

Raptor 30/50 v2 Assembly Manual

Here are some things to note about putting a helicopter together.

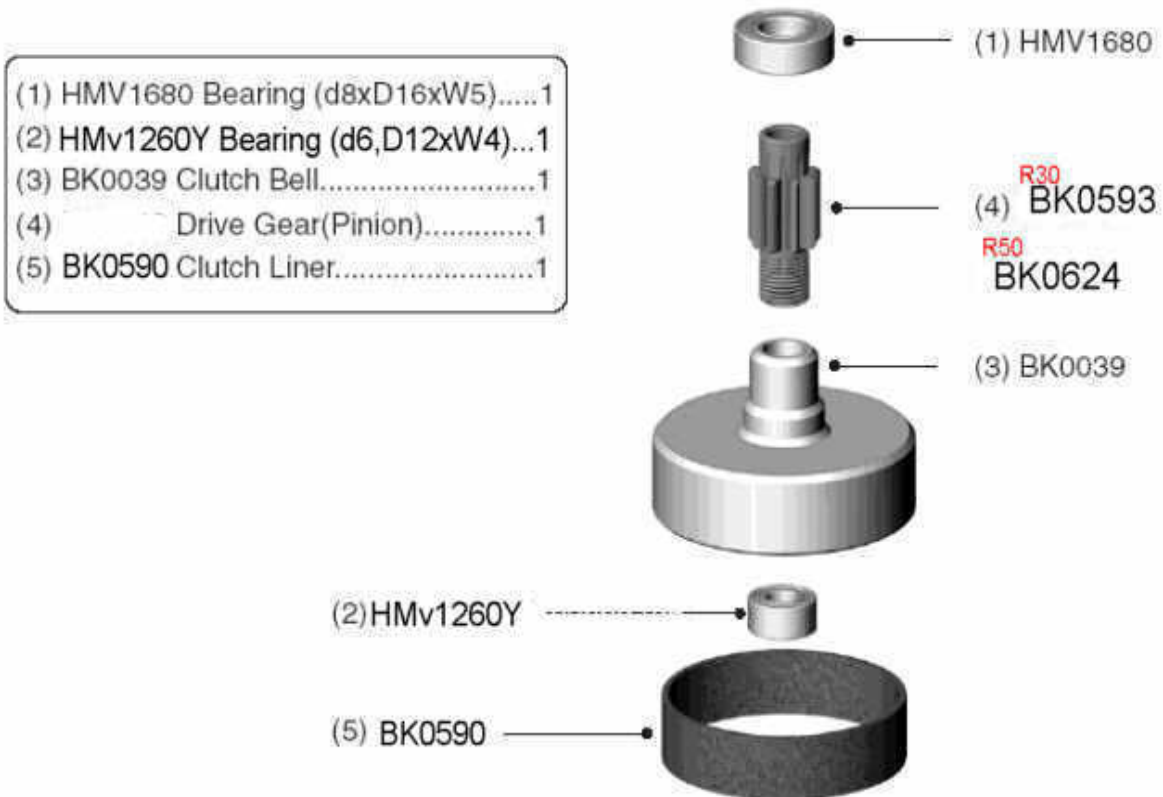
1. Bolts that go into metal thread need some blue loctite. Don't flood the bolt with it, just a drop is all that is needed.
2. If a screw goes into plastic then do not apply loctite, it will eat the plastic. Some say use a drop of CA, but I don't use anything on all but a couple of them, the plastic squeezes the screw and it will stay in fine (unless you have a lot of vibration from the engine/fan area).
3. It's a good idea to clean threads before applying loctite.
4. When a metal ball link wears out, it's usually because dirt got embedded in the plastic link and is acting like sandpaper on the metal ball. So just changing the ball will not be a long term solution. You have to change both the link and the ball.
5. Shouldered side of the link balls go on the opposite side of the screw head.
6. Most links have a special direction they go on. Place the link on the ball, don't snap it on, just push it against the ball and notice how far it goes on. Flip it around and try the other side. The side that goes on further is the correct direction. Most of the ball links have a label on the side that faces out. If the link goes on exactly the same amount either direction then it is bi-directional like the Rocket City links and can be installed either direction.
7. Anytime you make up a link/rod (or even adjust one), pull on the link to make sure it is securely on the rod. If you don't have enough threads of the rod in the link or if the hole in the link is too large (due to manufacturing error) then the link can come off in flight. So make sure you check this on each link.
8. When adjusting links, keep the same amount of thread showing on both sides. If you have no thread showing on one side but the other has a lot, then you probably don't have a lot of thread holding the link on. Try to keep them about equal.
9. A tight link is one that does not pivot freely on the ball. The ones in the rotor head area will free up quickly, but the control links don't. Stiff links cause the servos to have to work harder (and drain your battery). Also they attribute to a sticky feel in a hover. This is where you move one direction then back to center, but the heli does not, it drifts in the last direction you moved. To free up the links, there are three techniques. JR sells a ball link resizing tool part #JRP960219 (some like it some don't, mine works good with a little tweaking), you can make your own resizing tool using an extra ball mounted to a rod, then use some cutters to put a couple marks on the ball that will act to grind the excess material from the link. Another idea is to squeeze the links (while on the ball) with some pliers. This method sometime results in damaged links so you have to be careful not to squeeze too hard or to slip.
10. When you open a parts bag, empty it into a plastic bowl. Make sure the container has a curved bottom with no 90 degree corners so it will be easier to get the small screws out.



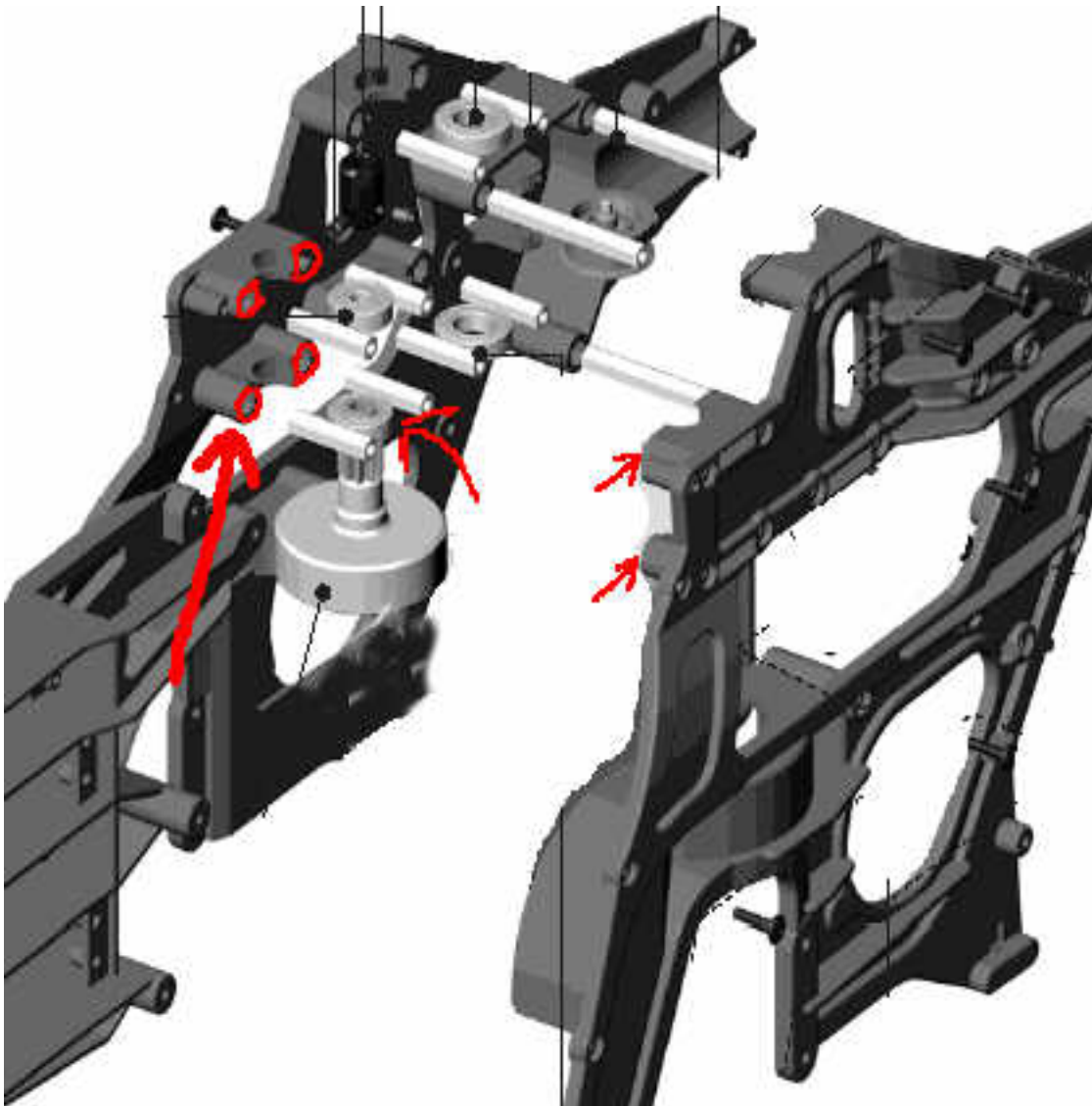
This step is simple, just place the parts together as shown. In most situations the bearing (1) is already installed (but you need to confirm the bearing is all the way down against the top of the teeth). Also the clutch liner (6) is already installed, however you need to make sure it is in fact glued in! Also the bearing inside the clutch bell (2) should also have been installed at the factory. When you screw the pinion gear into the clutch bell make sure you do NOT use loctite. The engine will take care of keeping it tight, no need for loctite, that will only make it very tough to remove. A note here about putting the bell on the pinion gear: I have had the bell thread on crooked sometimes. After you get the bell on, spin it to see if it wobbles. If so then take it off and try again.

In my kit the liner and bearings where installed correctly by the factory so all I had to do was install the pinion on the bell. If yours is the same the you can skip the next part and go to page 3.

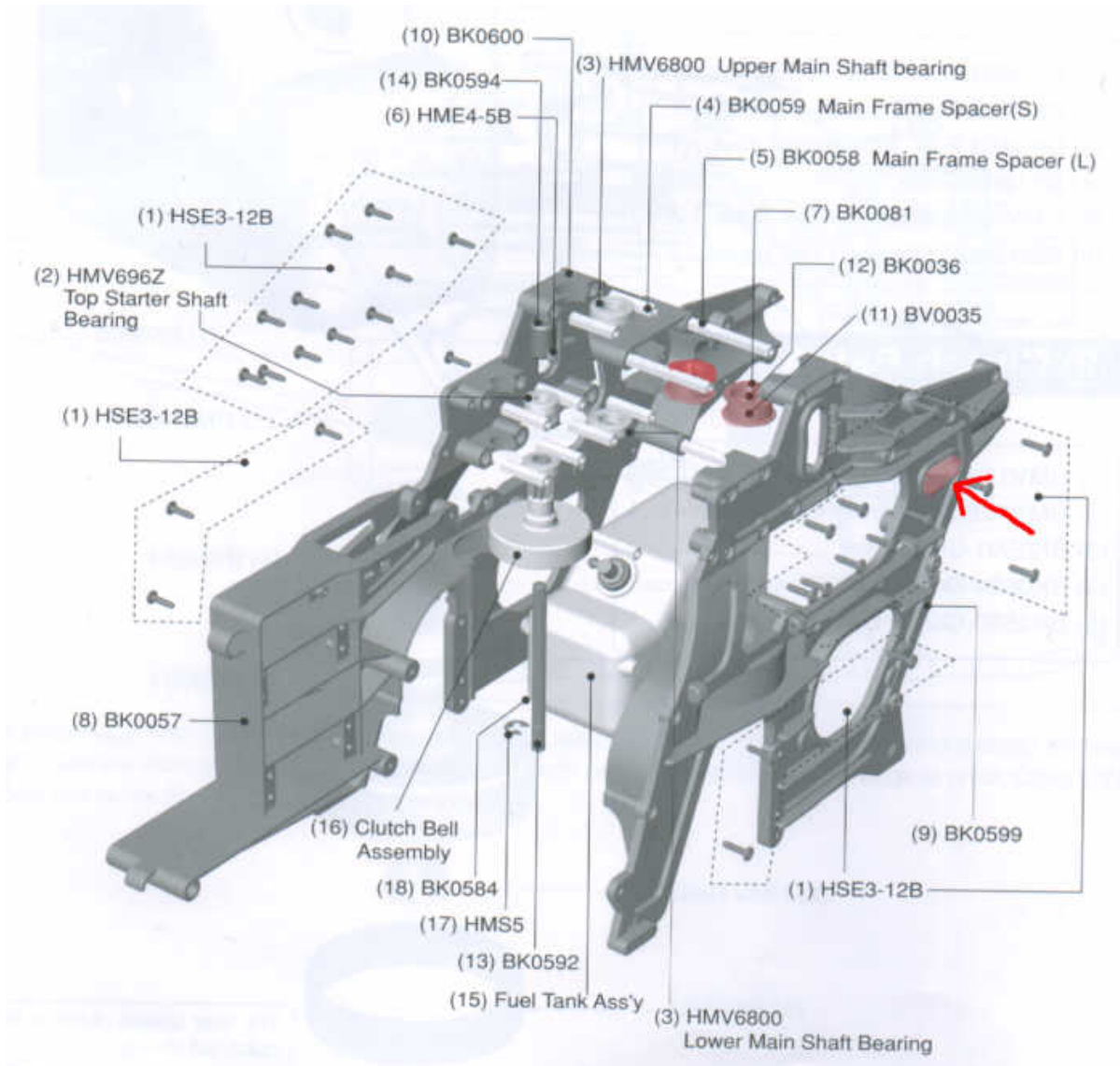
When installing the liner first pre-fit it. I recommend to slightly curl both ends of the liner. If you don't then after it's installed you will get a flat section where the ends meet and the clutch will catch on it. You can glue the liner in place with 5-minute epoxy or JB Weld. I like the JB Weld because it's thicker and helps to get the clutch to liner clearance closer. An ideal clearance would be less then 0.010" per side. If like most people, you don't have special equipment to make these accurate measurements, then wrap one layer of electrical tape around the clutch, glue the liner in, insert the start shaft (from page 4), then put the clutch in. The tape will keep the liner about the right distance away as the glue dries.

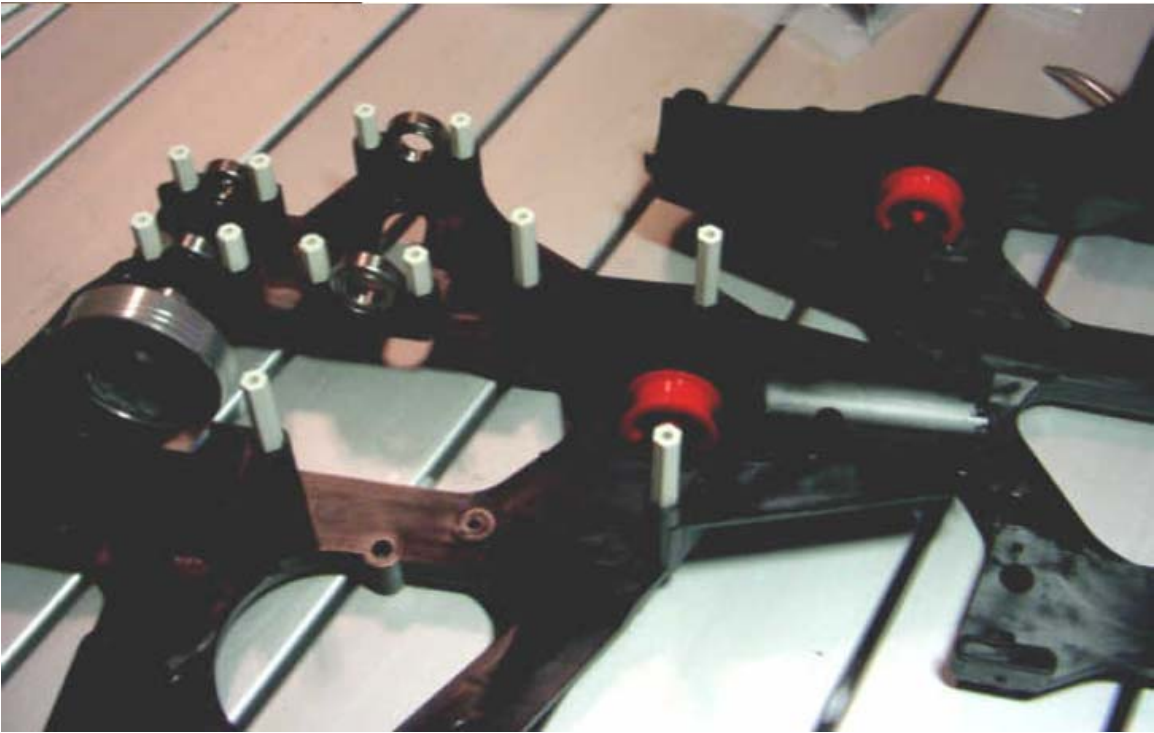


Note: v2 - I have found the quality of manufacturing to be very good and did not need to grind on the bearing blocks to get a tight fit. It is still however worth checking. This step is to pre-fit the pinion bearing in the frames. If it's not a tight fit then this could cause premature clutch failure. Install the two frame spacers (the hexagonal white post) that go in front and behind the pinion bearing. Insert the pinion bearing (with the bell attached) into the bottom bearing block of the right frame and then put the left frame on. Use 4 of the HSE3-12B screws to tighten the frames together around the pinion bearing. Now the test...grab the clutch bell and see if you can move it forward and backward. If it's just a small amount, like a couple of millimeters total, then you are probably just feeling the play in the bearing, however if it moves a few millimeters both directions then you need to file down the 8 spots where both frame halves touch around the top and bottom bearing block. In the picture below I colored the 4 on the right frame red. I used a grinding bit on my dremel to cut away 1mm from each side. This amount worked out great for mine. Once you get this right, then take the frames apart and go to the next section.



It looks like a lot of things, but it is easy. Start by laying the right frame half on the table. Insert the top (item 3) and bottom (item 3) main shaft bearings as well as the top start shaft bearing (2) and the pinion bearing/clutch bell assembly (16). Insert all of the white frame spacers (4) and (5) into that side. Note that as you can see in the picture below, some frame spacers are short and some long. Next insert the two red pulleys (12) with pins (7) installed into the slots in the frame. I marked a hole in the left frame where the pulley can be seen after it's installed. The pulleys just slide into the slots and the belt will keep them from coming out. Next join the frames together. You may have to lay the left frame on top of the right and align each post to slide in the holes of the left frame. Now it's time to bolt the frames together. There are 30 of the (1) screws. Don't tighten them so tight you strip out the plastic, just get them snug. The plastic will hold them, do not use loctite. Some use a small drop of CA on the tips of the screws, but I don't feel it's necessary on any of the ones in this section. I have never had any of these try to back out. Having said that, don't assume anything, keep an eye on all bolts and screws. If you find one of the screws that goes into plastic trying to come out, then clean it and put a small drop of CA on the tip. Now that you have the frameset together with bearings, pulleys, and clutch bell assembly together, it's time to install the servo tray (8). It is held in with 3 screws on each side.





There are three pieces of fuel tubing used. The one going to the engine is referred to as the fuel line, the one to the muffler is called the pressure line, and the one that goes inside the tank is called the clunk line. The clunk line needs to be checked regularly because the exhaust gases cause the material to break down. The one that comes in the kit goes fast. Check it after the first dozen flights. It will become crystalized and when pinched, the inside walls will stick to each other. This will cause engine tuning



problems because holes can develop and because the exhaust pressure can squeeze the line and reduce fuel flow. A good line to use for clunk line is the blue Aerotrend line. The pink Prather line works best for the fuel line and pressure line. When you replace the clunk line the new one should be cut to 65mm.

In my v2 kit the tank was already assembled, so if yours is then you can continue to page 6.

Begin by placing the clunk line (5) on the coned side of the fuel nipple (3). Next slide the rubber grommet (item 2) on. The big end will go toward the fuel nipple (item 3). Don't install it on (3) at this time. Next install the clunk (item 4) on the clunk line. Insert the clunk in the tank then fit the rubber grommet (2) in the larger hole of the tank. Put some fuel on the grommet to help slide item (3) in position. Usually what happens is the rubber grommet will be pushed into the tank. Don't use oil to make the fuel nipple go in easier, a lot of oils are petroleum based and will turn the rubber into goo. Another alternative is to place the grommet on the fuel nipple and use a flat blade screwdriver to push the bottom lip of the grommet into the tank. I have done this a few times, but be very careful not to damage the grommet. It is important that there be no air leaks anywhere. Also rotate the nipple so that it is pointed to the right side of the helicopter. Now that you have the clunk installed turn the tank upside down and confirm that the clunk does not get caught up on the back of the tank. If it does you will need to cut a little off the clunk line. You don't want the line so long that it gets stuck when doing 3D flying. But at the same time, don't cut it too short. When the tank is upside down make sure the clunk will fully reach the top of the tank. I have found on my 50 that the clunk line needs to be 65mm long.

[v1 to v2 difference] - The tank is not interchangeable due to the extra width. The fuel nipple (3) is different, the v2 version has a 90 degree nipple, however it can be used in the v1 and the v1 version can be used in the v2.

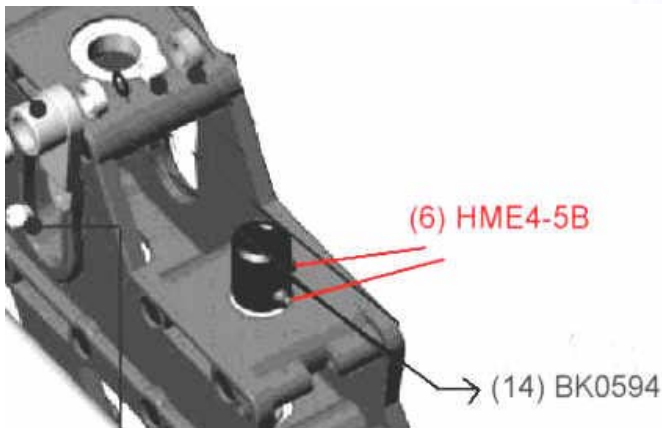
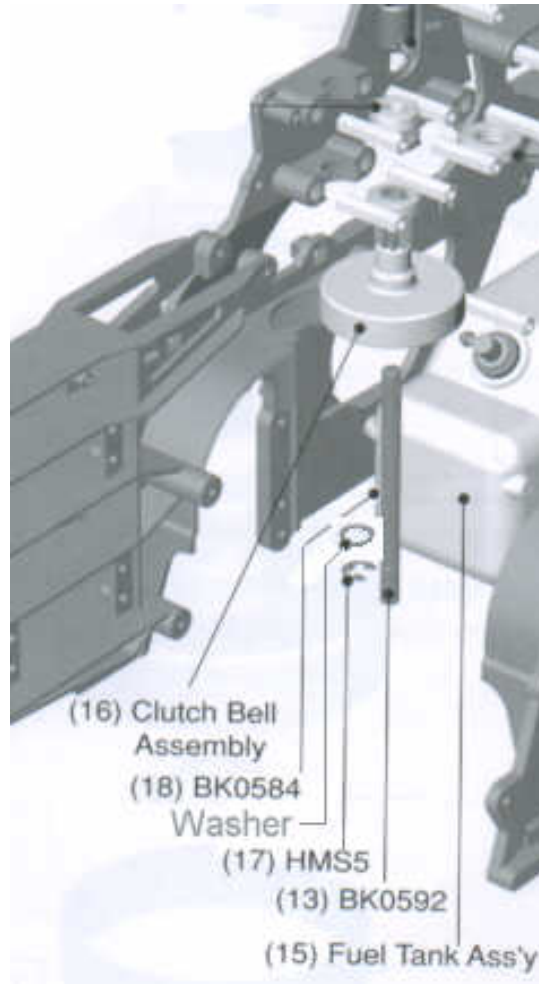


The first picture (on the right) still shows the frames apart, but don't worry, you don't need to do that, it's just pictured this way so you have a clear view of the start shaft (13).

The start shaft has a groove cut into one end. This will be the bottom. Start by installing the e-clip (17) in the groove then place the washer above the e-clip. This will go between the e-clip and bearing on the inside of the clutch bell. Now install the shaft up through the clutch bell (16) and up through the top bearing. Notice that the top of the shaft has two flat spots.

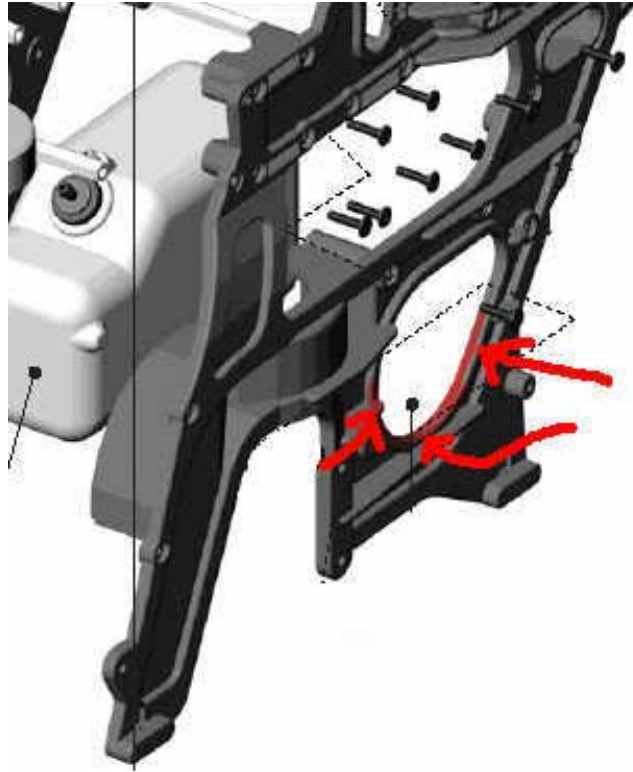
In the second picture (below) you can see the start coupler (14) slides down on the shaft. With one hand, push up on the start shaft from the bottom. Ok, remember the flat spots? You need to rotate the start coupler so that the two holes in the side match up with the two flat spots. Make sure the start coupler is all the way down (you are still pushing up on the start shaft right?)

Put blue loctite on the two set screws (6) M4x5 and screw them into the start coupler. Check for any up/down play in the start shaft. As long as you were pushing up on the start shaft and down on the coupler then you should not have any slop.

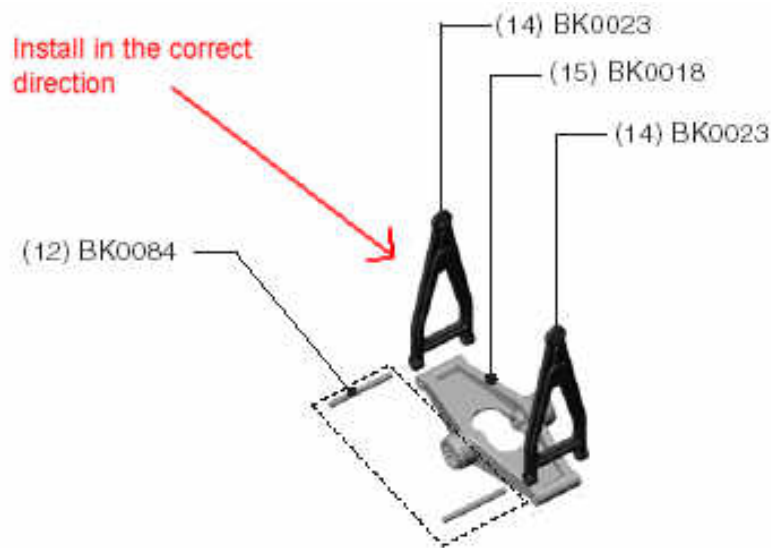


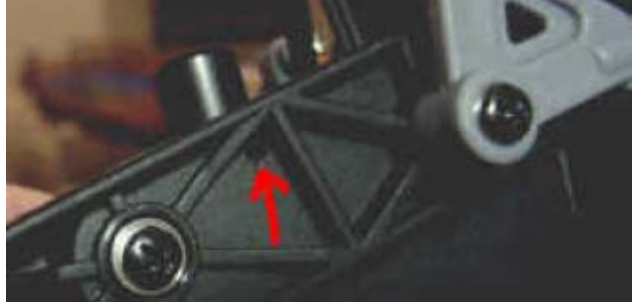
Note: Later if you have to remove the start shaft you could run into a problem with the shaft getting stuck as the top part gets to the bearings. This is caused by the set screws pushing the metal outward around the flat spots. The bulged area is then too thick to go through the bearings. If this happens then you have two options. The technique I use on the v1 kits is to use a dremel with a grinding tip to remove the bulge. Don't just knock the shaft through the bearings, you will more then likely damage the bearings. The second technique which can only be done on v2 kits is to remove the bottom e-clip and washer then put the start shaft out of the top.

Ok, one last thing for this section... install the fuel tank. Before you do this, take some sandpaper and smooth the sharp edges of the frame where it will touch the fuel tank. In the picture below, look at the three red arrows. This is the section that needs to be sanded. To insert the tank, just spread the back of the frames a little and push the tank in. There are some notches that it will lock into. BTW: Later when you need to remove the tank to change out the clunk line, simply remove just one of the rear landing skid screws. This will let you spread the frame enough to pull the tank out the back.



This is the elevator control arm. It goes in the top section of the frames. The key to getting this together is to make sure you put the 'A' arms (14) on the correct direction. If you put them on backwards you might crack them. Test fit each A-arm to find the right way. Place the A-arm against a ball (the swashplate would work for this test), don't snap it on, just push it against the ball and notice how far it goes on. Flip it around and try the other side. The side that goes on further is the correct direction and needs to go toward the center. Install them on the elevator control arm (15). Mark one side of the control arm so you can keep track of which way you installed the A-arms. I marked a letter 'T' on the top. If you don't and get it upside down then the A-arms will be backwards and you risk breaking them if you go ahead and force them on the balls. After you get the A-arms on and pins installed, you need to install this assembly into the frames. Fold the A-arms straight out then angle the assembly about 45 degrees and insert it through the top/back of the frames (as viewed in the 2nd picture). Once you get it inside, angle it back flat (with the side you marked facing up). The round center pivot points will fit in the slots on the left and right sides.

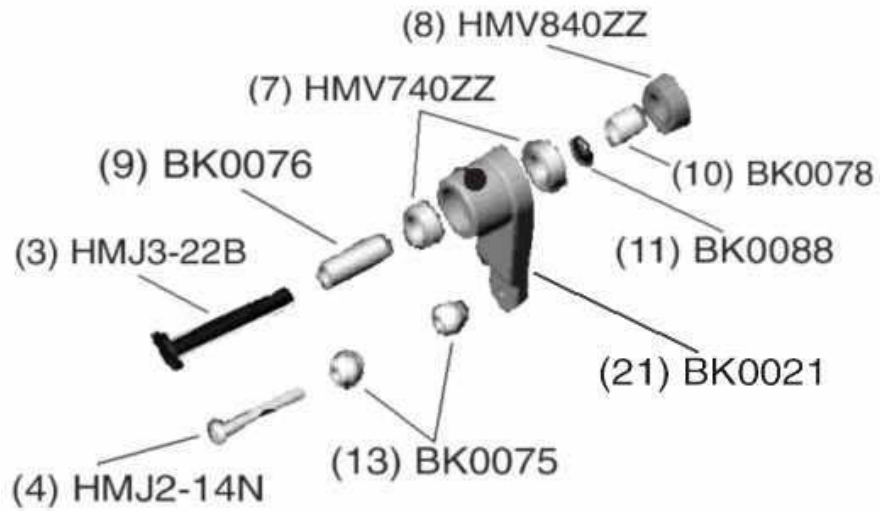
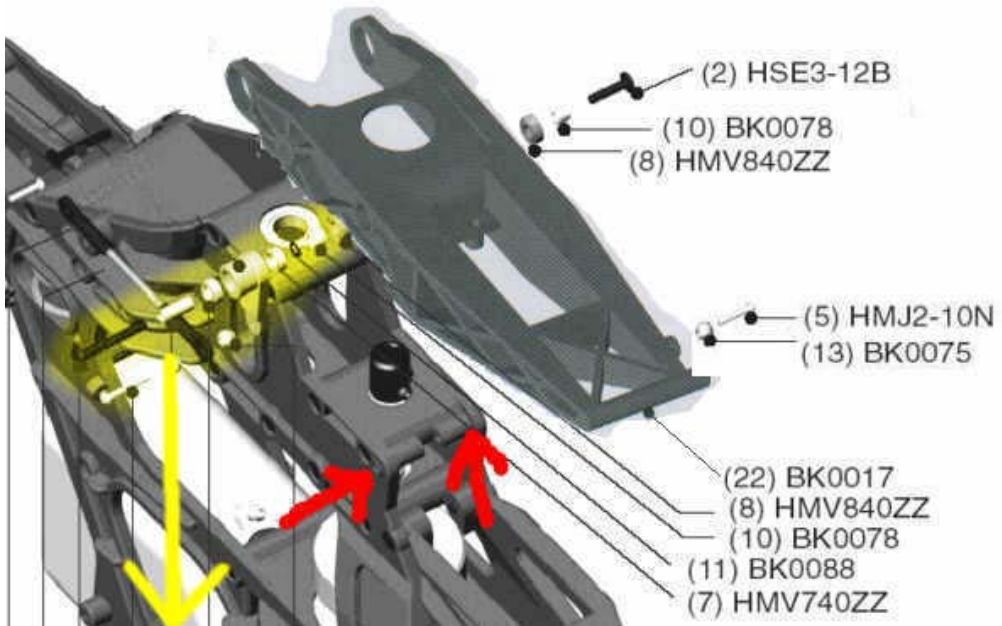




Tip: Before you install the pitch arm you might want to drill a service hole to make removal and installation of the start coupler easier. The version 2 pitch arm is larger and now you will not have a straight angle to get to the set screws in the coupler. To fix this you can drill a hole just large enough for your hex driver to go through as seen in the picture on the right.

Install the pitch arm (22) onto the frames. Install the (8) bearings into the middle hole in the left and right side of the pitch arm. The center of the (8) bearings need to align with the holes in the frame that I marked with red arrows. After you get it in place you can insert the elevator control arm (15 from the previous page) in the the loops at the back of the pitch arm. Next start on the left side of the pitch arm and slide the small sleeve (10) on the screw (2) this is a 12mm black screw. Now install it into the left side of the pitch arm. If you get the screw too tight then the pitch arm (22) will not pivot freely.

Now for the right side. The picture from the original manual makes it a little hard to see the small parts. If you look at the second picture you can see I edited the original so the background is removed. Insert the two (7) bearings into the elevator control lever (21). Slide the sleeve (9) onto the screw (3) (this is a 22mm black screw and is the longest one in the group) and then insert it through the bearings of the control lever (21). Slide the small washer (11) on the screw (3) followed by the sleeve (10). Screw this through the (8) bearing you already installed in the pitch arm and into the frame. Make sure the pitch arm can still pivot freely. Then slide both balls (13) on the screw (4) (the longest silver screw in the group) and screw this into the elevator control arm (21). Make sure that the shoulder side of both balls face the arm (21). Also make sure you tighten the screw enough that the balls are snug and will not rotate. Next install the link ball on the front of the pitch arm. There are two positions. If you are an advanced pilot then use the back hole. If you are just starting out and don't have a computer radio or you do but it is a Futaba 6X series then use the beginner hole in the front. All others use the back hole. The back hole will allow full collective range. Yes, you could get full range out of the front hole with a long enough servo arm, but that would make the servo have to work harder and because the pivot point is further out on the plastic pitch arm, this increases the amount of flex in the system. In other words, it's technically better to use the inside hole.



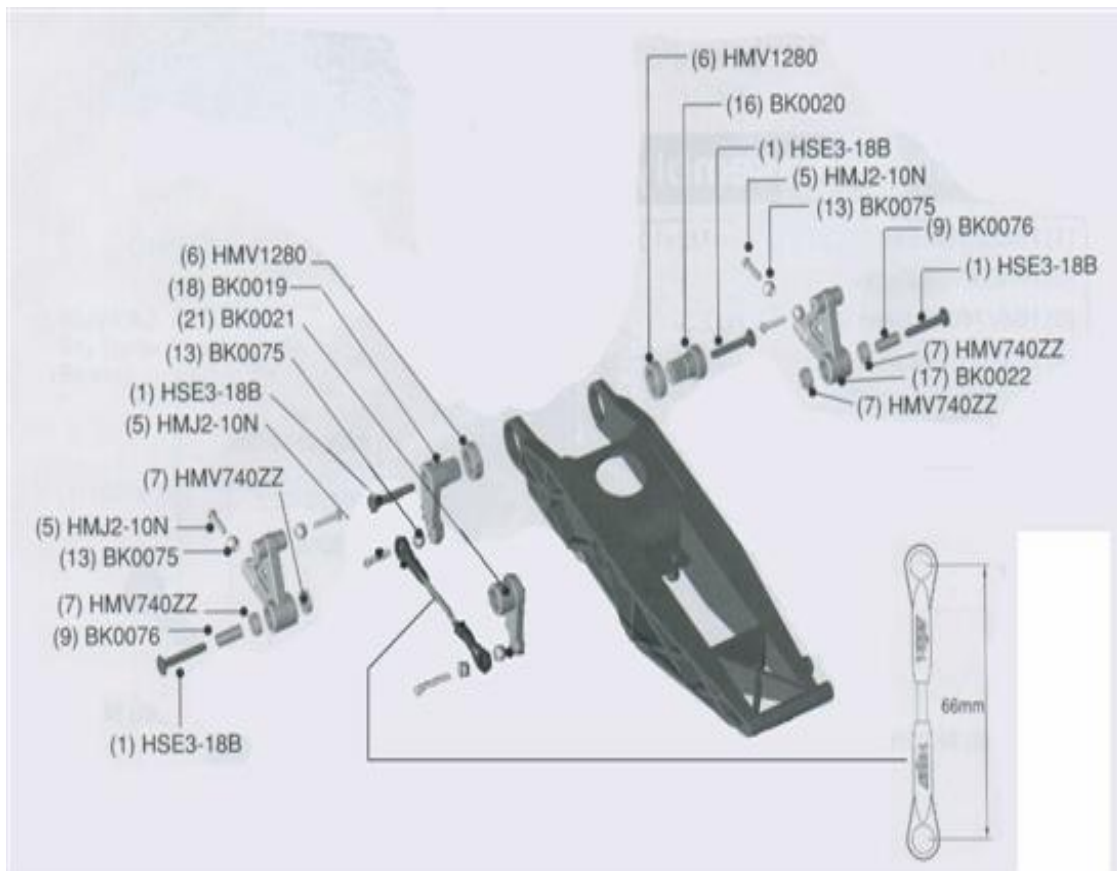
(14) BK0023

For model numbers 4831/4832:

(7) will be replaced by Bushing (BK0107x6)

(8) will be replaced by Bushing (BK0108x2)

At this point you should have the pitch arm installed as well as the elevator control lever that is in between the two loops at the back of the pitch arm. Start on the left side of the helicopter and insert the bearing (6) into the loop at the back of the pitch arm. Then insert the grey shaft (16) followed by the screw (1). Now on the right side of the helicopter insert the bearing (6) into the rear loop of the pitch arm. Next insert the lever (18), make sure the elevator control lever (page 9 item 15) is level and the lever (18) is 90 degrees to it (and pointed down). Use the screw (1) to secure the lever in place. Next slide the ball (13) on the screw (5) and install into Aileron Control Lever (17). As usual make sure the silver screw is just tight enough that the ball will not rotate freely on the screw. Use another screw (5) and ball (13) and install on the left side of lever. Install the two bearings (7). Slide the sleeve (9) onto the screw (1) and insert through the bearings of the lever (17). Add a small drop of CA to the tip of the screw and install into the pitch arm. Do the same for the left side, but make the ball (13) on the right side (facing toward the pitch arm). Next make up a link using a BK0093 rod and two BK0086 links. From each center of hole, it needs to be 66mm. Make sure the labels are facing out, and snap in place on the lever (21) and the inside ball of the lever (21).



For 29BB kits, model numbers 4831/4832,
 (7) will be replaced by Bushing(BK0107x6)
 (8) will be replaced by Bushing(BK0108x2)

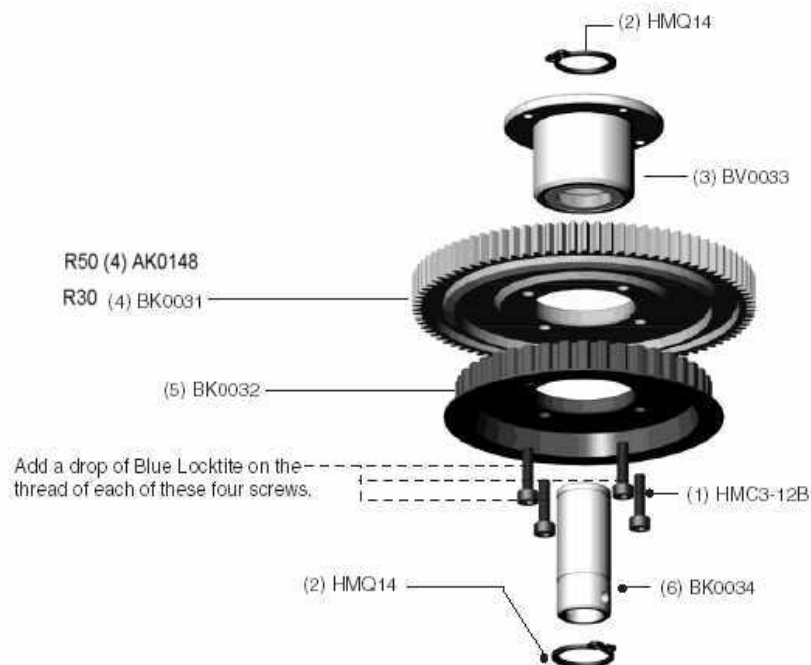
v1/v2 differences - All the parts are the same but the pitch that comes with the v2 has a new stronger design like used on the Raptor 60. The part number for the new pitch arm is the same so as stock of the old part is depleted all further orders will give the new design pitch arm. The new and old pitch arms are interchangeable. You can put a new pitch arm on a v1 or even put an old pitch arm on a v2.

The R30v2 comes with the same autorotation hub that the R30/50 v1 used. However the R50v2 comes with a constant tail drive. This is a white gear that is on the bottom side of the gray main gear as opposed to the other type which is red in color. The first set of instructions below are for the non-driven tail (the red gear). Go to the 2nd section if you have the white constant tail gear.

Tip: After you install the main gear on the main shaft (in the next step) check for any warping by watching for the gears to move up/down. as you spin them. If you see this first make sure you tightened the four bolts holding the main gear to the auto hub equally. If so then try rotating the main gear 90 degrees on the auto hub. If you are building the constant tail drive (R50v2) and you see the white tail gear wobble, then it maybe because it is tilted. The only thing holding it to the main shaft is the one bolt at the bottom. The gear can tilt slightly and cause the wobble. You can level the gear and that should correct it. It should level automatically with the belt installed it because it would ride on the shoulder of the gear and push it in place.

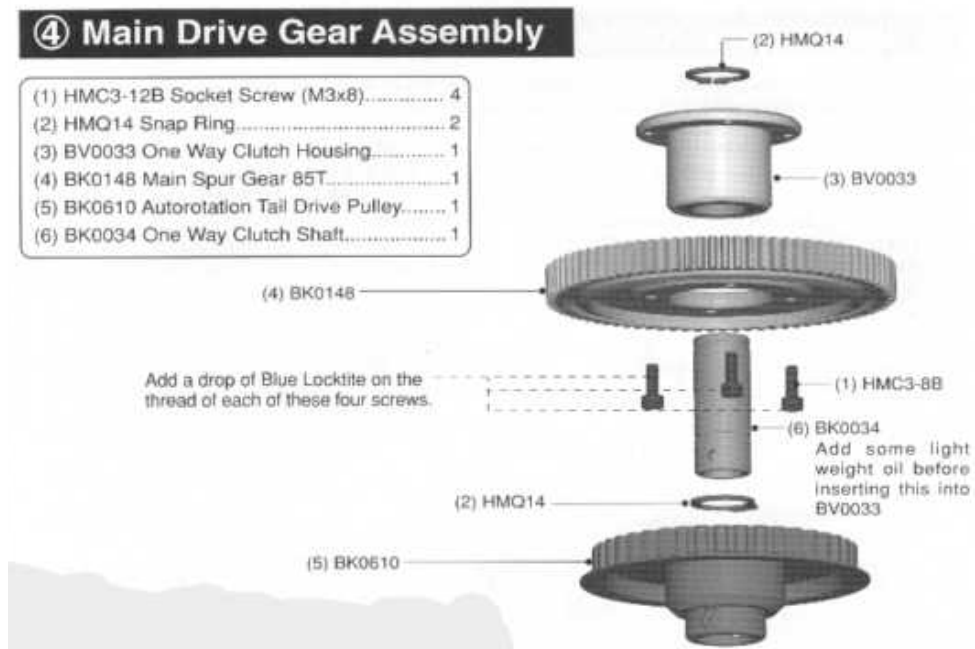
R30v1/v2 R50v1

In this section you have the main gear (4), tail gear (5), and autorotation hub (3). The top grey gear will have a number stamped on the top. The gear for the 30 size is 86 tooth and the one for the 50 is 85 tooth. The assembly is fairly simple with maybe the exception of the snap rings (2). You can get a cheap snap ring plier from your local automotive shop. I have installed them and taken them off without the special pliers but don't recommend it. Start by pushing the auto hub (3) through the top of the gray main gear (4). The top of the main is the side with the deep section. Align the four bolt holes with the four holes on the gear. Now apply blue loctite to the four M3x12 (1) bolts and use them to bolt the red tail gear (5) to the main gear and auto hub. Next install one of the snap rings (2) onto the auto hub sleeve (6). Slide the sleeve into the auto hub (keep the end with the hole through the side on the bottom). Note: Do not oil or lube the autorotation hub. There have been reported instances where this has caused the 'wah-wahs'. This is an oscillating sound during 0 degree descents (this can also be caused by non-lubed head dampeners or the low speed needle too lean). After you get the sleeve through the auto hub, install the second snap ring (2). Now try to move the main gear up and down. If it has some slack then buy or make some shims to install under the top snap ring. Ron Lund sells them in a package of 5 for \$3. Get some thin and thick ones. Part #: SHIM141 14mm X .1mm and SHIM142 14mm X .2mm If you have up/down play in the main gear this can contribute to the 'wah-wahs'.



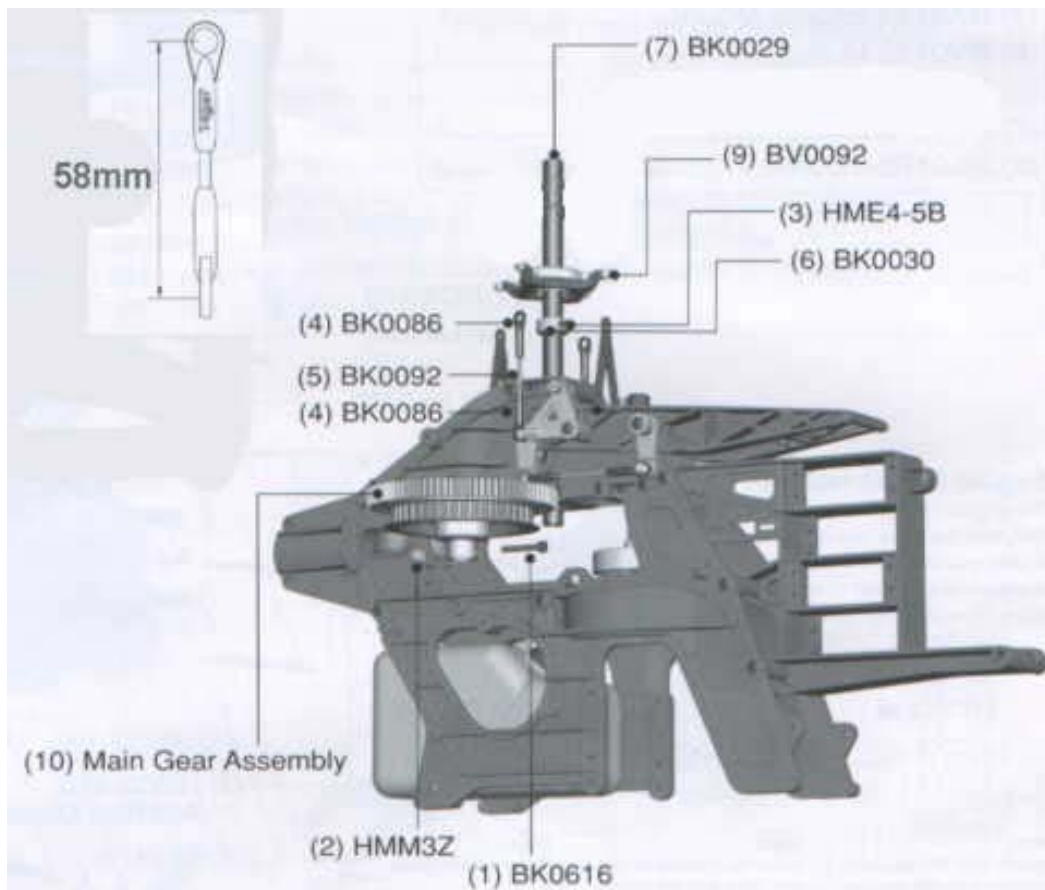
R50v2 - constant tail drive (white tail gear)

In this section you have the main gear (4), tail gear (5), and autorotation hub (3). The top grey gear will have a number stamped on the top. The gear for the 30 size is 86 tooth and the one for the 50 is 85 tooth. The assembly is fairly simple with maybe the exception of the snap rings (2). You can get a cheap snap ring plier from your local automotive shop. I have installed them and taken them off without the special pliers but don't recommend it. Start by pushing the auto hub (3) through the top of the grey main gear (4). The top of the main is the side with the deep section. Align the four bolt holes with the four holes on the gear. Now apply blue loctite to the four M3x8 (1) bolts and install them through the main gear and into the auto hub. Next install one of the snap rings (2) onto the auto hub sleeve (6). Slide the sleeve into the auto hub (keep the end with the hole through the side on the bottom). After you get the sleeve through the auto hub, install the second snap ring (2). Now install the white tail gear. Rotate the tail gear so the holes align with the holes in the sleeve (6).

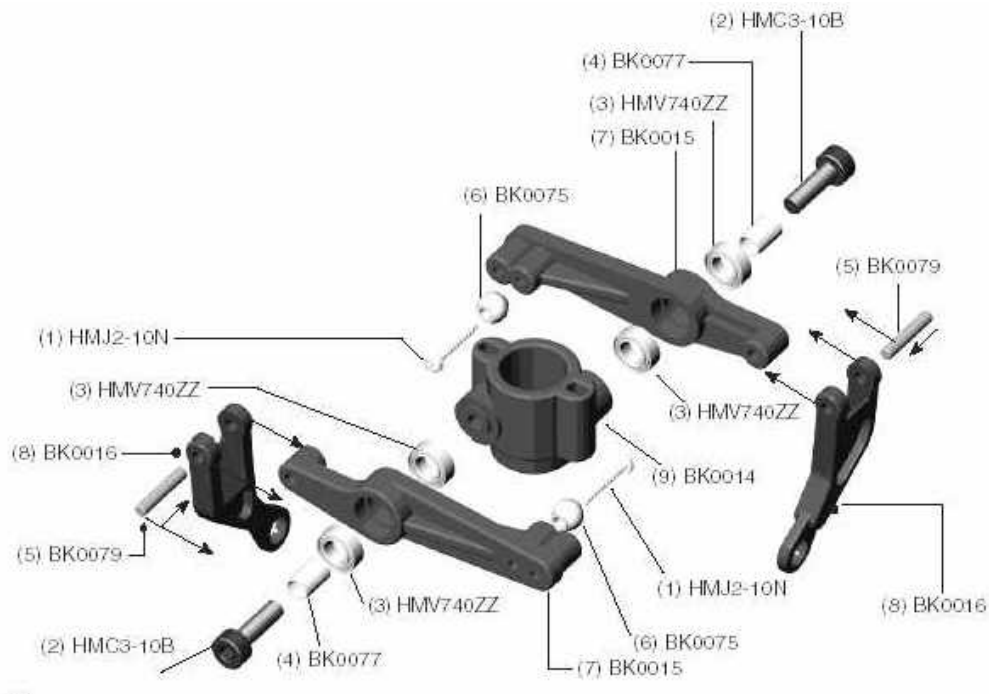


The main shaft only correctly goes one way, but it is possible to install it upside down. I had to fix one like this that was brought to me to be checked out. Look at both ends, you will see a bolt hole through the side. The end that has the bolt hole closer to it will be the bottom. Start with inserting the main shaft (7) down through the top bearing of the frameset, through the elevator control arm, and through the bottom bearing.

Slide the main gear assembly (10) into place under the bottom bearing (grey gear on top). Lower the main shaft (7) down through the center of the main gear until it is flush with the bottom of the auto hub. Rotate the gear and shaft so that the bolt hole of the auto hub aligns with the bolt hole of the main shaft. Insert the socket head screw (1) and secure with the lock nut (2). Do not overtighten as that will warp the auto hub and cause it not to work. Spin the grey main gear as you tighten the bolt and if you feel resistance develop then you have it too tight.. Next, slide on the mainshaft lock ring (3) all the way down the main shaft and against the top bearing. Put some blue loctite on two set screws (3) and while pulling up on the main shaft and pushing down on the lock ring, tighten the set screws in the lock ring. You should not have any up/down play in the main shaft. Then slide on the swash plate (9) on the main shaft. The inside ring of the swashplate needs to be on top. Attach the A-arms (aka elevator control linkages) to the outside ring linkage balls. Next make two links for aileron control. Make then each 58mm long and connect them from the swash plate to the aileron lever on each side.



This is the washout assembly. It goes on the main shaft, just under the head block. More than once I have seen this installed with the hub (9) upside down. The shouldered section goes toward the bottom. Start by inserting the bearings (3), or bushings if you have the 29BB kit, into the control levers (7). Slide the sleeve (4) onto the bolt (2) then insert the bolt through the bearings in the control arm (7) and into the hub (9). After you have both control arms installed bolt the ball (6) using the M2x10 screw onto the inside hole of the control arm. Note: The shouldered part of the ball will go against the control arm. The outside hole is used to increase the roll rate, but the problem is the helicopter has a more twitchy feel to it. The best way to increase the roll rate is to run a higher rotor speed (Not to exceed 2000 rpm) or to run different flybar paddles. Next install the washout linkage (8). Slide it onto the control arm and insert the pin (5). Next slide on the washout assembly (remember shouldered side down) and attach the washout linkage to the inner linkage balls of the swash plate.



Note about balance: If you have high frequency (above 10,000 hertz) vibration problems that you are trying to locate, then often it is from the clutch or fan. If you have a high point balancer then check them before installing. I suggest checking it with the clutch and fan bolted together. This will allow you to balance the assembly as it will be installed and it is also need so the cone of the balancer will center correct. When just balancing the fan, the cone will not center correctly due to the threads in the top of the fan hub.

***Note 2: When removing the fan it really is nice to have one of the delrin crank locks. I bought one from Ron Lund of Rick's R/C and it works great.. [Here](#) is a link to it. Another thing you can do is use a plastic toothbrush to jam between the case and the connecting rod.

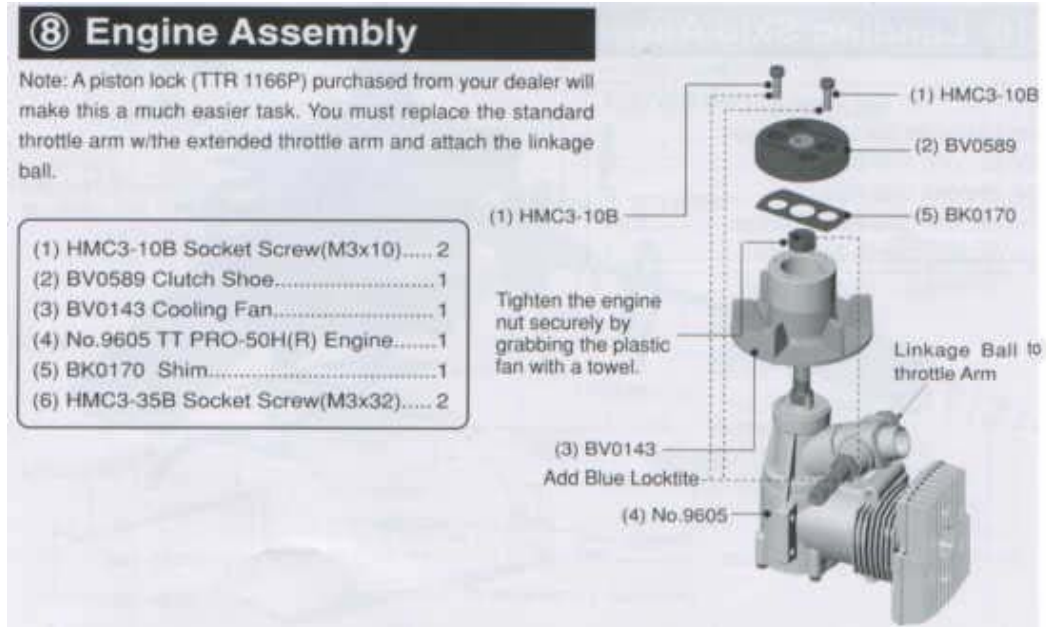
*Tip: With the fan installed there should be no in/out play in the engine crankshaft. When you pull on the fan there should be no movement. If you develop any play in this later on, for instance when you try to crank a fuel-locked engine, then this can cause engine tuning problems. Refer [here](#) for more info.



First remove any washers from the crankshaft of the engine. Next put a little blue loctite on the threads of the crankshaft and screw the fan (3) all the way down. The bottom of the fan hub should be against the front bearing of the engine. There is no need to crank it down extra tight, I just make sure it is fully against the inside race of the bearing with no gap. There should be no in/out play in the crankshaft*(see tip at top). Put a drop of loctite on the threads of the crankshaft nut and tighten the nut. If you don't get it tight then it might unscrew when you go to start the engine. If this happens you will notice the start system locks up, this is because when the fan unscrews it is shoved up against the top of the clutch bell. The original manual says to use a towel to hold the fan while you tighten the nut. The best method is to make a [fan hub tool](#) like I did. Basically you just drill one big hole and two bolt holes in a plate of metal. Click on the link for the details.

Two other common methods* of getting the prop nut tight are: use a crankshaft lock (delrin block that goes where the backplate is) or you can also use the technique of using a plastic toothbrush handle to do the same. Some people have had success using the piston lock tool (screws in place of the glow plug), but beware that this can dent the piston. *Although many use these techniques, you risk pre-loading the engine bearings, that is why if you have the time it is best to make a fan hub tool. Also you are applying abnormal stress to the connecting connecting pin and rod. Next place the clutch shim on the bottom side of the clutch (2). Note: the shim has a direction it needs to go. When you have it on right, the straight sides will be parallel with the straight edge of the clutch shoes. Next attach the clutch to the fan hub using two M3x10 bolts (1), use blue loctite on these two bolts. The bottom of the clutch is the side that will fit into the center of the fan hub. Note: Don't try to imitate the incredible hulk, if you really crank down on the two clutch bolts then eventually the head will snap off.

*Advanced installation: If you have a dial point indicator then take a little time and get the clutch on right. [Here](#) is a page on how to do this.



Now it is time to install the engine, but first check over the bolts and nuts of the engine. The factory might have not tightened all the bolts. BTW: I'm not just talking about TT engines, this applies to all engines. Don't over torque any, after all, it's threaded into aluminum and will strip out. Do make sure all bolts on the head and back plate are on snug. Ideally take them each out and put blue loctite on. When tightening the head bolts use a star pattern, don't tighten one beside another like in a circle pattern. Check the nut that holds the throttle arm on (again, blue loctite). Also check the fuel nipple on the carb. And the small bolt that keeps the carb arm/barrel from coming out.

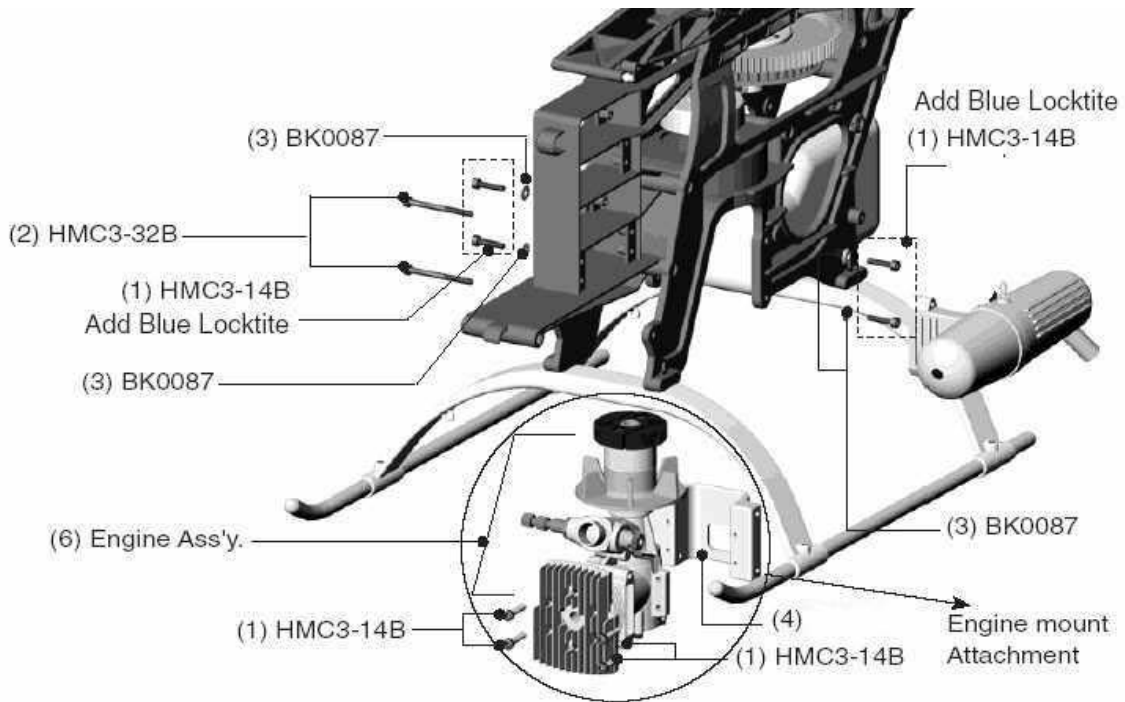
Next loosely bolt the engine to the engine mount (4) with bolts (1) and blue loctite. The end of the mount with the bolt holes closer will be the bottom. Slide the engine into position. Use four more bolts (1) with washers (3) on each to bolt the engine mount* in place. Remember the bolts holding the engine to the mount are still loose. Rotate the start shaft coupler (the hex start on top of the start shaft) backwards. You should feel very little resistance if any. If it's good then tighten the bolts and check again. If the coupler does not turn freely then twist the engine to find the best position. If this helps but is still not enough, then go ahead and tighten the bolts and then loosen the engine mount bolts and twist the engine slightly one way or the other to find the position that offers little resistance to the start coupler. Tighten the bolts and recheck. What this does is align the engine to the start shaft.

Now it's time for the muffler. If you have a two piece muffler like in the picture then make sure you get the bolt tight that runs through the center of the muffler. It helps to tighten the bolt after it's hot from the first run. If the two half's get loose, this will cause the engine to run lean. Also check the pressure nipple. I recommend to install it with JB Weld. Make sure the hole through the center of the nipple was drilled all the way. Sometimes during mass manufacturing, flaws like this can occur. Bolt the muffler to the engine. Use loctite unless the muffler has nyloc nuts that the bolts screw into. BTW: If the bolts screw directly into aluminum threads that are part of the muffler then usually you will find after taking the bolts in/out many times that the threads strip out. In that case just use a longer bolt that will go through the holes and out the other side. Then use nyloc nuts to secure the muffler to the engine.

PS: Notice I did not say to install a gasket? In my experience it always seems they do one of two things... break down and leak and/or cause the bolts to get loose because of the different expansion/contraction rates between the aluminum and the gasket material. I just make sure the surface of the engine and muffler exhaust flanges are clean and flat and just bolt them straight together. This has worked much better than any gasket I have ever used. Next hook up the pressure line from the top nipple of the tank to the muffler. Also hook up the one from the tank to the engine.

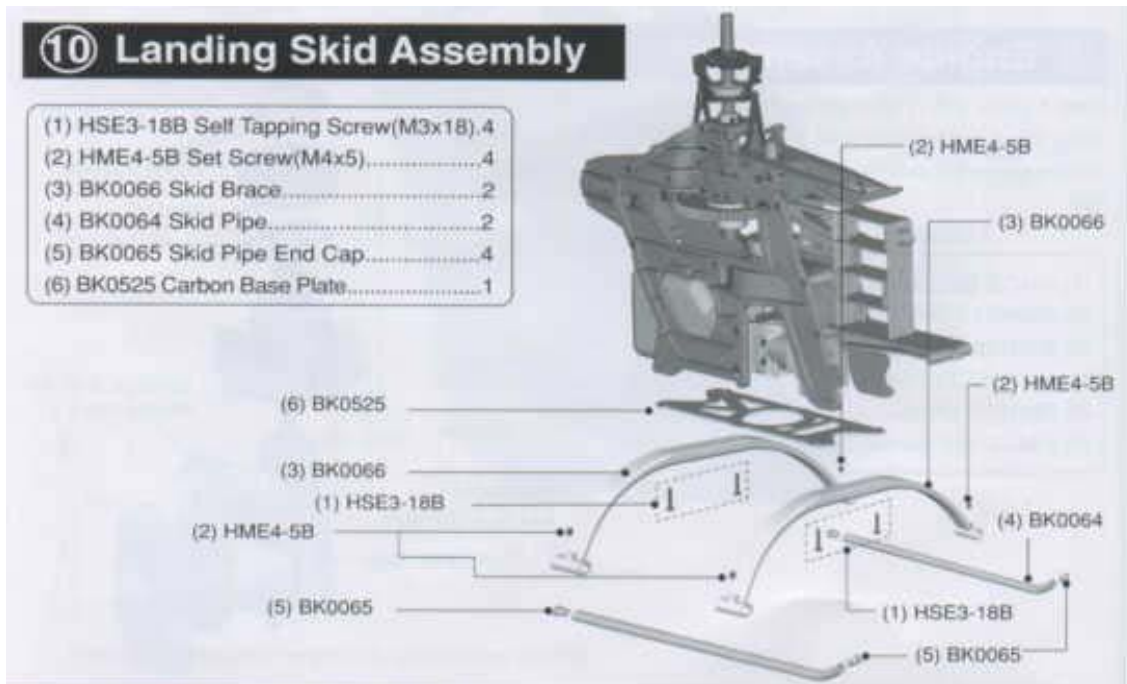
*If using the TT glow plug extension 3808, then put the glow extension plate in place of the bottom right washer (3). Also if installing on a Raptor 50 then you may need to put a bend in the plate to angle the wire so it does not touch the engine. Also remember not to flood any bolt with loctite, just use a drop. The 3808 extension depends on the ground connection through the engine mount bolt. So if you have too much loctite then it may not work. You can use a metal brush tip on a dremel to clean off excess loctite and remove some of the enamel coating on the bolt so the bolt will conduct good.

Tip: After the first run, re-tighten the muffler bolts while it's still hot. This will help keep it from loosening and falling off later :)



The landing gear set is designed to be installed with the struts angled forward. Some people however install it backwards to get the tail a little higher off the ground. This helps if you take off and land in tall grass or on uneven ground, but it does cause the canopy clip not to fit well, the protective antenna tube guides to be on the wrong side, and it looks a little funny.

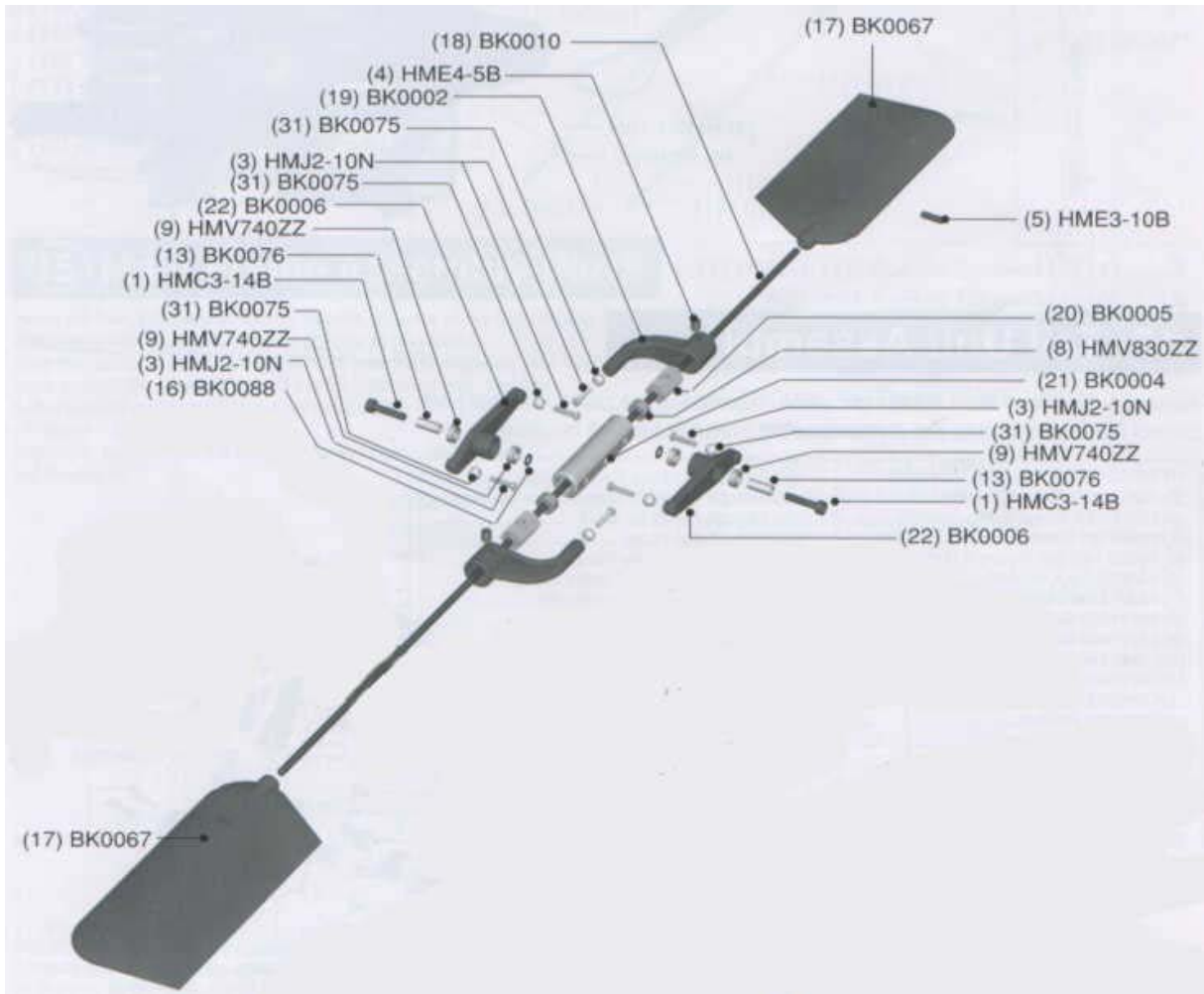
Start by bolting the base plate (6), front and back struts (2) to the frameset using four (1) screws. Next slide each skid (4) into the struts. Adjust the skids so that there is 30mm from the back of the skid to the back of the rear strut then secure them with set screws (2). Don't use loctite, you are going into plastic. Later as the bottom of the struts wear down from landing on pavement then check out the tips on [this page](#). Next apply a small amount of epoxy to the four skid end caps (5) and push them in place.



I know, it looks like a lot of things to do... no point in delaying, let's get started. Start by placing the two bearings (8) into the flybar see saw hub (21). Note that if you have a 29BB kit then these will be bushings. Slide both hexagon shaped flybar arm bushings (20) into each flybar control arm (19). Make sure you get the bolt holes aligned. Wait just a moment before you put in the set screws (4). Insert the flybar (18) through the bearings in the hub (8). Slide one of the flybar control arms (19) on the flybar and align the bolt hole with the flat spot on the flybar and lightly tighten the set screw (4). There are two of these flat spots on the flybar. Push the flybar control arm up against the hub and install the second flybar control arm on the other side (orient as shown in the picture). Make sure the set screw contacts the flat spot and that you can't move the flybar in/out of the hub. Now measure the length of the flybar from the control arm to the tip. Do the same for the other side. If it is not equal length then loosen the set screws and slide the flybar to center it. Once you get it centered, take out one set screw at a time so you don't lose your position and put blue loctite on them. Next install the ball (31) and screw (3) onto both flybar control arms (19). While you're at it go ahead and install the other four sets of (31) and (3) onto the mixing levers (22). Now insert the bearings (9), two per lever, into the mixing levers (22). Slide the sleeves (13) onto bolts (1) then install through the bearings in the mixing lever. Put the washer (16) on the bolt. Put some blue loctite on the threads then bolt the assembly to the end hole on the side of the hub (21). Do the same for the other mixing lever. The last step on this page is to install the flybar paddles (17). Thread them on the flybar until you see the end of the flybar in the cutout window of the paddle. Make sure the short side of the paddles are in front (as viewed by a clockwise rotation from above). Thread on the other paddle and measure the distance from paddle to hub for both sides. Make sure they are equal distances. Now you need to make sure both paddles (17) are parallel with the flybar control arms (19) then install the set screws (5). You can double check by sighting down the flybar to see if the paddles align to each other. The symptom of misaligned paddles will be that you can get one side of the rotor tracked but not the other.



First adjust the flybar paddle closest to you so that it is parallel with the flybar control arm. In the first picture you can see the angle I look at. This position allows you to see the tips of both flybar paddles. Move yourself (not the helicopter) up or down until your line of sight is such that the tip of the paddle closest to you is in the center of the flybar. Then look over at the tip of the other paddle, it should also be in the center of the flybar. If not adjust it so that it is. Don't forget to tighten the set screws in the paddles to keep them from turning in flight.



For 4831/4832:

(9) will be replaced by Bushing(BK0107x4)

(8) will be replaced by Bushing(BK0108x2)

Ok, two main things to note here. 1) get the thrust bearings in right. 2) lube the rubber head dampeners. If not done, both can cause the blades to go out of track in flight.

Tip: Build the bearing assembly on the spindle shaft then use it to slide the whole thing in each blade grip. See the 2nd picture.

*Note: Now do not get confused, I have had two people email me thinking because I say to put the smaller thrust bearing race on first, they think this is opposite of what the instructions say to do. The smaller diameter thrust bearing race does go toward the blades just as the instructions say. When I describe the assembly of this, I have you build the bearing stack on the spindle shaft then pull the whole thing into the blade grip. When assembling the bearing stack on the spindle shaft, the smaller race will go on first.

First build both main blade grips (23). Start by installing the ball (31) and screw (3) onto each grip. Next is to build the bearing stack. As I mentioned above I install the bearings in the correct order on the spindle shaft then use the shaft to pull the bearings into the blade grip. So start by installing the washer (6) and bolt (7) on the spindle shaft (sometimes called the 'feathering' shaft). The smaller side of the washer will go against the head of the bolt. Now that you have a spindle shaft with one bolt/washer on only one end you can use this to build the bearing stack on. Start by sliding a radial bearing (12) on the spindle shaft followed by a thrust washer (32). There are two different washers in this section and the thinner one is (32), the thicker one will go between the grip and the head. Okay, the next part is where a lot of people mess up on. Most of the time it is just because they assumed the two parts of the thrust bearing (11) were the same. The inside diameter is slightly different and you need to figure out which one is which. To do this, slide them both onto the spindle shaft (24) and rock them side to side. One will not move much and the other will. The one that rocks side to side the least is the one that needs to go on first (make sure you get the flat side toward the washer #32).

Next slide on the caged ring of balls* (with the opening of the cage toward the center of the shaft) followed by the second thrust bearing race (larger hole) and make sure you have the grooved side facing the balls. *Note: add a little silicon grease to the caged balls. Now that all the bearings are in the right order, poke the spindle shaft into one of the blade grips (23) and pull it through until the bearings are seated all the way. Pull the spindle shaft out and install the last radial bearing (12) on the end of the grip as seen in the exploded view. Now do the same for the second blade grip. Next we will work with the head block (30). Usually the pins (28) are already install. Check to make sure they will not pull out easily. If they do, roughen the end that goes into the head block and put CA on it. Make sure you do not bend these pins, if they are not straight then the mixing base will not slide up/down smoothly. Install the rubber dampeners (27) into the head block. The smaller diameter side will go toward the inside of the head. Make sure the outside corner of the dampeners are flush with the outside of the head block.

Now, this next step is important, many people don't do it. Lube the inside of the head dampeners with 100% silicon grease. I use dielectric grease (aka tune up grease) that I get from the local auto parts store. Also lube the inside of the rotor hub pin (29) and install into the side of the head block and align the hole with the dampeners. Slide the spindle shaft (24) through one of the blade grips, then a spacer (15), oval link (25)* (see note below), then through the head dampener (27), then rotor pin (29), and out the other dampener (27). Smear some more grease on the shaft beside each dampener and slide the shaft back and forth to get good coverage. You should be able to turn the shaft easily with your hand.

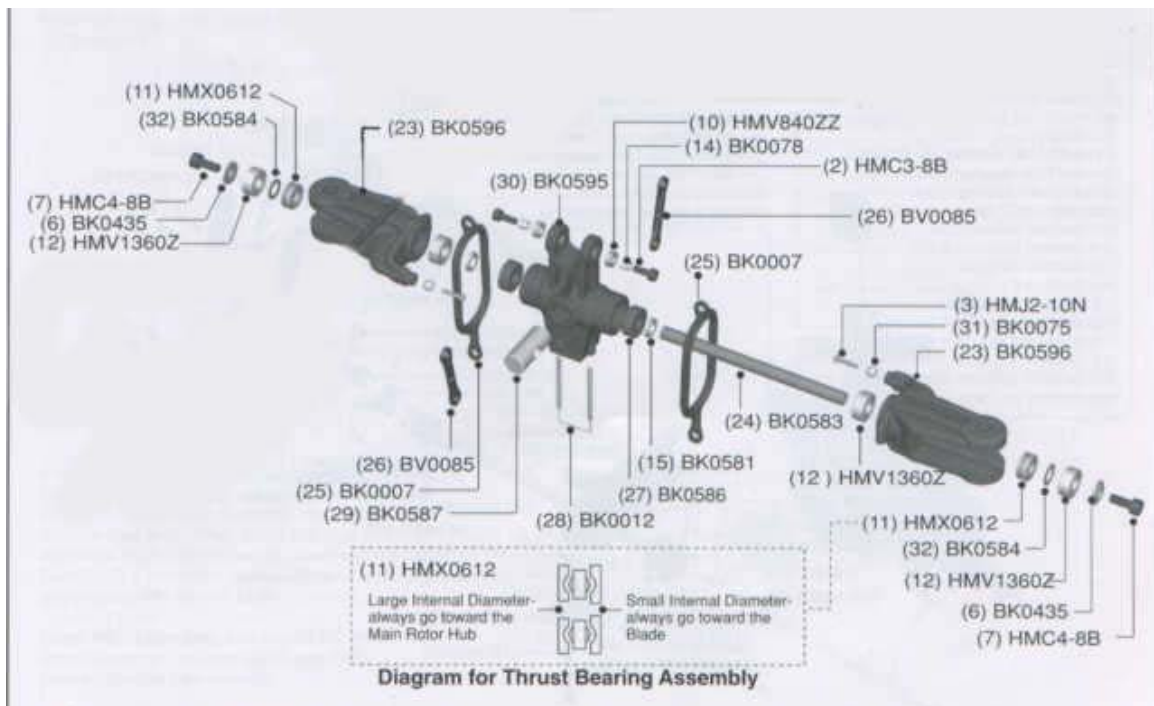
Next install the collar (15) on the other side of the shaft (24) followed by the oval links (25)* (see note below), then the blade grips (23). Slide the washer (6) onto the bolt (7) with the smaller side of the washer to the head of the bolt. Add a drop of blue loctite to the threads on the end of the bolt and install it in the end of the spindle shaft (24). Remove the bolt from the other side,

add loctite and re-install. You will need to use two allen wrenches to get them both tight. Note: as with all the previous occurrences, when you have a bolt going into metal thread then use loctite (do not use loctite on bolts going into nyloc nuts). If any bolt is more important than another to loctite I would have to say it would be these head bolts. You don't need to go overboard, just the normal drop of blue loctite will do.

To finish the head assembly, just bolt the flybar unit from the previous page onto the top of the head block. Align the center hole in the flybar hub with the holes in the top of the head block. Install the bearings (10) followed by the sleeve (14) and bolt (2). Use blue loctite on the bolts. Twist the flybar so that the flybar control arm (19 on the previous page) that is closest to you is on your right side. Check out the 3rd picture for a visual of how this should be. Notice the directions of not only the control arm, but the blade grips, flybar paddle, and oval links.

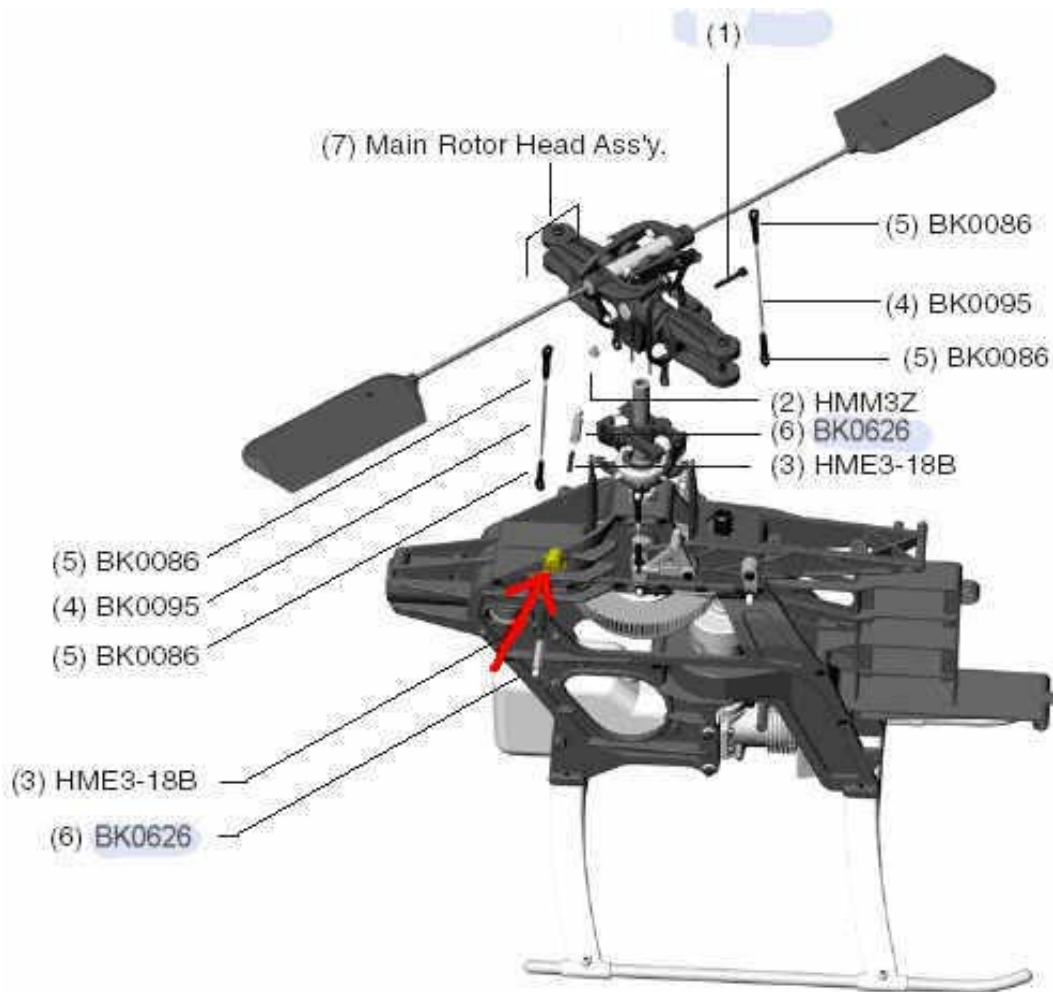
To finish the assembly connect the double link (26) and oval links (25). The double links should already be made up, but if not or you need to make new ones, set them to 30mm.

*Note: Test fit the oval links to find the side that goes on the ball first. If you don't get the links on right, you will have to take the blades grips off to turn them around. And if you try to put them on backwards, you risk breaking the link. Also remember the short side goes on top.





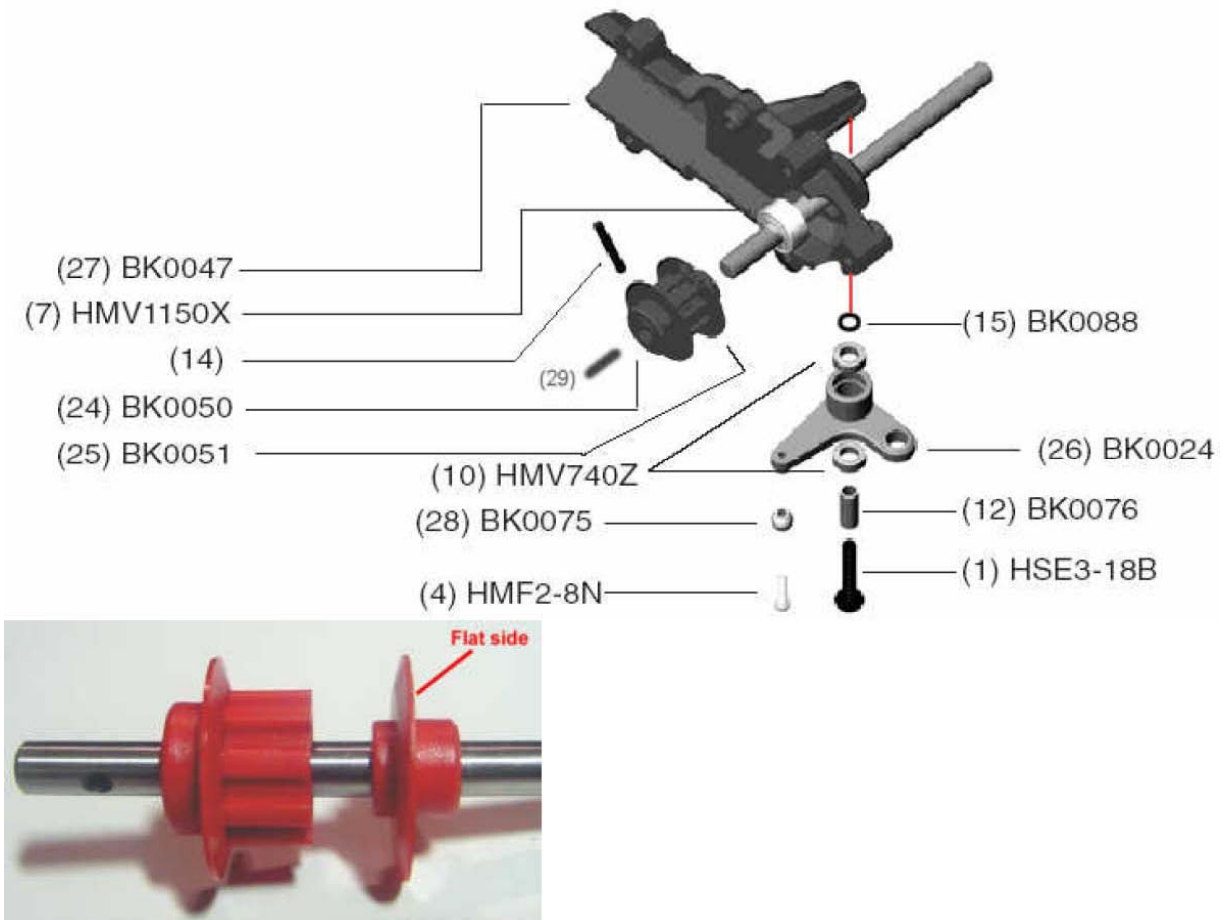
Install the completed head assembly on the main shaft. Make sure the two pins in the bottom of the head block go into the holes in the mixing base. Also confirm the mixing base will slide freely up/down these pins. Look through the bolt hole in the head block and rotate the main shaft by spinning the main gear until you see the bolt hole in the main shaft line up. Insert the bolt (1) and nut (2). Note: The nut will go on the side with the hexagonal hole. Do not overtighten this bolt. Get it a little past snug. If you tighten too much then you will have a lot of pre-tension that will increase the chance of the bolt snapping in two. Connect the short side of the oval link to the flybar control arm (19 on page 16) and the long side to mixing control arm (7 on page 8). Next make two links with rod (4) and links (5). Set the length to 100mm. Connect one side to the long end of the mixing lever (22 on page 16) and the other to the swashplate. Install the canopy stand-offs (6). Thread the all-thread bolt (3) into the stand-off (6) and then screw into the bolt hole in the back/top of the frameset (by the gyro platform).



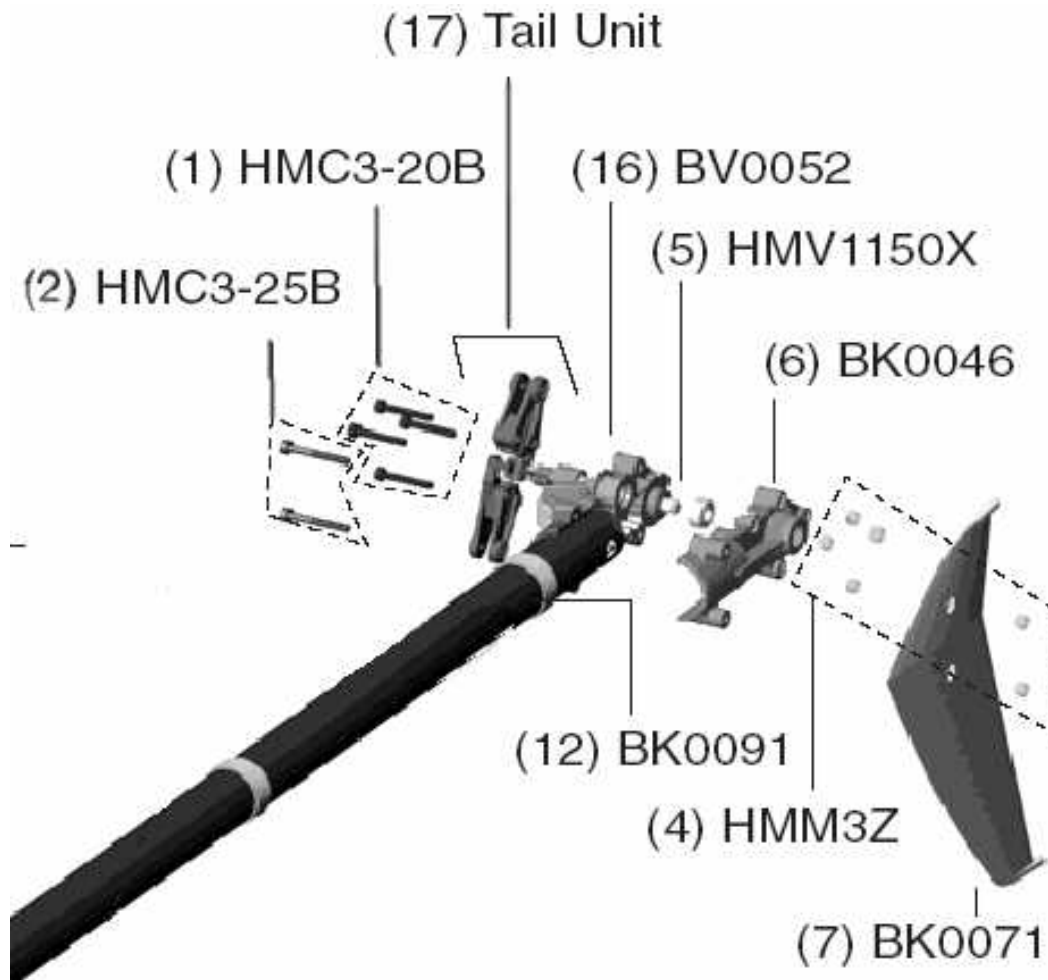
Start by installing the tail hub (18). slide it on the end of the shaft with the indentations (not the hole, that is the wrong side of the shaft) and align the screw holes of the hub with the indentations of the shaft. Put a small drop of blue loctite on the end of the threads of the long set screws (5), and screw it through the hub and into the indentations of the tail shaft. Slide the (8) bearings on the extended portion of the hub (18). Hold the bearings in place by the nyloc nuts (6). Test the fit of the bearings, if you find the bearings can be slightly moved back and forth then file the end of the hub so the nut will be able to go on far enough to hold the bearings in place. Next you need to do a test fit of the blade grips. Install them on the bearing and see if you can rock them side to side. If you can then the grips are not holding the bearing tightly. Sand the inside half of one of the grips until you get a solid tail. The next step is to slide the sleeve (11) on the screw (3) then slide this through the control link (19) and into the blade grip (16). Note: You need to get the right orientation. Refer to the 2nd picture to know which side the arms of the blade grips need to be on. The next step is to install the two bearings (9) in the tail pitch slider (21). Install a ball (28) and screw (4) in the side of the slider. Next slide the assembly onto the tail pitch control slide bushing (22) and thread on the tail pitch arm (20). Do not overtighten this part, only get it just tight enough that the pitch slider (21) will not move back and forth. Slide this assembly onto the tail shaft (23). The side with the pitch arm (20) needs to be toward the tail hub you just installed. Next install the control links (19) onto the pitch arm (20) using the two pins (13).



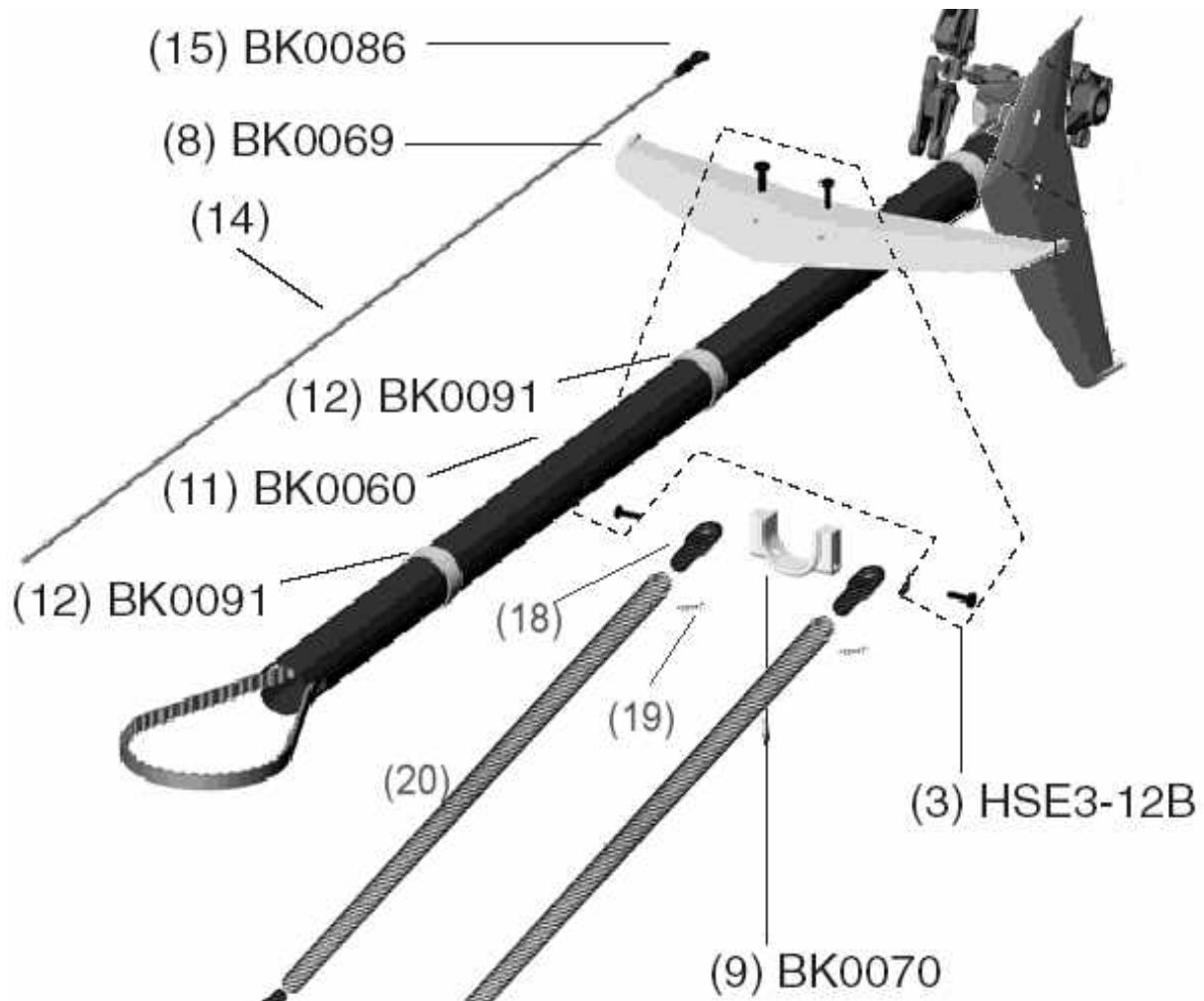
Install the bearing (7) in the tail case. Slide the tail shaft through the right half of the tail case. The side with the hole all the way through the shaft needs to be on the left. Put the red tail gear together (24) and (25). See the second picture to get these two gear halves oriented correctly. When you have them together correctly the flange on each gear half will have the flat sides on the outside and the curved sides toward each other. Slide onto shaft with (25) toward the bearing inside the tail case. Align the hole in the red gear with the hole in the tail shaft and install the pin (14). Use blue loctite on the set screw (29) to secure the pin in place. Install bearings (10) into the tail pitch control lever (26). Note, (10) are bushings in the 29BB kit. Slide the sleeve (12) onto the screw (1) followed by the lever (26) and washer (15). Screw this into the tail case while making sure that the ball on the tail pitch slider (21 on the previous page) snaps into the link hole of the lever (26). Next install the ball (28) and screw (4).



Slide the belt through the tail boom. You may need to tie a string on the belt then use it to pull the belt through the boom. Install the tail case from the previous page on the end of the boom with the holes (not the slots). Make sure the protrusion on the inside of the tail case fully seats in the hole of the tail boom. Wrap the belt around the tail gear and slide on the bearing (5) on the end of the tail shaft against the red gear. Install the pulley (16), this is a loose fit until the other case half is installed. The belt will ride under the pulley, don't try to wrap it around. Place the left tail case (6) on. Make sure the protrusion on the inside of both case halves are in the holes of the tail boom. If you don't get this right then you won't be able to get the tail boom to slide in the frames far enough to wrap the belt around the front tail gear. Install the bolts (1) and nyloc nuts (4) to secure the tail case and the tail fin (7). Rotate the red pulley on the top of the tail case to make sure it is free. If you tighten the bolt too tight then you will get resistance when trying to rotate this part.



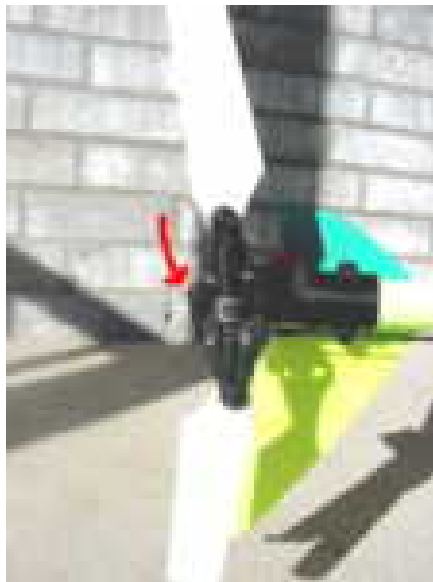
Start by sliding the three tail control rod guides (12) on the tail boom. In some cases these are very tight and you need to sand the inside of the guides before they will slide. From the front of the tail boom, the first guide will be about 4 1/3" (or 11cm). At this time you will just get them in about the right location. Later you need to position the front one so that with the tail control coupler all the way back, the guide will be a 1/4" behind that and rotated to provide low drag to the tail control rod (14). You need the front guide close so that it keeps the coupler from touching the tail boom. Next install the horizontal mount (9) and fin (8). Now make the long tail control link (14) by installing the link (15). Slide the rod through the back guide, then middle, and then the front guide. Rotate the guides to get the rod straight. Later after you get the guides in the best position to allow low resistance, then put a drop of CA around the edge of the guides to prevent them from moving. For the next part, you need to epoxy the ends (18) in the tubes (20) and secure them each with a screw (19).

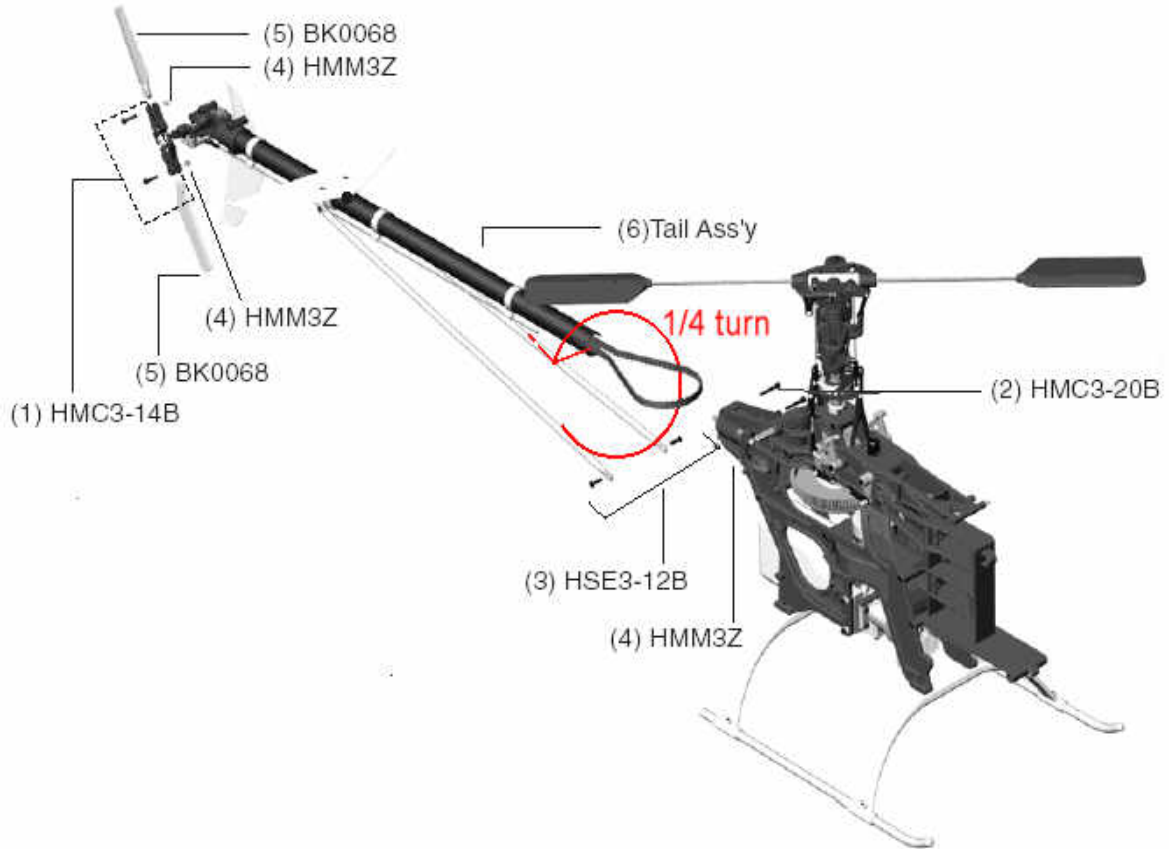


Putting the belt on... sounds simple right? Well it is, but more than once I have seen the belt twisted backwards and one time I saw it twisted 3/4 turn (and some how it still worked, but not work well).

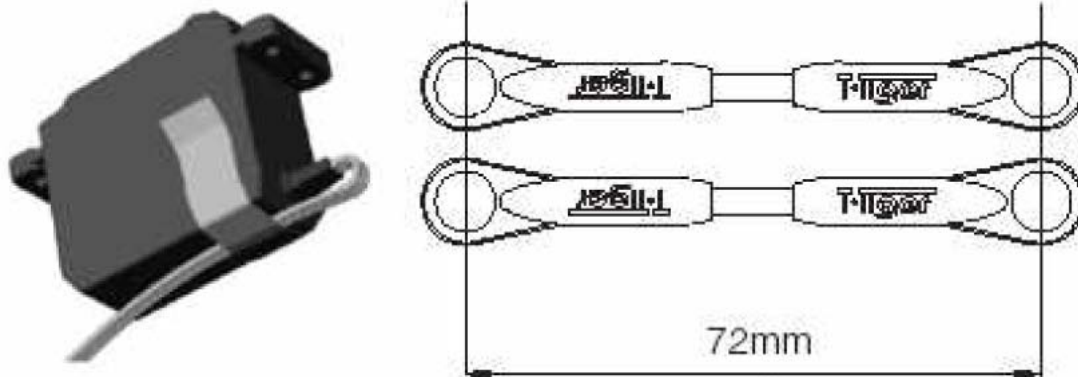
Install the four bolts (2) in frames using four nyloc nuts (4). Don't tighten the bolts, just get them started into the nuts. We'll do that later after installing the tail boom. Now hold the belt and let the tail boom assembly dangle below. After it stops twisting the belt should be straight. Look inside the tail boom and verify the belt is not twisted. Now twist the belt counter-clockwise 1/4 turn (90 degrees). I usually hold the front end of the tail boom in the palm of my hand and use my pointer finger and thumb to pinch the belt and keep the orientation (see 3rd picture). Next I push the belt through the back of the frames and as the belt comes out behind the auto hub I pull it out the right side of the frameset and hold onto it (see 4th picture).

Make sure the orientation is still correct then you can stop pinching the belt with your left hand and push the tail boom assembly into the frameset while you pull on the belt. With the tail boom all the way in, this will give you enough slack to wrap the belt around the red main tail gear. Pull the tail boom back to tighten the belt. Check that the belt did not get caught under either of the two red guide pulleys in the frames. It is common for this to happen. If you leave it like this, the belt will wear off the flange* of the pulley (not to mention the increased drag on the system). Check the belt tension. When you push in on the belt (just behind the red main tail gear) you should be able to feel it go in an 1/8" (about 4mm). Tighten the four bolts (4) in the back of the frameset. At this point the two screws in the top of the horizontal fin should be loose. Move the tail boom support rods so the holes in it align with the bolt holes by the fuel tank and use screws (3) to attach the support rods. *Another thing that can wear out the left pulley on the frame is if the belt has a manufacturing problem on the edge of the belt. Next install the tail blades (5) using two bolts (1) and two nuts (4). Make sure you get the blades on the right direction. To check for correct assembly of the tail rotor: Stand on the right side of the helicopter looking at the tail rotor. Rotate the tail so that one blade is pointed straight up. The leading edge of the blade pointed up needs to be pointed left (to the back of the helicopter). The blade grip arm for that blade also needs to be on the left side (toward the back). Rotate the tail rotor so the other blade is point up and check it also.





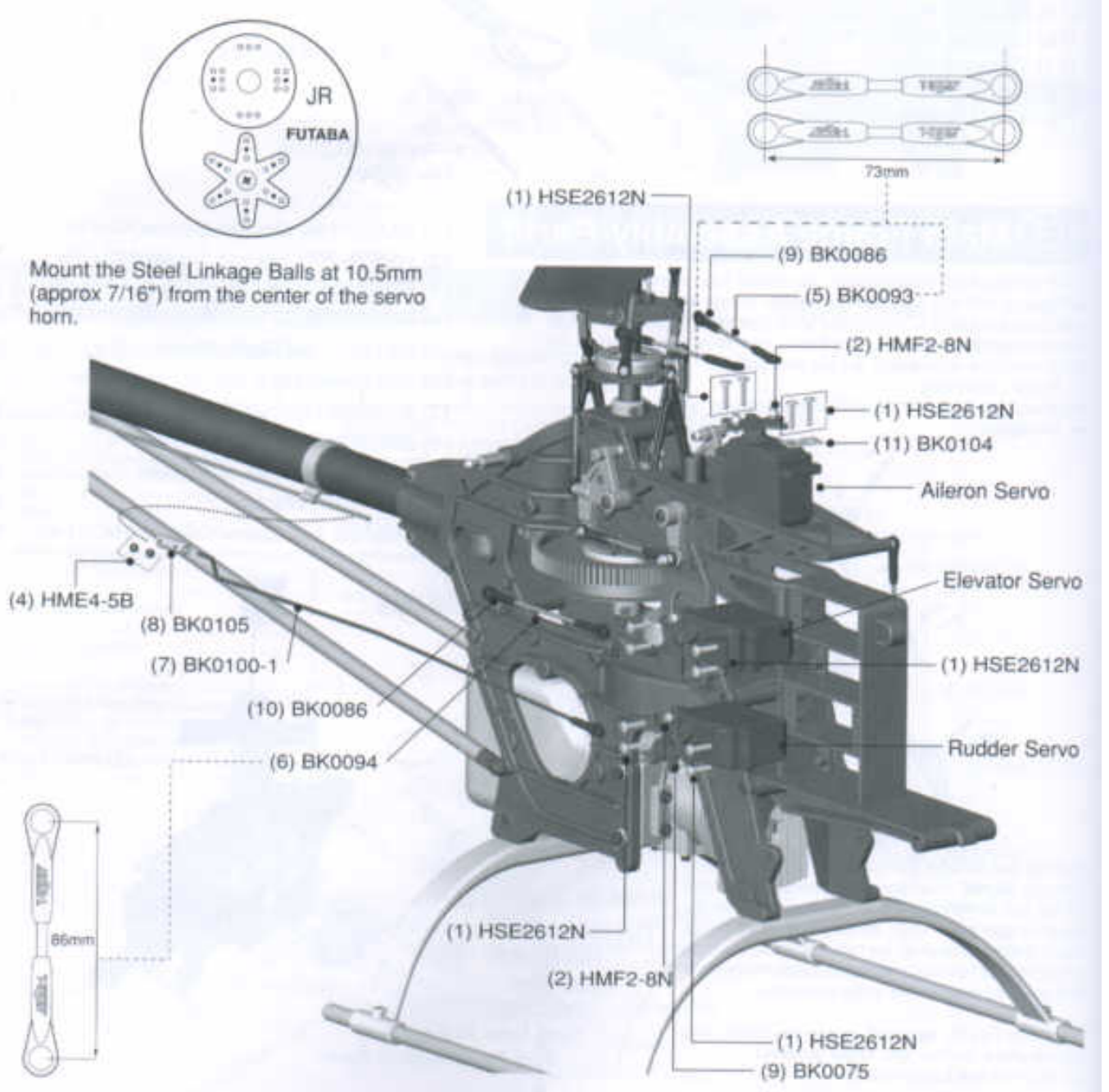
Before installing the aileron servo tape the wire as shown. Also with all links, the measurements given are from center of each hole. And don't forget, label side out on the links.



Note: If you have the servo mounting plates (PV0054) that come with the R50v2 then install the rubber grommets on the servos but do not install the brass eyelets.

Start with the Aileron servo. This is the servo that will move the heli left/right. Install the rubber grommets on the servo then the brass eyelets. The flared end of the eyelets need to be on the bottom. Mount the servo in the middle of the pitch arm. Install it so the spline is toward the main shaft. Use four screws (1) to hold the servo in place. Next make up two links 72mm long and snap them in place on the aileron levers, but not on the servo. In fact it would be better to wait until you do the radio setup before you place the balls on the servo arms. When you are ready for radio setup, you need to go to RaptorTechnique.com/radiosetup.htm For each of the next servos, first install the grommets, then the brass eyelets (remember flared side down), install each with the servo spline toward the main shaft, and secure the servo by using four (1) screws to hold it in place. The servo in the top slot of the servo tray will be the elevator. It moves the helicopter forward/backward.

Mount so the servo top is on the right side. Next down is the collective servo, this makes the helicopter go up/down. Mount so the servo top is on the left side. Next down is the rudder, Make the top on the right side. The one on the bottom is the throttle, mount so the top is on the left side. At this time you can go ahead and make up the links, but some may need slight adjustments during radio setup. For the Aileron servo make two links each 72mm long. The elevator link should be 86mm. The collective is 51mm. And the throttle is 75mm. For the rudder rod (7), insert it from the back of the frameset, through the two loops on the right side, then install the link. When joining the front and back rudder rods together using the coupler (8), make sure the end of each rod extends past the hole. It is sometimes easy to be tricked because the end of the rod gets caught up on the holes and it makes you think it is in as far as it can go. If either rod does not extend past the hole then there is a chance it will come out in flight (not a good thing, better know how to auto). And be sure to blue loctite the two set screws. After joining these two rods you need to align the tail boom guides to give the least amount of resistance. First start with the front guide, slide the rod toward the back as far as it will go, then position the guide so that it is 5mm behind that. Rotate it and the rest of the guides so the rod is straight. Slide the linkage to test the positions. You can sight down the back of the linkage to help tell if it's straight. Once you find the best position use a drop of thin CA between each guide and the tail boom to prevent it from rotating later. Later when you do radio setup, you find the correct hole in the servo arm to use then insert the ball (9) with bolt (2) and nut (3). Use blue loctite on each 2mm nut (3).



This is the end of my manual, there is not much left to finish the assembly. You can refer to the original manual on page 15, step 18, to install the main blades. Make sure you glue the blade grips as described in the addendum (or on the ACE website). Also that you install them in the right direction. An easy way to tell is to look at the screws in the blade grip, the head of the screws should be facing upward. Also the leading edge (the thicker part) should be in front as viewed from a clockwise rotation). Also the heat shrink covering on the wood blades need to be re-shrunk. Use a hair dryer if you don't have a heat gun and if you have neither you can use steam from boiling water to shrink the covering. Try to evenly go over the whole length of the blade, if you stay just in one spot you might split the covering on the ends.

Step 19: The manual has you mounting the receiver with double-sided tape, this is ridiculous! Believe me, the receiver would much appreciate it if you mount it with some automotive weatherstrip tape. I have details on Step 17 on the [ARF construction](#) page. For the radio setup, go to my [radio setup](#) page.