carefully remove the facing paper.

There is another decal with my internet site www.henseleit-helicopters.de which decorate the boom in front of the support fixing clamps. This is not only useful for advertising but also it is helps to see the boom in the air.
Attach the front 10 mm plywood canopy fixing blocks 0302 as follows. Cut and file the blocks according to the template, which is in the appendix. Put one or two layers of paper into the 10 mm slots of the blocks and push them from the front all the way onto the silicon tubes round the canopy mounts 0740. The paper is to keep the blocks tight in place. Mark the blocks with “L” for left and “R” for right and position them horizontally with the slot pointing to the back all the way to the end of the fuselage mounting.
Fix a 2 mm thick foam strip onto the two upper corner points of the cooling shroud duct, where the cooling shroud ends. These are the points where the canopy touches the cooling shroud first. The back of the canopy can be opened wide enough to push it from the front over the assembly. Push the canopy grommets on to the canopy supports 0736 (grease the supports occasionally) and stand the helicopter on its head. Lift the nose of the canopy so that the inside of the fuselage sits on the previously fixed foam rubber pieces on the cooling shroud. Check from the front that the fuselage is straight. The seam of the fuselage should be in the middle of the rotor shaft axis. Support the fuselage so that it does not slide off again. Look through the canopy opening and check if the plywood blocks are still positioned correctly and use a thin felt tip pen to draw the outline of the blocks onto the inner wall of the fuselage. Take the fuselage off and glue the blocks marked “L” and “R” into the correct position onto the marked inner wall of the fuselage. It is best to position the blocks by hand first and drop a little cyno into the slots. Micro balloons are put around the glued seam of the blocks and covered with cyno.
Another possibility is to take some high viscosity cyno and drip down a long stick on the blocks in the assembled canopy. Wait until the glue is dry, take of the canopy carefully and glue it a second time with cyno and micro balloons as described before. After the glue has dried put the canopy back on and check when turning the rotor blades, that the swash plate rods and the fly bar link guides 0100 don’t touch the canopy. (If so rub down the high points).
In the bag marked “*DIFFERENT PARTS*” is some Velcro (hooks and loops). Cut off a small piece and stick the loop piece just above the canopy support. Leave a small gap between the halves and stick the hooks to the canopy, this stop vibration and also stop the canopy being blown of its mountings during fast backward flight. There is a 2mm hole in the rear canopy mounting support, here you can secure the canopy with an additional split pin.

4.0 Fundamental Adjustments

This is a very important chapter of the manual, intended to help you find the optimal adjustment for your Three Dee NT. Any one who implements my advice and puts in a little effort, will have no problems flying the helicopter at the field.

We start by adjusting the final length of the push rods. For this you will need the swash plate lock, which is found in the bag marked "*DIFFERENT PARTS*".

Attention ! First take a brightly coloured, piece of string about 30cm long and fix it through the swash plate lock from the outside using tape or cyno glue. This may seem a little strange but it has the purpose of making sure you do not forget to take out the swash plate lock.

The RC-system has already been configured in chapter 3.8.

If your RC- system will allow it I would suggest that you program four flight conditions, which should be chosen by switches on your transmitter.

Condition 1: This flight condition (we will call it **NORMAL**) is used to start the engine, rev up the system and hover with about 1500 rpm. at middle stick position.

Condition 2: This flight condition (we will call it **3D**) is used for 3D acrobatic (suggested speed range between 1500 and 1700 rpm.).

Condition 3: This flight condition (we will call it **soft 3D**) is used for soft 3D and also normal flying with low noise (suggested speed range about 1300 rpm.).

Condition 4: This flight condition (we will call it **speed**) is used for spacious high speed flying where the pitch is slightly reduced to maintain pitching stability during a fast approach in straight flight (suggested speed range 1800 to 1900 rpm.). Don´t use these revs. for hovering, as it is noisier than is necessary.

4.1 Swash plate adjustment.

The transmitter having already been configured. Switch on your TX and RX and put the pitch stick into the mid-position. Slide the swash plate lock from the back under the swash plate. The pitch has to be negative and the swash plate has to be in its upper position, for the lock to fit. With the slot to the front, position the swash plate lock on the upper bearing holder directly under the swash plate move the swash plate down carefully to the mid stick position. Make sure that the swash plate sits in the lock and the servos are not stalling. Adjust the lower swashplate rods, so that at the mid-position of the pitch stick, the swash plate is lying flat on the lock. The stick must be positioned in the middle to set this correctly.

Now go into the transmitter menu for 120º CCPM swash plate mode, where you can change the percentage of the total pitch range, the elevator and aileron rate (most of the time the adjustments are at 50%). Move the pitch stick to minimum pitch, so that the swash plate drives upwards. The swash plate will drive up too far and the percentage of the pitch rate value has to be reduced so that the bottom edge of the swash plate is level about 1mm over the swash plate lock. This means that the swash plate lift should be 7mm from the stick mid-position to minimum pitch. This is exactly the required pitch angle of 11º. Drive the swash plate all the way up and pull the lock out from underneath. When the pitch stick is pushed in the other direction to the maximum pitch, the swash plate should move symmetrically from the zero point to 7mm down. (Check it using a rule). If there should be some differences between the up or down movement, this can be evened up in the pitch travel adjust menu. Now we have got the basic pitch adjustment from minimum -11º, through 0º with stick in the middle position to +11º at maximum pitch.

Move the swash plate to the middle position 0º and give full cyclic to one side. Hold a rule against the threaded ball on one side of the swash plate and measure the amount of movement between stick neutral position and full cyclic. The lift should be about 7mm, the full cyclic from left to right, is about 14mm. Change the aileron percentage in you swash plate menu, until the given values are correct. Repeat the procedure to the fore and aft cyclic, at the front ball link on the swash plate. Movement for the elevator also has to be set at +/- 7mm, using the elevator percentage in your swash plate menu.

(For example, the values on the Futaba 9Z radio are: Pitch 25% / Aileron 60% / Elevator 60%)

4.2 Flybar seesaw

Switch off the RC system. Pull up the swash plate manually, put the swash plate lock underneath and press the swash plate down on to it.

Check the position of the fly bar seesaw assembly. It has to be exactly in the middle of the rotor head cavity in line with the middle fixing screws of the fly bar seesaw guides 0122.

There should be a 10.5mm space above and below the fly bar guide box in the centre hub 0120.

If not the two fly bar push rods 0623 can be readjusted to correct the position (make sure that both rods stay the same length.

4.3 Paddle adjustment

Stand the helicopter onto an even surface and view it from the front when adjusting the paddles and blades. First adjust both paddles to align with blade holders 0114 using a paddle gauge.

Ensure that the swash plate is flat on the swash plate lock 0394. Line up a paddle gauge top edge with the blade holder bottom edge.

To do this hold the fly bar with pliers just in front of the paddle and turn the paddle at the root until aligned with the blade holders. (The pliers have to have smooth flat jaws, so that the fly bar does not get scratched).

Turn the rotor head 180º and repeat the procedure with the second paddle. If you have two paddle gauges you can check if the are adjusted correctly to each other. This job is a little laborious, because the paddles are not easily turned to the correct point. Repeat this procedure until set up is correct. In the meantime check if the swash plate is still lying flat on the lock.

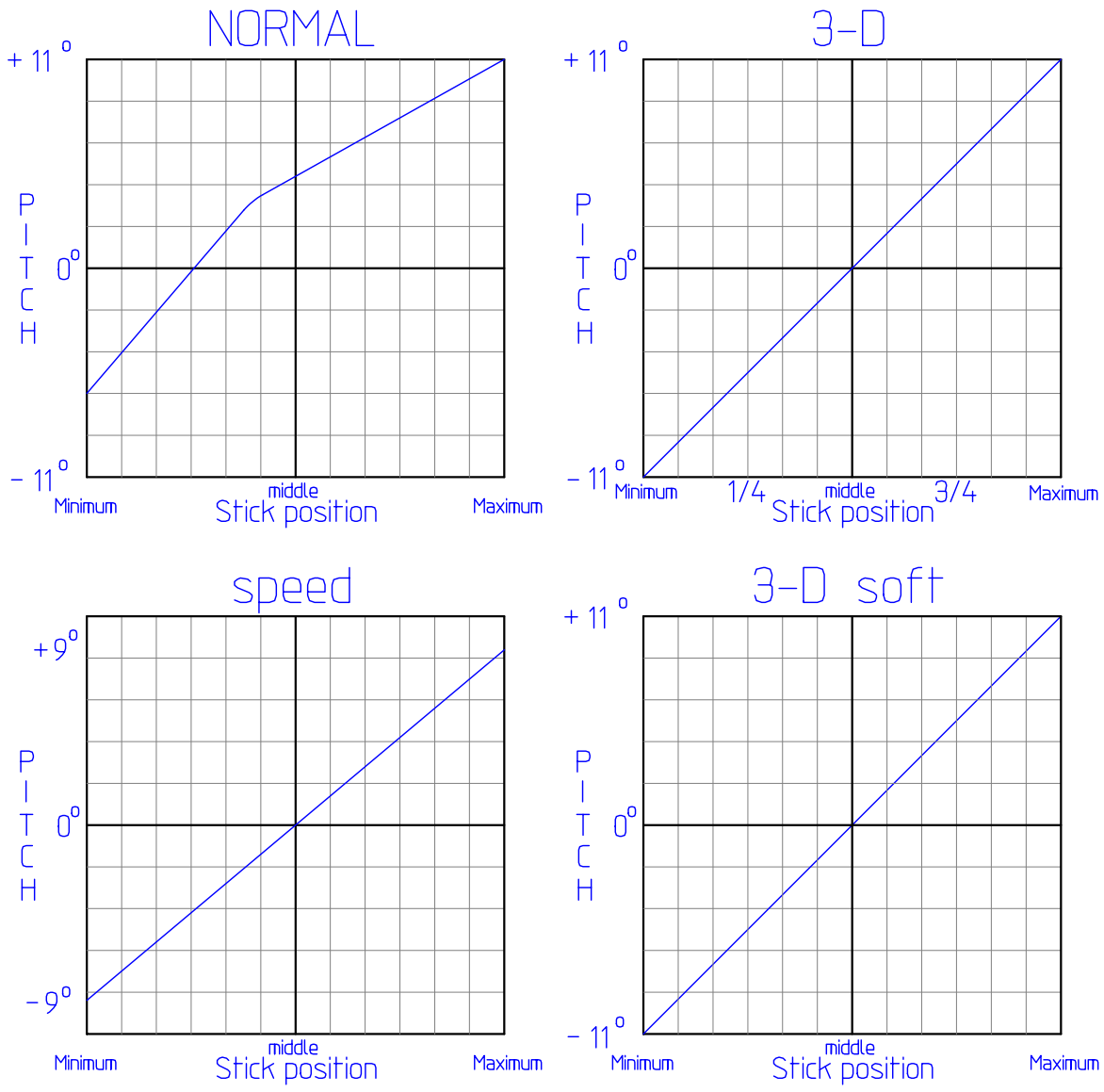
Do not take short cuts by adjusting the length of the rods 0623. They must stay the same length. If the seesaw swings all the way to the front, you will find that the paddles hit the canopy. You do not need to worry about that, because it does not touch in flight even in extreme acrobatics (I have tested it thoroughly).

4.4 Rotor blade adjustment

Fit the rotor blades and make adjustments from the front of the model. Use a pitch gauge with the swash plate at 0º (using the swash plate lock 0394). The helicopter must be on a horizontal table. Adjustment are only done with the two pitch mixing push rods 0625 and not with the fly bar link 0131. It is quite possible that the rod adjustments differ on both sides from the given values and that the rods have to be adjusted differently, so that both blades are exactly 0º at the tip. This is due to tolerances in the blades or pitch arms, which have to be balanced. Ensure that the swash plate does not lift off the lock when turning the rotor head 180º to adjust the opposite blade. Only a small gap can totally distort the outcome. It is important to set the blade angles on the bench and only do fine tuning at the field. I myself have experienced, a helicopter playing up whilst hovering, even though the track was optically correct. When checking afterwards the difference between the blades were 4º. Do the set up carefully, so that you do not have to make any adjustments at the field.

4.5 Pitch curve settings

First set up the pitch curves for the different flight conditions. The maximum value of +/- 11º has been done in the swash plate set up menu. Set a straight line of the co-ordinates in the pitch range for the flight conditions **3D / soft 3D** and **speed**. In the flight position **Normal** the curve has to be pulled up and then levelled out in the hover area and limited to minimum value to –5. For the flight condition **speed** it can be useful to reduce the maximum and minimum pitch to 9° - 10° for keeping the rotor revs high enough all the time in speed flight without overloading the engine (see diagram).



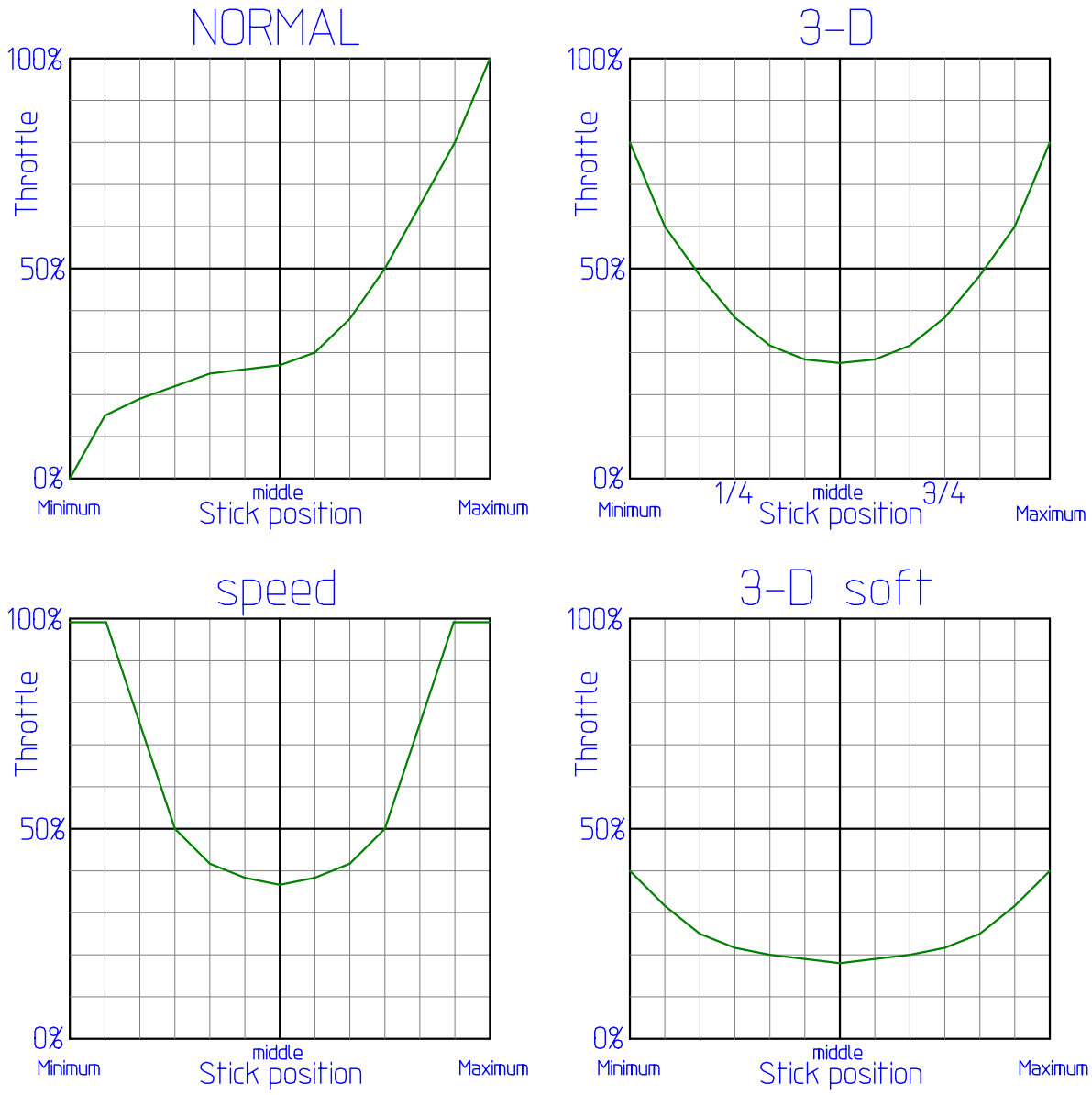
4.6 Tail rotor drive

Adjust the travel of the gyro so that the tail pitch slider does not touch the gearbox at full movement (about 7mm stroke to each side). Set the sensitivity of the gyro to a conservative level and then steadily raise the gain to maximum value for each flight condition. Between flight conditions with low and high rpm. are differences from 25 % gyro sensitivity possible.

4.7 Throttle curve adjustment / governor

If a governor is needed, fix a magnet on the fan, as mentioned in chapter 3.10 and fix the sensor holder onto the cooling shroud support. If you are using a governor needing 3 magnets, there are 3 holes in the large belt pulley, where you can press them in. Behind the transmission bearing holder 0728 are two holes in the chassis, that are normally allocated to fit a tube tail drive. In these holes a sensor holder can be fixed. Because I do not use a governor and the OS 91 engine runs with no problems without it, I have listed some throttle curve diagrams below, which you can programme into your transmitter. These throttle curves are only valid with the OS 91 engine and the Lötterle carb, because they are different with other types of carb. It is important that the instructions for the throttle linkage have been followed. When flying 3D it is necessary to add extra swash to throttle mixing from about up to 20%, to hold the rotor head revs constant. If the CAM PAC is sent to me I am offering to copy my TD-NT Program free of charge for pilots using Futaba 9Z remote controls.

Three-Dee NT throttle curves for the OS 91 FX-HGL with Lötterle carb.



5.0 Fuelling, starting the engine and flying

This is the chapter you have probably been looking forward to. It is important that you do not rush into things and only fly the first flight in good weather conditions. Before venturing out to the field go over the whole helicopter and check the functions of the radio. Also spectators with unnecessary comments are not an advantage for the maiden flight. Always prepare for the unexpected in the first few flights. Tighten the rotor blade fixing screws only enough that the blades will not turn by themselves. They still have to be moveable so that they can lead lag in flight. Leave the canopy off for the first two flights, to make it easier to adjust the carb needles until the optimum setting for the engine has been found. By doing this no more holes have to be drilled into the canopy for the needle to be adjusted after the running in phase. To help orientation without the canopy, do not fly the helicopter too far away from yourself.

Fuelling:

Fill the tank through the bottom right tube to just below the top of the tank. Attention! If you do not stop in time the fuel will run into the tuned pipe. To fill up with fuel I always take off the canopy in order to see when the tank is full. After a bit of practise it can be done quickly and the plug for the receiver power supply can be plugged in at the same time. People who do not wish to do this can cut the tube from the tank to the tuned pipe and put a simple coupling piece (i.e. piece of brass pipe) in place. The fuel will then flow out when the tank is full.

Starting the engine:

For the main adjustment of the throttle turn the idle mixture screw level with the brass spacer. The adjustment is not very critical, because with this throttle you hardly notice half a turn. It is difficult to give the exact main jet needle adjustment, because the needle in the screw can be adjusted to any position and fixed with a grub screw. For the first attempt close the speed needle all the way and then turn it back about 3 turns. With both my helicopters, they are open 2½ turns after running them in. Switch on the radio, check the function of the servos and connect the glow plug with the glow plug jack underneath the engine. Open the throttle a little and start the engine. To start the engine, cover the end of the tuned pipe for a short time to allow the fuel into the throttle under pressure.

Flying:

Program the stopwatch on the radio for 12 minutes flying time, because the engine is rich and uses more fuel in the beginning. It is important to stand the helicopter on an even grass surface and NOT onto an even asphalt surface, because with the small skids and high engine torque the model will spin around. Open the throttle and carefully accelerate to gently engage the clutch. When increasing the revs it is normal for the helicopter to shake a little. On the ground in heading hold mode make sure the tail servo does not move one end of travel, because the tail belt will vibrate from the high load. Lift off with the helicopter and adjust the trims. If the needle setting is too rich the helicopter will vibrate. To check how the engine runs apply full throttle for a short time. If the engine wants to cut out immediately the needle setting is to lean. If the engine starts to shake and shows a lot of smoke, the engine is running to rich. The engine is only adjusted correctly when the model climbs constantly without choking and with a steady smoke trail.
At half throttle make sure the engine still has a smoke trail, but runs smoothly, and if needed adjust the idle mixture control screw. You might have to get used to the new control characteristics of this helicopter, depending on which helicopter you have been used to. The helicopter reacts promptly, and steadily in the air. It also is sensitive to the pitch movements. Therefore fly with small pitch movements until you are used to it.
Fly a few small circles, changing the throttle position and land the helicopter occasionally. In theory the helicopter does not need a long running in phase. After refuelling the tank twice the helicopter can cope with more strain. You will notice that the engine rpm is higher after each refuel and the performance increases with each flight. To start with, the engine sounds a little metallic between 1400 rpm and 1600 rpm and does not run smoothly. The engine running characteristics will improve with time, when the compression decreases. If the engine running characteristics are really bad I suggest putting a second 0.2mm thick gasket under the cylinder head. You could also experiment with different glow plugs. The engine runs very well with the ENYA 4 glow plug.

Now fit the canopy, so that the helicopter can be flown faster. It is advisable to progressively explore the flight envelope, because the helicopter is very fast and covers a lot of ground quickly. Look that the canopy fixing blocks in the front are in the correct position on the canopy mounting support. Orientation can be lost at long distance because the silhouette is very slim and not easily recognisable especially with deteriorating light. Despite my wearing glasses I fly the model at great distances. Through experience and knowledge I can compensate for the disadvantages. It is only a problem if the helicopter suddenly flies unwanted movements at long distance and you lose orientation.

If you still have problems seeing the helicopter after a longer time you can colour skid plates, skids and tail assembly bright yellow.

Fly at low rpm only after the engine is run in. (after about 6 – 8 tanks). You will realise that the helicopter is agile even at low rpm and the engine pulls 11º pitch with no problem. Altogether the flying behaviour is different. After a short while you get used to it and will enjoy flying with very little engine noise.

Find the rpm where the engine runs steadily and smoothly. I have experienced that only a 50rpm change on the rotor head makes all the difference to the engines behaviour. Trim the throttle curve accordingly. Because of the lower engine noise it is less stressful to fly demanding acrobatics. You can be much more relaxed and the noise does not get on the nerves of the spectators.

Also the fuel lasts longer than 18 minutes. Until you gain experience of how long the fuel will last, and because you can not see the fuel tank in flight, you should land after 12 minutes. If you do not trust the radio clock or your judgement, practice auto-rotation out of hopeless positions, or you can fix an electronic fuel indicator with a lamp outside the canopy that you can check once in a while when passing in slow flight.

Avoid hovering in front of you with to high revs on the head because the 91size engine and a light helicopter there will be more vibrations. Because of the light weight it is not necessary to do that. The NT is powerful enough with only 1600 rpm for acrobatics. Only for speed flying let the engine revs up to maximum.

Program some delay for your flight condition switches so that the engine does not rev up to quickly when you move the switch. Otherwise your clutch lining will wear prematurely.

6.0 Maintenance

The belt tension has to be checked once in a while. Also once in a while check the main drive belt for cracks at the edge of the belt and if necessary change it. I can't give a specific answer on how long the belt should last. If a component is not adjusted correctly it could break after only a few hours. Normally the belt should last for more than 100 hours.

After the first flights it is important to check the helicopter over. Screws and ball bearings might have loosened. If something happens then it is usually in the running in phase. Screws that stay tight for the first three hours are not likely to loosen later. Check everything carefully and lubricate the rotor shaft in the area of the swash plate and the tail output shaft pitch slider. Also lubricate the tail belt reduction gear from time to time, the fly bar seesaw guides on the rotor head, and the fly bar centre support 0125. Check that the undercarriage, skids and boom are still tight.

Check once in a while that the O-rings 0102 on the feathering spindle are in working order. Old rings can tear and squeeze out of the side of the bush. When fitting new rings grease with vasoline.

Check the main shaft bearings after a crash and also every 25 houres. Change them if you feel that they are running roughly.
Attention ! rough running bearings can be responsible for radio interferences.

Other wise the Three-Dee NT is very easy to maintain. You fly the helicopter, clean it occasionally to keep it looking good and put it back onto the shelf, and that is all.

7.0 Closing words

The development of the Three-Dee NT is based on the experiences with the old Three Dee and the Rocket. The construction is uncompromising and simple, the lowest possible number of components are used to produce a robust fun machine which covers a very wide spectrum of flying but of course cannot satisfy all wishes and desires. I will always be grateful for any improvement suggestions from the experiences of pilots in the course of time. Such a product will only ripen through the experiences of customers. Of course one cannot incorporate everyones ideas, however, I will collect the information and try to filter the essential things out. Because my factory is small, I am able to react very fast and flexibly if improvements are necessary.
I wish all Henseleit-Helicopter pilots many hours of fun and success with my helicopters and look forward to meeting you personally at one the many helicopter meetings.

Happy Flying ☺

Jan Henseleit

8.0 Attention! Safety Advise.

A remote controlled helicopter is not a toy and must be kept out of the hands of children. Only correctly assembled helicopters, that are maintained regularly after each flight, can function properly.

Keep a safe distance from the helicopter and always assume that something may go wrong at any time causing it to become uncontrollable.

If repairs have to be carried out only use original parts.

Lack of attention to detail, or mistakes in the helicopter assembly, or assembly of components and a lack of experience in using the radio control can result in the helicopter becoming uncontrolled and dangerous. Due to the enormous kinetic energy in the rotors, there is a risk of fatal injuries and damage of any type can occur due to lack of attention. Therefore do not fly over people, cars or anything else that might be in danger. Safety is very important and is your responsible.

As the manufacturer and the sales agents have no control over the use or maintenance of the Three-Dee NT. The company *Henseleit Metallverarbeitung* and it sales representatives are not liable or responsible for any damage or injuries arising from products out of their supply programme and therefore is not responsible in any way, as proper use or assembly can not be supervised by us. I strongly recommend that you do not use products that are not documented and specified in my handbook. An up to date spare part price list can be obtained from myself or my sales agents. The copying of text or text extracts, drawings and pictures is only allowed with my prior agreement in writing.

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CFK - PARTS

1x 2311 horizontal stabelizer
1x 3321 vertical stabelizer
2x 3339 under carriage plate
2x 2345 side strip
1x 2350 RC-main plate
2x 0388 pipe support
1x 0634 push rod guide
2x 2700 side frame
1x 0734 cooling shroud support

CHASSIS

2x 0303 canopy mounting support bunk
1x 0712 or 0714 roller support
1x 0722a upper bearing holder
1x 0722b bearing 10x22x6
1x 0724 lower bearing holder
1x 0724b bearing 10x22x6
1x 0726 belt guide roller
1x 0726c washer 0.5x4x8
1x 0727 steel pinion shaft
1x 0728 tail drive shaft bearing holder
1x 3729 bearing 3x9x5 (front belt support)
1x 3731 front tail toothed belt pulley
1x 0732 front tail boom holder
1x 0733 rear tail boom holder
2x 0735 M3x17 threaded studs
2x 0736 rear canopy support
4x 0737 M3x72 threaded studs
5x 0738 spacer
3x 0739 silicon tube
2x 0740 canopy mounting support
2x 0815 graphit rollers
2x 0816 graphit roller support
21x caphead screw M3x10
1x caphead screw M3x14 for 3729
1x washer 2x3x5 for 3729
1x caphead screw M4x16
9x domehead screw M3x10
1x domehead screw M3x12
2x caphead screw M3x16
11x nyloc nut M3
1x nyloc nut M6
31x washer M3 large
1x alu washer 6x18x2,5

SKIDS

2x 0338 under carriage studding
2x 0340 skids
4x 0341 skid clamp
1x 0342v front under carriage plate holder
1x 0342h back under carriage plate holder
1x 0342g alu cover M4
1x 0342s alu cover 4mm hole
2x 0343 skid cap
4x domehead screw M3x8
4x nyloc nut M3
8x washer M3 large
4x washer M4 large
2x nyloc nut M4

MAIN SHAFT UNIT

1x 0393 washer set
1x 0400 swash plate
3x 0400a threaded link balls M3x3
4x 0400b threaded link balls M3x3
1x 0410 rotor shaft
1x 0412 spacer
1x 2416 large toothed belt pulley
1x 0417 toothed belt 725mm
1x L0418 or R0418 one way drive shaft
1x 0424 gear wheel
1x 0426 main gear centre hub
1x caphead screw M4x20
1x nyloc M4
4x 1219 counter sunk screw M3x10
4x 1197 dome head screw M3x8

MAIN ROTOR

2x 0100 flybar link guide
2x 0101 flybar link guide pin
4x 0102 O-Ring 16x2.5
2x 0104 O-Ring outer bush
2x 0107 washer 0,2x8x16
2x 0109 O-Ring inner bush
1x 0110 feathering spindle
2x 0111 washer 0,5x8x16
2x 0112 bladeholder retaining bush
4x 0113 bearing 8x16x5
2x 0114 bladeholder
2x 3115 thrust bearing 8x16x5
2x 0116 pitcharm
2x 0117 washer M5
2x 0118a bell hiller leaver
4x 0118b bearing 3x7x3
2x 0118c spacer
2x 0118d washer 0.3x3x6
2x 0118e threaded link balls M3x4 / 7mm long
2x 0118f threaded link balls M3x4 / 9mm long
2x 0119 caphead screw M5x12 12.9 special
1x 3120 centre hub
4x 0122 flybar seesaw guide
4x 0123 silicon rubber dampers
1x 0124 flybar seesaw
2x 0400a threaded link balls M3x3
2x 0125 center support
2x 0126 flybar guide box side plates
2x 0127 flybar guide box top and bottom plates
1x 0128a flybar leaver
2x 0128b special threaded balls 9mm long
2x 0129 bearing 15x21x4
2x 0130 bearing 4x10x4
2x 3133 paddle
2x 0135 flybar collet
1x 0136 rotorhead bolt
2x 0138 shanked blade bolt
1x 1195 grub screw M4x4
2x 1193 grub screw M4x4
8x 1189 grub screw M3x6
12x domehead screw M3x8
4x caphead screw M3x16
4x caphead screw M3x6
2x caphead screw M3x8
8x cheeshead screw M2,5x8
3x nyloc nut M4
2x washer M4

ENGINE

1x L0331 or R0331 cooling shroud
1x 0362 high speed needle support
1x 0385 tuned pipe retaining spring
1x 0395 socket support
1x 0396 remote glow plug socket
1x 0397 plug clamp
1x 0500 starter cone
1x L0503 or R0503 cooling fan flywheel
1x L0504 or R0504 clutch
1x 0505 taper collet
1x 0506 clutch bell
1x 0508 special washer
2x 0716 motor mount
1x 0718 4mm spacer
3x caphead screw M4x10
5x caphead screw M4x16
4x washer M4
4x washer M4 large / 1,6 thick
1x caphead screw M3x25
3x caphead screw M3x12
2x caphead screw M3x8
2x caphead screw M3x6
3x nyloc nut M3
5x washer M3 large
1x 1193 grub screw M4x4

LINKAGE

2x 0131 connecting rod
21x 0389 Kugelgel. M 2,5
3x 0391 quick link M2,5
1x 0609 fore & aft cyclic push pull leaver
2x 0609f spacer
1x 0609g stud M3x72
6x 0609h threaded link balls M3x3
2x 0611 left & right cyclic push pull lever
2x 0611d washer 0.5x3x6
6x 0611e threaded link balls M3x4
2x 0612 fore & aft cyclic servo stand off
2x 0613 tail servo mount
2x 0617 fore & aft cyclic push rod
4x 0619 left & right cyclic push
2x 0623 flybar push rod
2x 0625 pitch mixing push rod
1x 0629 throttle servo push rod
2x 0630 connecting rod
2x 0633 36mm rod for tail push rod
6x 0637 servo fastening plate M2,5
6x 0638 threaded link balls M2
2x caphead screw M3x20
4x nyloc nut M3
4x washer M3 large
12x cheeshead screw M2.5x12
8x cheeshead screw M2.5x10
8x cheeshead screw M2.5x8
6x nut M2
6x washer M2
24x washer M2.5

TAIL GEAR BOX

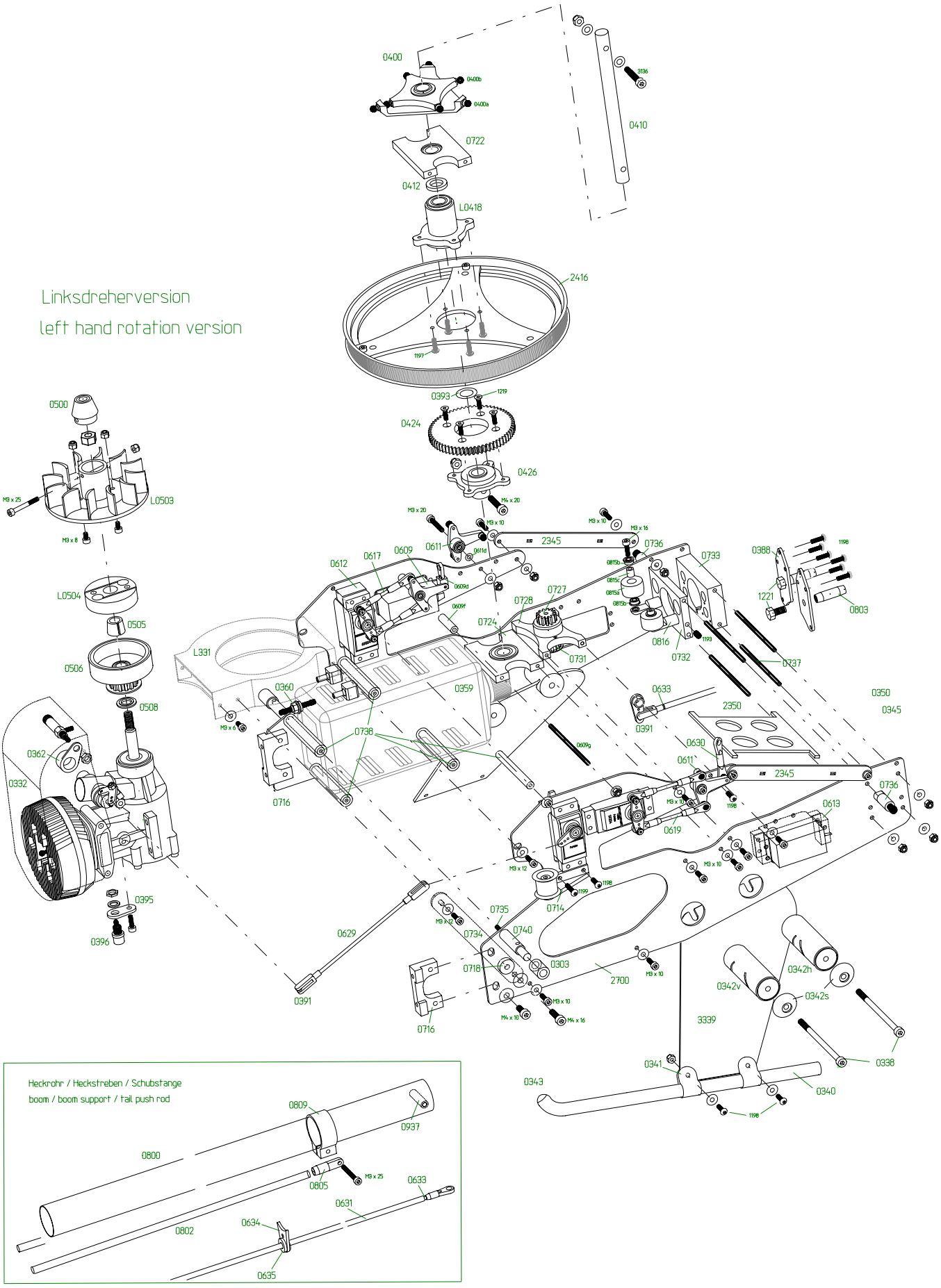
1x 0812 tooth belt
1x 0900 tail gear box
1x 3907 rear tail toothed belt pulley
1x 0908 tail unit support
1x 0910 tail output shaft
2x 0911caphead screw M3x6 (12.9) special
1x 0916 tail pitch slider
2x 0918 C-clip
2x 2919 bearing 5x13x5
2x 2920 spacer 0,1x5x10
2x 0921 thrust bearing 5x12x5
2x 0923 threaded link ball M3x3
2x 3927 tail blade holder
1x 2936 tail centre hub
1x 0937 spacer
1x 0938 bell crank mount
1x L0939 or R0939 bell crank
1x 0939d threaded link ball M3x4
1x 0939e washer 0.3x3x6
1x 3940 rear belt support
2x 1193 grub screw M4x4
2x caphead screw M3x8
3x caphead screw M3x16
1x caphead screw M4x35
2x washer M3 small
2x washer M3 large
2x nyloc nut M3

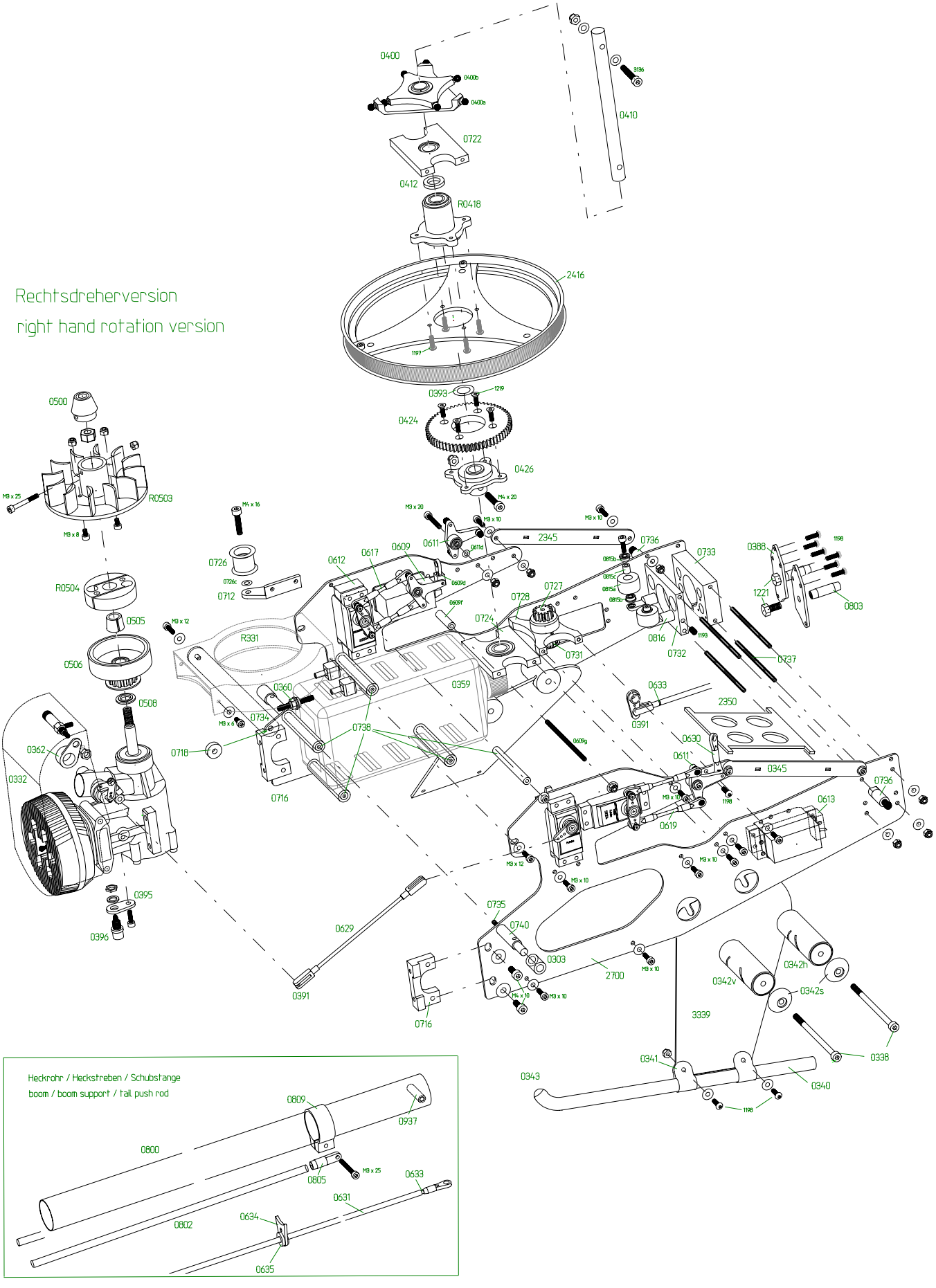
DIFFERENT PARTS

2x 0302 canopy fixing blocks
2x 0305 rubber grommets 4mm
1x 0394 swash plate lock
1x 0635 push rod guide grommet 5mm
2x 0803 front boom support ends
2x 0805 back boom support ends
1x 0809 boom clamp
1x caphead screw M3x25
1x nyloc nut M3
2x nylon screw M5x10
8x cable tie
1x velcro
1x feeler gauges
1x micro ballons
1x fuel tube 3 feet
1x 3398 belt tension tester

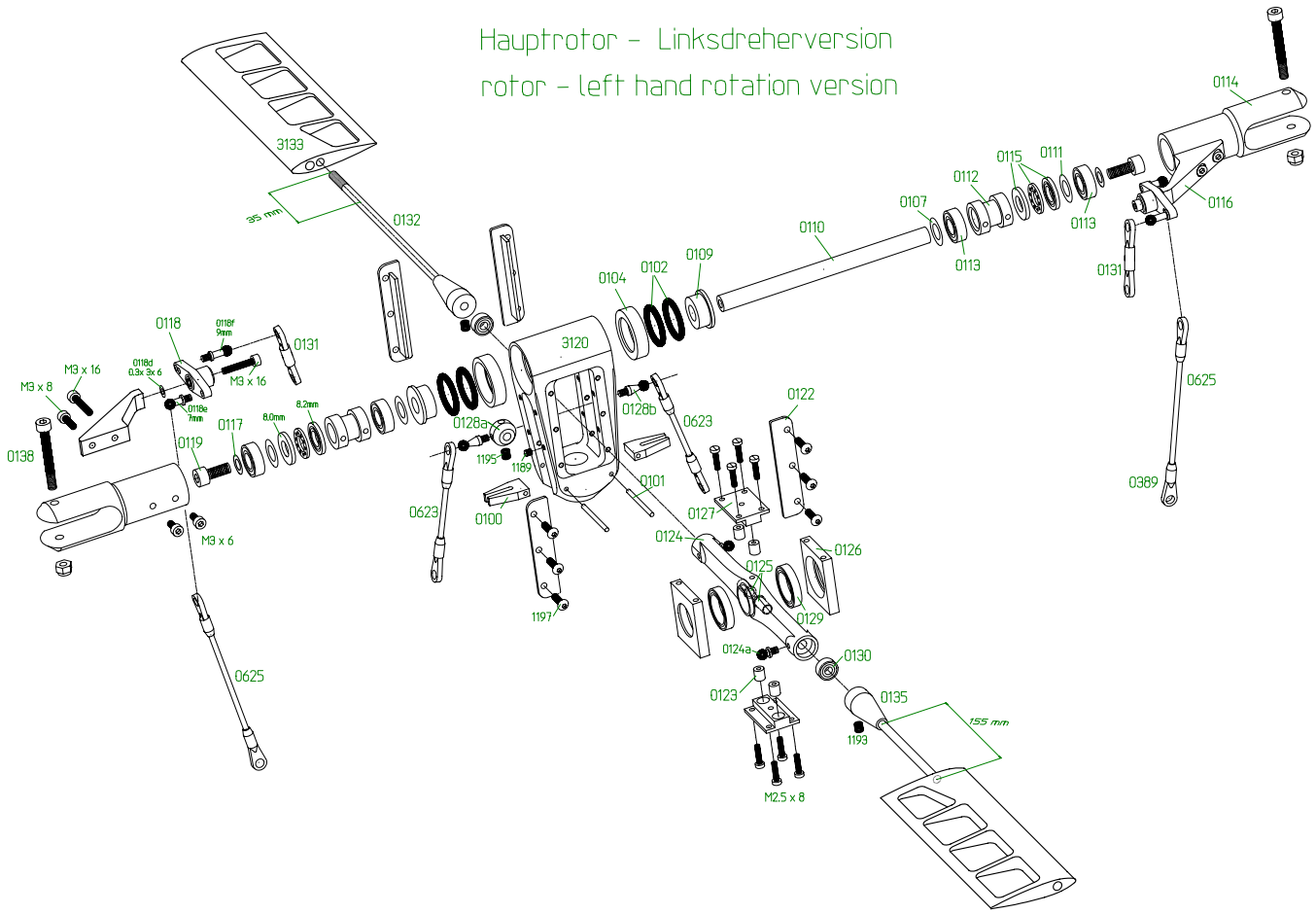
OTHER PARTS

1x 0132 flybar
1x 0301 canopy
1x 0332 cooling shroud duct
2x 0333 *THREE-DEE NT* decal
2x 2333 www.henseleit-helicopters.de decal
1x 0337 antenna tube
1x 0631 CFK-tail push rod
1x 0800 CFK-boom
2x 0802 boom support
2x 3358a 90° tank nipple
2x 3358b brass nipple
1x 3359 Tank
1x 0360 double nipple
1x 0361 filter clunk

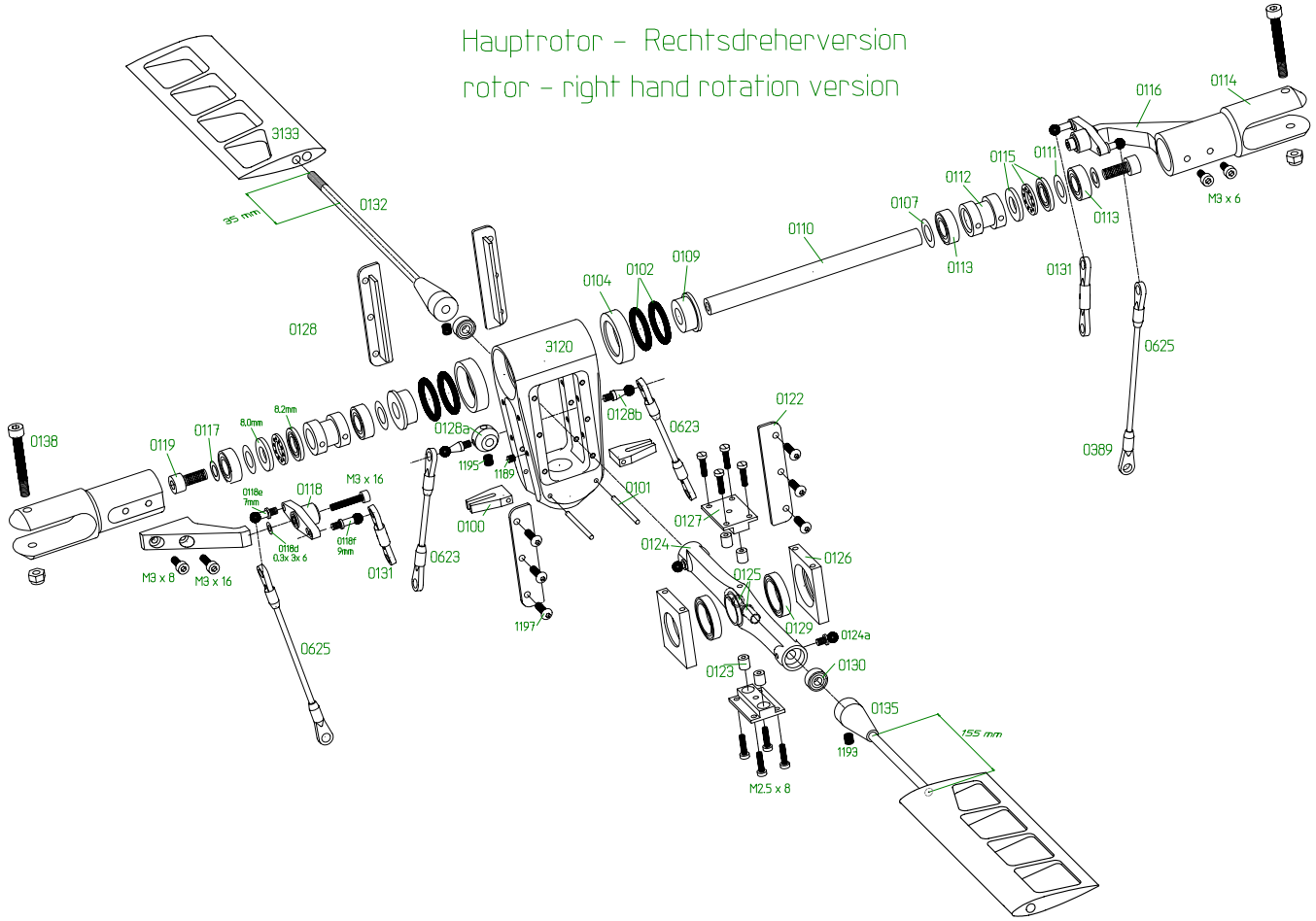

Linksdreherversion
left hand rotation version
0400
0400b
0400a
3136
0410
0722
0412
L0418
2416
1197
0393
1219
0424
0426
0500
L0503
M3 x 25
M3 x 8
M4 x 20
M3 x 20
M3 x 10
M3 x 16
2345
0736
0733
0388
1198
1221
0803
0611
0611d
0609
0612
0617
0815b
0815c
0815a
0609d
0609f
0727
0728
0724
0731
0816
0732
0737
L0504
0505
0506
0508
L331
0360
0359
M3 x 6
0738
0716
0633
0391
2350
0350
0345
0609g
0630
0362
0332
0619
0613
M3 x 12
1199
0714
0735
0734
0740
0629
0718
0303
2700
0342h
0342v
0342s
3339
0338
0341
0343
0340
0395
0396
Heckrohr / Heckstreben / Schubstange
boom / boom support / tail push rod
0809
0937
0800
0805
0633
0631
0802
0634
0635


Rechtsdreherversion
right hand rotation version
0400
0400b
0400a
3136
0410
0722
0412
R0418
2416
1197
0393
1219
0424
0426
0500
R0503
M3 x 25
M3 x 8
M4 x 16
M4 x 20
M3 x 20
M3 x 10
2345
0611
0611d
0736
0733
0388
1198
1221
0803
0726
0726c
0712
0612
0617
0609
0609d
0609f
0727
0728
0724
0731
0732
0816
1193
0737
R0504
0505
0506
0508
M3 x 12
R331
0360
0359
0734
M3 x 6
0718
0738
0716
0362
0332
0395
0396
0633
2350
0391
0630
0345
0736
0613
0619
0609g
0629
0391
0735
0740
0303
2700
M3 x 10
M4 x 10
0716
0342h
0342v
0342s
3339
0338
0341
0343
0340
1198
Heckrohr / Heckstreben / Schubstange
boom / boom support / tail push rod
0809
0937
0800
0805
M3 x 25
0633
0631
0634
0802
0635

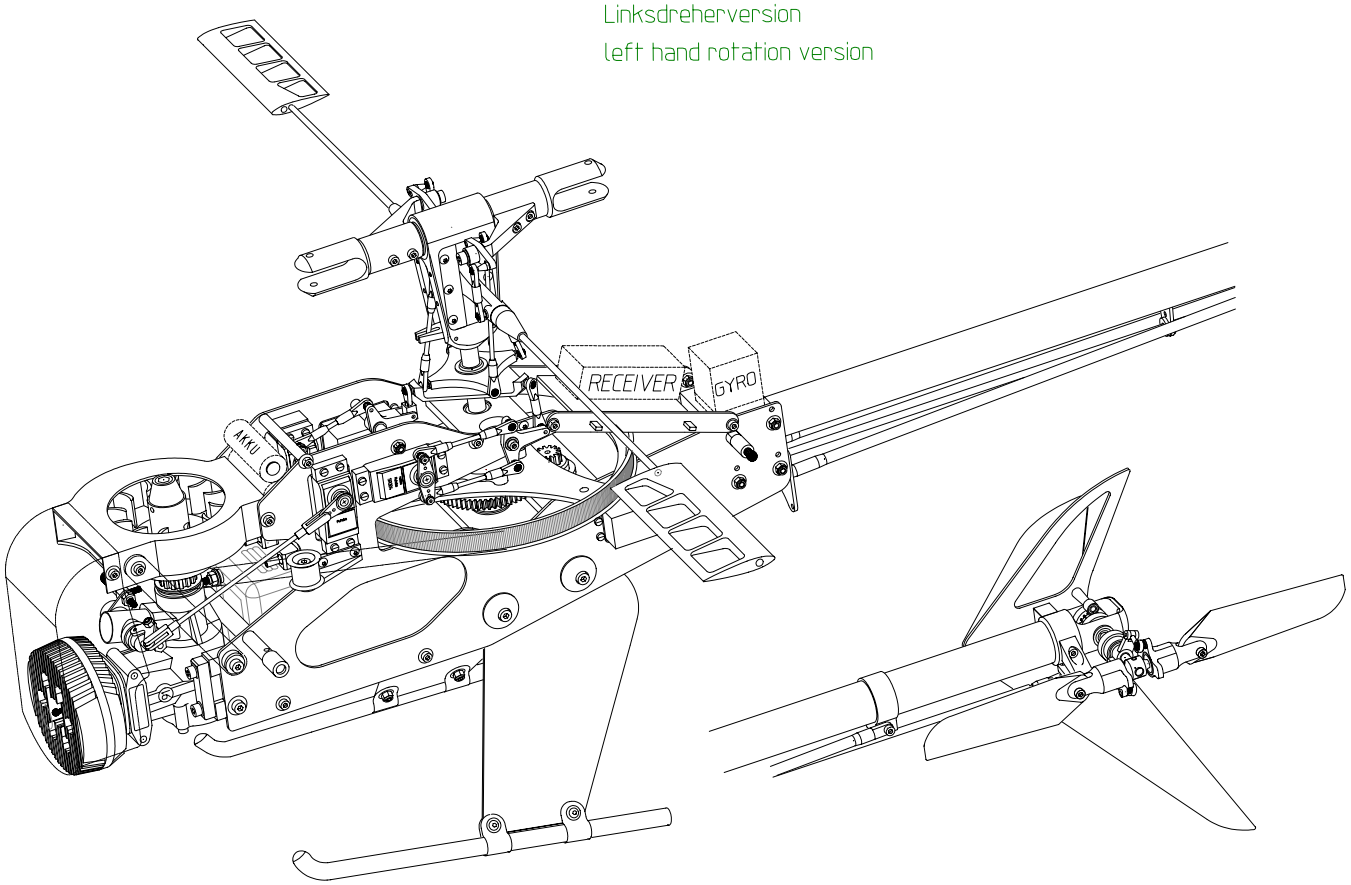
Hauptrotor – Linksdreherversion
rotor – left hand rotation version



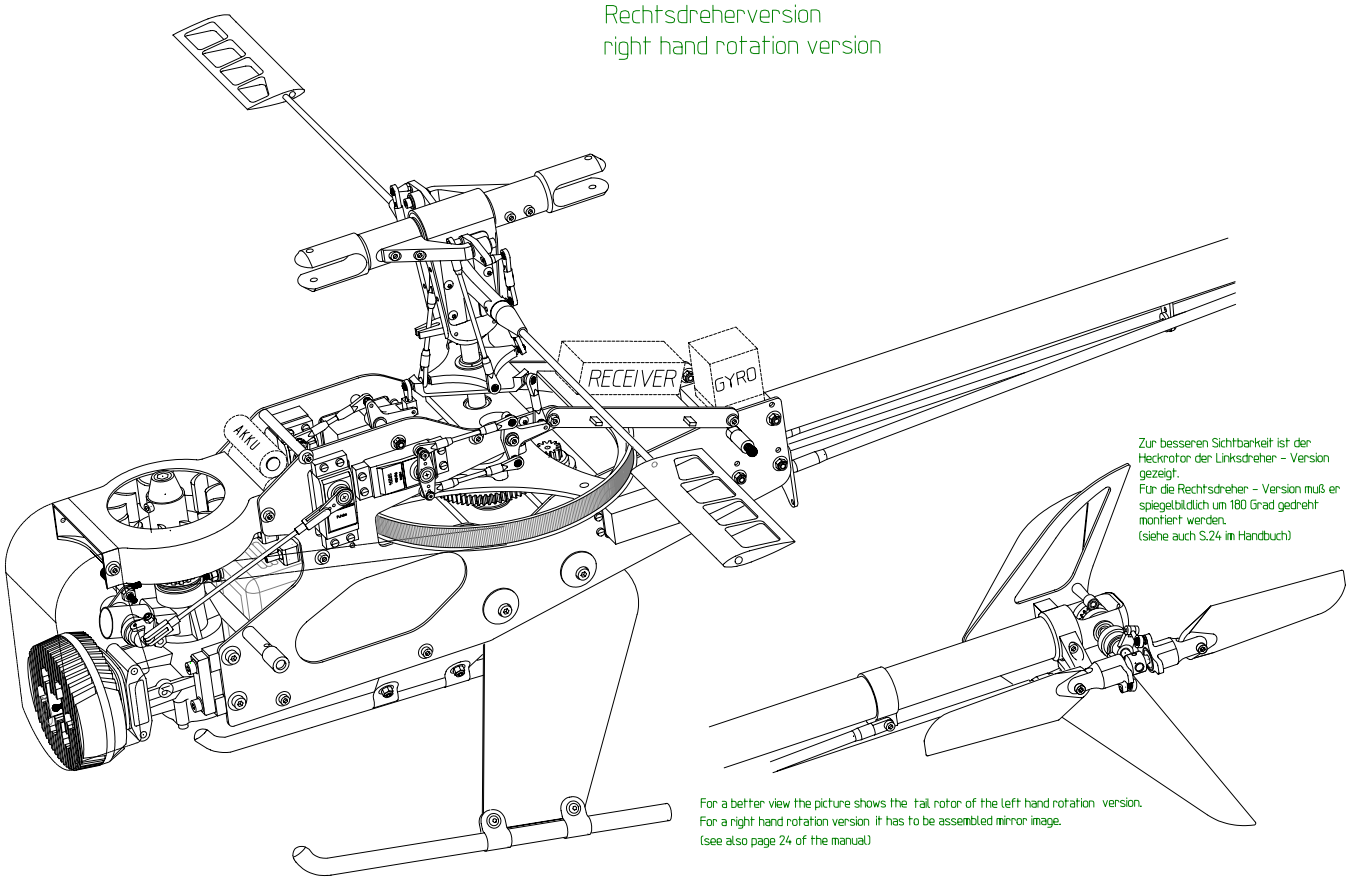
Hauptrotor – Rechtsdreherversion
rotor – right hand rotation version



Linksdreherversion
left hand rotation version



Rechtsdreherversion
right hand rotation version



Zur besseren Sichtbarkeit ist der Heckrotor der Linksdreher – Version gezeigt.
Für die Rechtsdreher – Version muß er spiegelbildlich um 180 Grad gedreht montiert werden.
(siehe auch S.24 im Handbuch)

For a better view the picture shows the tail rotor of the left hand rotation version.
For a right hand rotation version it has to be assembled mirror image.
(see also page 24 of the manual)